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Congress Chairman
PROF. DR. MURAT YAKAR

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2nd Advanced Engineering Symposium

I would like to thank all of the contributing authors and reviewers to the 2nd Advanced Engineering Days (AED) Symposium, 16 March 2022. In this international symposium there are 33 presentations, 3 of which are Albania and the rest are from Türkiye. We would like to see you in the 3rd AED which will be held on 8-9 June 2022.

Best regards

Prof. Dr. Murat YAKAR

The proceedings of the
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Volatile compounds and antioxidant activity of *Rosa canina* L., biotypes from spontaneous flora of Albania

Migena Hoxha*1 , Lindita Vrushi2

1Faculty of Biotechnology and Food, Agricultural University of Tirana, RrugaPaisiVodica 1025, Tirana, Albania, migenahoxha@gmail.com
2Esencial ® Company, Elbasan, Albania, lindita_vrushi@live.com

Keywords
Rosehip fruits
Ascorbic acid
Total Polyphenols
Flavonoids
Natural antioxidants

Abstract
It is reported that the *Rosa canina L.* fruit, with its high ascorbic acid, phenolics and flavonoids contents, have antioxidant, antimutagenic and anticarcinogenic effects. The aim of this study was to evaluate the content of polyphenols, vitamin C and antimicrobial and anti-inflammatory compounds. Volatile compounds of wild rose fruit were extracted by the SCFE-CO2 following the method (ISO121.2007E). The composition of the botanical extract was analyzed with 436-GC FID detector (Scion Instrument) in accordance with the standard (ISO 1124/1; 1124/2). The main groups of organic compounds identified by GC in the samples taken for analysis were Alkanes/Alkenes (76.5% ± 2.4), Alcohols (10.6% ± 2), Monoterpene (6.3% ± 1.3), Sesquiterpene/ oxygenated sesquiterpene (1.47% ± 0.6), Eugenol (5.03% ± 0.28). The content of polyphenols varies from 53-248 mg GAE / 100 gr per sample, the content of vitamin C from 545-1756 mg. Ascorbic acid/100 gr of sample. Most of the potential of medicinal plants in Albania are found as a part of spontaneous flora, which makes the quality of medicinal or aromatic plat values they contain to be higher compared to other areas in the region.

Introduction

In the Albanian economy Medicinal & Aromatic Plants (MAPs) hold a very special place. In the communist era, exports of MAPs earned close to $50 million [1]. High potential of medicinal and aromatic plants that grow spontaneously are a natural asset for which there is a high demand in the international market [2]. *Rosa canina* L. (Rosehip fruit) is a shrub of the Family *Rosaceae*, native to Europe, Western Asia, and northeastern Africa. At the wider contexts this species expresses an extremely high biological diversity, as no more than 200 biotypes, forms and hybrids have been identified. Nutritional and therapeutic value of wild rose, respectively ripe fruit (FructusCynosbati) in their content include sugars, organic acids, pectins, flavonoids, tannins, carotenoids (β-carotene, lycopene, and isomers of rubixanthin (especially). vitamin C, but also vitamins B1, B2, K, PP, D, and E), macro and microelements [3, 4, 5]. The seeds of the wild rose plant contain oils and minerals; fatty acids in the content of oils that are mainly represented by linoleic, oleic, linolenic, palmitic, stearic, and arachinodic acid [6]. Fruit content analysis further confirms the presence of vitamin components, antiscorbutic, astringent, collagen, diuretic, antidiarrheal, antioxidant, anti-inflammatory, even anti-mutagenic; they also increase collagen biosynthesis, stimulate the immune system, improve the body's resistance [3, 4]. Some properties of wild rose fruit have been attributed to some hypothetical silicon compounds. At the same time, wild rose is useful to prevent soil erosion, especially in the case of our country when the levels of abandonment of agricultural lands are pronounced. Nutritional, therapeutic and ecological value of the wild rose plant do these plants to have a very good perspective in the situation of opportunities to be cultivated at least in regions with degraded lands, which in terms of abandonment of rural and hilly and mountainous areas are numerous. In this view, some forms

of wild rose are distinguished for their productivity and fruits quality. This is one of the reasons for undertaking this study.

Material and Method

Raw material or plant material consists of dried fruits that have reached a good ripeness and have been collected in different areas of Albania, and respectively: Skrapar, Korce, Tropoje, and in also obtained occasionally from different markets. The dried fruits are pre-pressed and ground in a blender until they have reached a smaller particle size of 2 mm, to be further subjected to extraction procedures.

Determination of total polyphenols

5 g of dried and ground sample was treated with solvent (water: methanol; in a ratio of 4: 1) and then centrifuged for 15 minutes at 3000 rpm. The supernatant was used for further analysis of total polyphenols. The concentration of total polyphenols in the extracts was determined according to [7] with the help of the Specord 40 spectrophotometer (Analytic Jena) based on the colorimetric oxidation-reduction reaction according to the Folin-Ciocalteu method following the extraction procedure. Folin-Ciocalteu reagent has been used as the oxidizing agent. 500 ul of sample extract was treated with 1 ml of 96% Ethanol, 5 ml of distilled water and 0.5 ml of Folin-Ciocalteu reagent. The mixture is homogenized in the vortex for 30 seconds and then 1 ml of Na2CO3 solution (20% v/v) is added. The samples were incubated for 30 minutes. The absorbance measurement was performed at 760 nm. The amount of total phenols is expressed in mg Gallic acid equivalent per 100 grams of dry matter (mg GAE/100 mg dry matter). The calibration curve was constructed using pure Gallic acid with concentrations of 20 - 80 ug GAE.

Determination of vitamin C (Ascorbic Acid)

The concentration of vitamin C in wild rose extract was determined by redox titration with standard 0.01N Iodine solution (Sigma) using 1% starch solution as an indicator. In the analysis, 2.5 grams of each sample were taken after grinding. The amount is placed in a beaker with a volume of 250ml to which is added about 100-150 ml of distilled water. The mixture is allowed to extract in the cold with the aid of a horizontal shaker for about 2 hours. The mixture was rapidly titrated with 0.01N iodine solution in the presence of 2ml of 1% starch until blue. The titration is performed quickly so as not to affect other substances such as cysteine and glutathione, which are slowly oxidized by Iodine. The calculation of the amount of ascorbic acid is performed per 100 g of dry weight sample knowing that for every 1 ml of solution 0.01N Iodine consumed is equivalent to 0.88 mg of ascorbic acid.

Chromatographic analysis

The botanical extract was obtained by extraction with super critical fluid with CO_2 (SCFE CO_2) and further analyzed for the composition of volatile compounds by chromatograph model 436-GC, flame ionization detector (FID) by Scion Instrument, nonpolar-low polar column (60m x 0.32 mm, 0.1umdf). Injection temperature 180°C, oven temperature 70°C, detection temperature 280°C, carrier gas flow 1ml/min, volume of injected extract 2 ul.

Results

Table 1. Content of VitaminC and total polyphenols

Sample	Skrapari	Prespa 1	Prespa 2	Tropoja	Random sample
mg Acid askorbik/100 gr sample	792	545	1756	1076	1084
mg GAE/100 gr sample	248	93	201	85	53
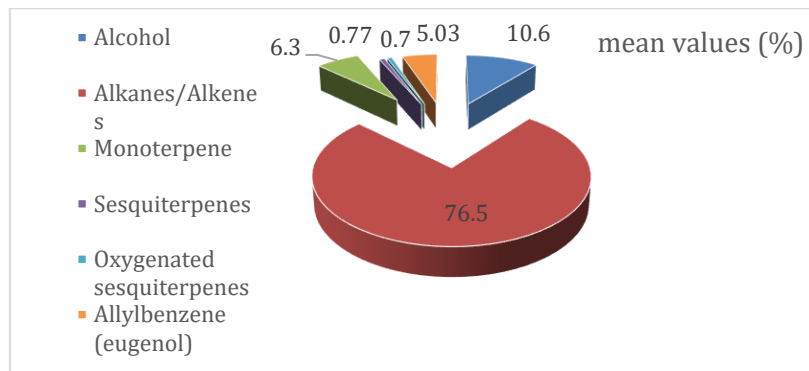
Figure 1. The main groups of compounds identified in SCFE-CO2 extract of wild rose fruit
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Discussion

The results show major differences in the content of active compounds coming from different areas of our country, such as the content of vitamin C and total polyphenols. The level of vitamin C content in the dried fruits of wild rose varies following biotopes, altitude, depending on the geographical area of their origin, with higher values at higher altitudes. Differences have been observed not only between different areas but also within the same area. The results show that there are similarities with the values of other studies [8, 9, 10]. In our extracts were identified about 24 organic compounds of the group's Alkanes/alkenes (76.5% ± 2.4), alcohols (10.6% ± 2), Monoterpene (6.3% ± 1.3), Sesquiterpene /oxygenatedSesquiterpene (1.47% ± 0.6), data which are consistent with other studies. Undoubtedly the study and investigation of the role of climatic factors on the active ingredients of medicinal plants is necessary to look at the interdependence [11]. The most important environmental factors that have a major effect on the quality and quantity of active ingredients are light, temperature, precipitation, day length, latitude, soil characteristics, altitude and nutrition [12]. The role and impact of each of them on the growth, development and active ingredients of medicinal plants should be emphasized. From our study it is noticed that the amount of vitamin C varies from 545 in Tropoja to 1756 mg / 100 grams in Prespa. The amount of polyphenols in different areas of our country varies from 53 to 248 mg of Gallic acid per 100 grams of dry matter in the Skrapar area.

Conclusion

Our survey confirms the high values of the content of polyphenols and vitamin C, antimicrobial and anti-inflammatory compounds in different samples. Based on our data, it is concluded that climatic conditions have a significant impact on plant development and the content of active substances. Undoubtedly the study and investigation of the role of climatic factors on the active ingredients of medicinal plants is necessary to look at the interrelationship.

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Suitability of multicriteria approach for assessing landscape values in the UNESCO Lake Ohrid region on the Albanian side

Laura Shumka*[1] , Andi Papastefani [1]

[1]Albanian University, Department of Art and Design, Tirana, Albania, shumkalaura@gmail.com;
a.papastefani@albanianuniversity.edu.al

Keywords
landscape
protected site
ecological values
sustainability
suitability

Abstract
The model takes into account with regard to landscape assessment in Lake Ohrid region, Albania is based on five assessment dimensions which are considered to be independent: the ecological, productive, economic, social and cultural evaluative systems and following this approach it recognizes and assumes conflicts and trade-offs between these components. The inclusion of the production system based that in the focus area is of limited rate, as an independent assessment dimension is for the first time employed within area and is justified because it is the link that connects the ecological and economic systems. Following the nature and dimension the economic activities and ecosystem services most directly influences on the ecosystem, while the production system includes the attribute of ecological or intended sustainability.

Introduction

The aim of this paper is to propose this model as suitable for conserving aquaculture and agricultural landscape in a typical area belonging to developing country contexts in an area that is hotspot for biodiversity and cultural values [1, 2, 3, 4]. The Lake Ohrid region due to its natural and cultural values is one of the most representative sitein both Albania and North Macedonia. For these reasons firstly Lake Ohrid has been inscribed on the UNESCO World Heritage List under the name "Ohrid Region with its Cultural and Historical Aspects and its Natural Environment", North Macedonian side [5]. So, in 1979, it was inscribed as natural heritage, while in 1980 it was extended to include the cultural heritage as well. On the initiative of the competent institutions, the Ministry of Environment and Physical Planning and of the Ministry of Culture, the Institute for Protection Monuments of Culture and Museum – Ohrid, the Cultural Heritage Protection Office, and the OE, the new name of the nomination was proposed – Natural and Cultural Heritage of the Ohrid Region. The new proposal was accepted in 2006 at the 30th Session of the World Heritage Committee. At the very late stage the UNESCO World Heritage site was expanded on Albanian site, so since July 5th 2021, this lake shared by Albania and North Macedonia is inscribed on the UNESCO list as mix heritage, natural and cultural property.

Traces of human existence on the territory of the within area date back to the oldest times and it could be followed through the rich archaeological heritage [5]. The favorable geographic and climate conditions have enabled the settlement and presence of humans as early as the Prehistoric Period.

The contact with the lake shore and the sweet-water lake rich in fish, as one of the essential preconditions for life, has allowed establishing of both palaphitte pile-dwelling settlements and settlements located along the shores itself. This is witnessed by the numerous pile-dwelling settlements and recorded archaeological sites from the Prehistoric Period on the territory of this region.

Material and Methods

A multicriteria approach model was used to assess landscape values of the Ohrid region and Pogradec municipality. This area exhibits a notable richness of situations owing to their socioeconomic and environmental variability. The region contains tectonic lake basin, calcareous plateaus and alluvial systems that define a complex landscape changing and land uses in mountain forests to lakeside shrub land. Further, the influence of the main regions city and its urban metabolism has led to important residential, tourism and infrastructural developments, all with considerable impact on the landscape.
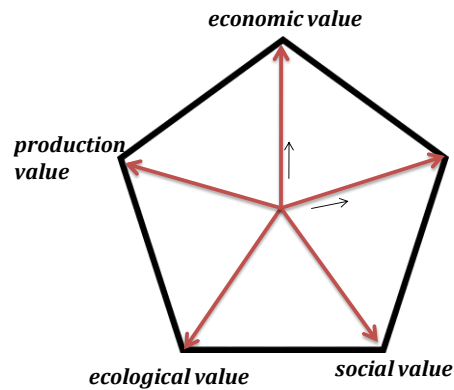
Figure 1. Satellite image of the Ohrid Lake with the Balkan region (left) and five-dimensional model of the feasible sustainable use

Results and Discussions

The introduced model to be followed is presented in the Figure 1 (b), as an example of the sound sustainable scenario that takes into account the five assessment dimensions [6]. With this contribution we propose this model as suitable for conserving aquaculture and agricultural landscape in a typical area belonging to developing country contexts. In this case, landscape conservation is not considered an option of quality and services assessment, but an inescapable necessity for a basic human use and excavations. This scenario is based on findings of [6, 7] and authors opinion and is characterized by: (a) the maintenance of a unique Ohrid Lake ecological features, (b) the production system not being intensive but compatible with the ecosystem carrying capacity, (c) the ecological value increasing by means of improving quality of goods and services that is in line with Lake Ohrid UNESCO site objective for conservation, (d) increasing cultural heritage (branding, landscape elements and knowledge about the resources that so far has been significantly neglected and (e) the search for equity, social integration and distribution of wealth.

Following findings, the setting is highly vulnerable to excessive lakeshore development, landscape fragmentation, inappropriate restoration, construction on open hillsides and high-rise buildings. On a finer scale, the quality of land and waterscape is diminished by inappropriate shoreline development, solid waste and air and water pollution. Coastal development is breaking the ecological linkages between the lake and its setting; the remaining intact areas between the Lin Peninsula and the border with Macedonia and elsewhere along the coast are of particular importance for conservation and wise management.

Land use changes affection of the proposed model

Understanding possible lake impacts from past management practices and changes in biophysical processes in the lakes require accurate quantitative assessment of historic and current landscape patterns. Indeed, obtaining accurate quantitative assessment is a complex process because the lakes are shared among different countries that recently experienced uneven and rapid changes at many levels including agricultural, natural resources, demographic, political, socioeconomic and climatic.

In Albania, the forest has experienced heavy damages from cutting and fires. Most of the cutting is for fuel wood although lumber is also produced. In the hills above Pogradec, chestnuts are harvested from the remaining

forests. There are few reforestations after cutting, and erosion is a serious problem in much of the forest. The use of the forest for pasturing goats has also contributed to the erosion problem by overgrazing the understory vegetation. Contrary to that, the forests in Macedonia are in generally better condition. Cutting is regulated and the land must be left in good condition for regeneration.

The expansion of inhabited area, increase of population and infrastructure developments were significantly affecting the littoral part of the lake and its ecosystems.

In both inscribed and nominated property the vital small wetlands in vicinity of Ohrid city and in between Pogradec and Driloni springs were converted through infrastructure and agriculture development. The ecosystems that have been modified by human interventions - mostly for forestry, agriculture and fishery purposes - are still conserving the features of the original cultural landscape; there are no intensively mechanized activities in the territories of the inscribed and nominated property and no particularly destructive settlements. In the urban areas, sprawl has expanded, primarily in response to touristic demands. Nevertheless, the phenomenon has not reached disastrous consequences yet, and the adoption of integrated land use planning, linking urban and rural areas, is considered to be an element of key importance in the future proper management.

Conclusion

The proposed model is based on the importance of the elements of the production system, primarily agriculture and fishery as a link between ecology and economy and it is recuperated as a basic element for the assessment of the sustainability of development and of the natural resources management.

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Jeopardize induced by use of carotenoides in small scale trout farms in the Ohrid Lake Catchment (Albania)

Enkeleda Berberi[1] , **Spase Shumka**[*1]

[1]Agricultural University of Tirana, FBF, Department of BFS, Tirana, Albania, e.berberi@ubt.edu.al; sprespa@gmail.com

Keywords
Carotenoides
Oxidative stress
Authenticity
Fish feeding
Trout

Abstract
Due to chemical features additional fish food ingredients and particularly carotenoids are considered able to protect against oxidative stress, while are also were investigated in terms of disease prevention and treatment. The color of Ohrid Lake trout (*Salmo letnica*) and Ohrid belvica (*Salmo ohridanus*) is one of their most important quality criteria. In their natural ecosystems this is naturally induced particularity due to their food diet i.e., copepod calanoid (*Eudiaptomus gracilis*). The application of carotenoides as a nutrient impute to the feeding system of rainbow trout (*Oncorhynchus mykiss*) has other side of authenticity associated within fish marketing at the small-scale farms.

Introduction

The aim of this paper is to present the experimental try conducted in four different small scale trout farms in vicinity to Lake Ohrid area where caroteonieds as a food supplement were employed. The typical typical pink muscle color is determined by astaxanthin, a carotenoid coming from dietary compounds that fish cannot synthesize in the aquaculture systems [1,2]. In natural conditions the color of Ohrid Lake trout (*Salmo letnica*) and Ohrid belvica (*Salmo ohridanus*) is one of their most important quality criteria. In their natural ecosystems this is naturally induced particularity due to their food diet i.e. copepod calanoid (*Eudiaptomus gracilis*). In addition to the pigmentation contribution, carotenoids are important in fish life, contributing for the proper function of some complex biological processes. Most of the time, the color of farmed trout is induced by adding cantaxanthin and astaxanthin which are two synthetic carotenoids, but this process is often too expensive [1]. For this reason, it is important to find some new and cheaper alternatives to improve the meat fish color. Carotenoid concentration in rainbow trout depends on fish weigh, can reach 6-7 mg/kg in the flesh at specimens weighing 0.1-0.5 kg, and to 25 mg/kg at larger trout. According to [3] it was noticed that improving the fish feed with a carotenoid concentration above 50 mg/kg dry matter does not induce a significant increase of meat fish pigmentation.

Rainbow trout (*Oncorhynchus mykiss*) is a highly commercial sport and market fish (FAO, 2011). Following official data [4,5] in 2018 aquaculture produced 6 258 tonnes, consisting of marine fishes (77 percent), rainbow trout (13 percent) and mussels (10 percent). There are currently 24 marine fish farms for sea bass and sea bream, 22 trout farms, several enterprises that farm mussels in Lake Butrint and 4 hatcheries for carp fingerlings that are grown in inland natural and artificial reservoirs.

Trout farming (*Oncorhynchus mykiss*) in raceways is concentrated in the north and southeast of Albania, where about 60 companies have their facilities. Most of them try to hold down costs by allowing the fish to reproduce naturally. Cultivation of the endemic fish koran (*Salmo letnica*) is restricted to the area near lake Ohrid. A few hatcheries are involved in the cultivation of common carp (*Cyprinus carpio*), Chinese carps such as grass carp (*Ctenopharyngodon idellus*), bighead carp (*Hypophthalmichthys nobilis*), and silver carp (*Hypophthalmichthys molitrix*) for restocking purposes. Carps are farmed in ponds. Aquaculture plays an important role in the Albanian economy. The government supports restocking policy, with carp and salmon family fingerling restocking every year. During the past decade, the national aquaculture sector has been creating a new vision, structure, and technology to meet consumer demand for fish products. This creates benefits for the farmers, increasing fish consumption by the local population and facilitating local employment and economies of

scale in rural areas. In fact, it seems that rainbow trout (*Oncorhynchus mykiss*) in Albania has been introduced in mid 70s. Currently the largest trout farm in Albania is that of Vau i Dejes, operated by Turkish company "Kilic" (established in 2013), while all others are of small-scale type of farming located in Tamara, Sina, Ulza, Qarishta, Bushtrica, Xhyra, Rajca, Bistrica, etc. The capacity of Kilic Aquaculture Albania is at 15 milion fingerlings per year with production capacity of 2500 tonnes, while 95% of production is exported.
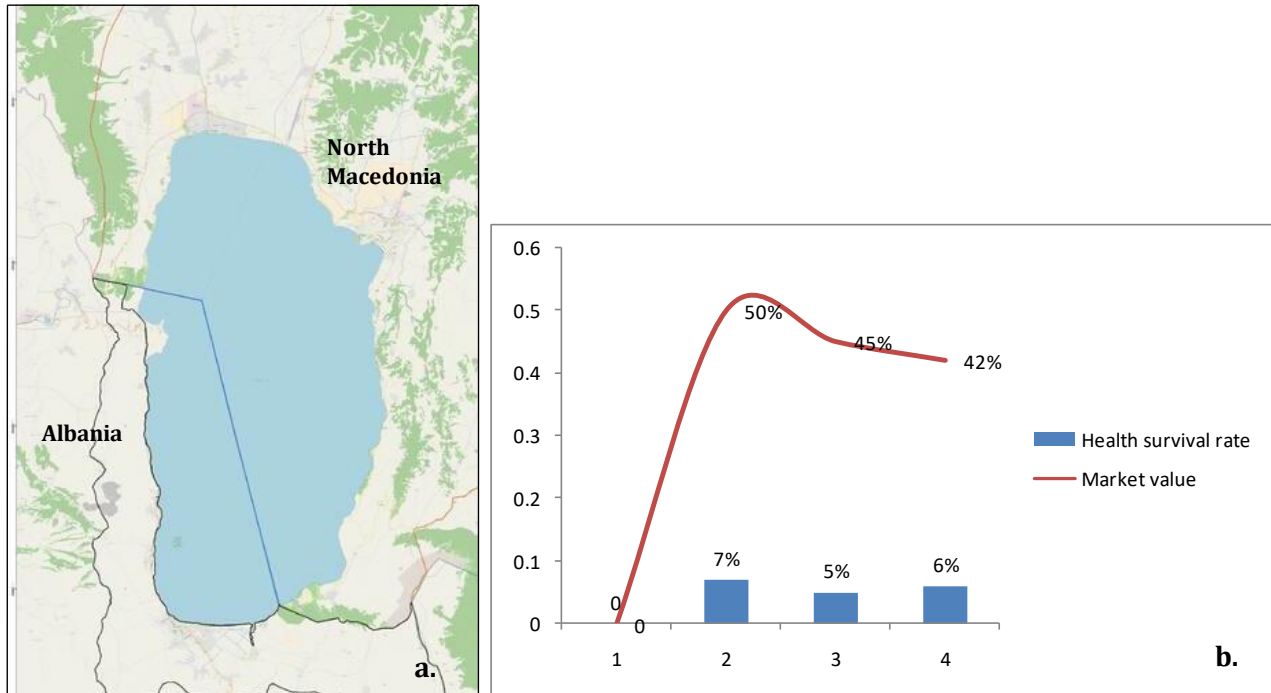
Figure 1. (a) Lake Ohrid settings; (b). The effects of carotenoids use in feeding trout expressed as percentage of increased survival and market price

Material and Methods

The experimental try with application of caroteoides as food additional ingredients to the commercial trout food was conducted in four different trout farms in vicinity of Lake Ohrid area. One of the farms was considered as a control one. Further data for compiling this survey is based on analyse scientific papers and online resources in the area of aquaculture development focused in trout farming in Albania, use of additional diet components, carotenoids, fish species employed in aquaculture practices, food types used, fish diet and ingredients. All data are sourced with aim to perform a concise literature review of natural sources including those rich in carotenoids in the farmed trout feed.

Results and Discussions

The natural food of rainbow trout depends on the age and size of fish, on the size of food item and on the habitat occupied [6,7]. Rainbow trout are aggressive and greedy in feeding. They are opportunistic feeders that grab and eat almost anything. Following [8,9,10], the terrestrial insects are also consumed when they fall into the water. These insects are adult beetles (Coleoptera), flies (Diptera), ants (Formicidae) and larvae of Lepidoptera (moths and butterflies).

Our finding (Figure 1,b) revealed significant increase in fish survival rate and small scale trout farm incomes. The experimental try done in four different farms (farm 1 used as a control one) concluded in a survival rate increase from 5-7% and generated income from 42-45% compared to the farm where was not applied carotenoide supplement. Similar results have been confirmed priory by [3] and [1].

Following the communication with local farmers, use of home-made feeds in some occations seems to be feasible (fish based one-*Alburnus* sp., mainly). Home-made feeds seem to be a good solution, especially where commercial trout feeds are not readily available (Rajca farms). The commercial food used is completely imported from Greece, Turkey and other countries. The usual feeding daily feed rations are offered in 2–12/24 equal portions, where the younger fish are fed more frequently than older ones.

Conclusion

Is there any ethical dimension in use of carotenoides in case of Ohrid lake area?
Firstly, due to the fact that rainbow trout (*Oncorhynchus mykiss*) is alien species and Lake Ohrid is been assigned as hotspot of biodiversity and other designations it is prohibited to be farmed in wider catchment. Secondly, due to existence of naturally feeding based species (Ohrid trouts), the price of marketed   rainbow trout mystifies the authenticity.

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PV connected Pumped-Hydro Storage System

Ayşenur Oymak*[1] , **Mehmet Rıda Tür [2]** **Nouha Bouchıba [3]**

[1]Batman University, Electrical Electronic Engineering, Batman, Türkiye, ayse231994@gmail.com
[2]Batman University, Electrical and Energy Department, Batman, Türkiye, mrida.tur@batman.edu.tr
[3]Université de Moncton, Department Faculty of Engineering, Moncton, Canada, bouchibanouha@gmail.com

Keywords
Energy Storage
Solar system
Mechanical storage
Pumped hydro storage

Abstract
Storage systems are needed to increase the number of renewable energy sources that can be integrated into distribution systems in smart grids and to ensure the continuity of energy. Energy storage can support system operators and provide many services such as energy time shifting, capacity backup, outage management, transmission congestion relief and power quality improvements. Batteries and storage are used due to interruptions and waves in renewable energy sources such as wind and solar. In order to expand the use of clean energy and to ensure energy continuity, mechanical storage methods are emphasized in large power systems. Storage studies have been carried out to increase efficiency, reduce costs and improve storage time. In this study, the stages of the PV integrated system model of pumped hydro storage systems, which is one of the mechanical storage methods, will be mentioned.

Introduction

The fact that renewable energy sources are far from consumption points, the weather forecasting cannot be done well enough, the inability to meet and regulate the continuous power supply has increased the importance of storage systems. Energy storage is a necessary technology that uses stored electrical energy when there is peak load demand. Energy storage has benefits such as increasing grid stability and security. The main technologies developed for energy storage are; electrical, mechanical, chemical and thermal storage technologies [1].

The contribution of energy storage systems to smart grids is expressed as meeting the frequency-controlled, instantaneous and highest power demands. The conversion and storage of energy is done with batteries, compressed air, flywheels, thermal power, ultra/super capacitors, superconductors, and fuel cells [2].

Mechanical energy storage technologies include pumped water-based energy storage systems, compressed air energy storage systems and flywheels. Mechanical energy storage is generally preferred in large power plants. The most preferred mechanical energy storage methods are compressed air storage and pumped hydro storage. In addition, hybrid renewable energy storage systems are important to ensure a high level of power quality and energy management. It is very important to be able to solve power quality problems. Because poor power quality affects efficiency and economy [3, 14]. The hybrid energy storage system can powerfully provide the dynamic load demand supported by the components of the photovoltaic power and grid connection [4].

If we look at some studies on this subject;

Mousavi et al. [5] the effects of the solar connected pumped storage system on the performance of the microgrid during sunny and cloudy times were investigated.

Javed et al. [6] In their study, they examined the studies on solar-wind pumped hydro storage. They concluded that it is a viable option technically and economically and can increase system reliability.

Bhoya et al. [7] In their study, they performed energy analysis and optimization of a hybrid system consisting of a solar system integrated with pumped hydro storage to power a residence.

In the study, the study of the PV connected hybrid storage system is explained and its mathematical expressions are mentioned. As a result of the study, the advantages of the system are given.

Material and Method

PHS is the most common energy storage technology with a round trip efficiency of 70-85%. It remains the most widely used and commercially viable electricity storage technology, especially for large energy storage systems of utility grids. The total installed power in the world is over 127 GW, making up 99% of the global storage capacity [8]. Pumped hydroelectric energy storage stores energy in the form of potential energy of water pumped from a lower reservoir to a higher reservoir. In this type of system, low-cost electrical power (electricity at off-peak times) is used to run pumps to raise water from the lower reservoir to the upper reservoir. During periods of high power demand, the stored water is released via hydro turbines to generate electrical energy. Reversible turbine/generator sets act as pumps or turbines when needed [9]. Pumped hydroelectric storage (PHES) uses mechanical storage to maximize solar energy use and prevent outages. This process is carried out to maximize the use of solar energy [6-8].

Energy Model of the System Components

The studied system consists of different stages that can convert solar radiation into hydro potential energy. First, the photovoltaic cell system works as an energy source. The output of the first stage is processed by a dc-dc converter to feed and electromechanical pump-hydro stage. It follows from this that the pumping system is able to raise a column of water through a water recovery pipe from the bottom to the upper reservoir [10].
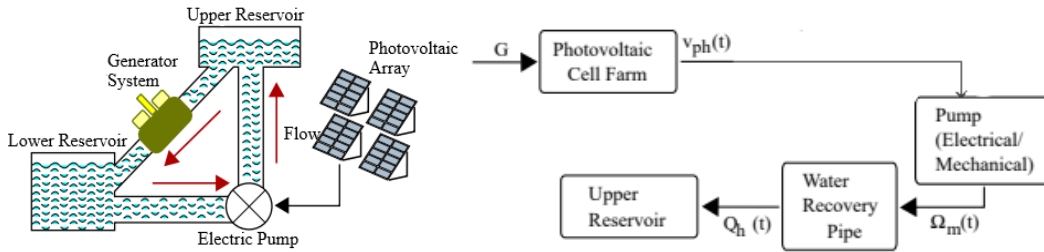
Figure 1. a) Model of the solar-powered pumped-hydro system for energy storage b) System blog diagram

The complete system is illustrated in Figure 1a with a more detailed block diagram given in Figure 1b, where the inputs and outputs of each of the subsystems (domains) are presented. In Figure 1b we see that the system has as input the current due to the sun's G radiation and as output the hydraulic flow Qc. A solar cell, also known as a photovoltaic cell, is an electronic system that converts solar energy into electricity using the photovoltaic effect.
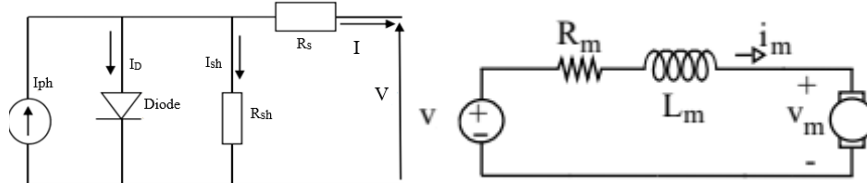
Figure 2 Photovoltaic cell circuit diagram and Pump circuit diagram

A single diode PV circuit diagram is used in the solar model. V output will be the pump voltage. The relationship between the outputs current (I) and voltage (V) of the PV panel for a single unit is expressed as follows [11, 12].

$$I = I_{Ph} - I_0 \left(e^{\frac{V + I R_S}{a V_T}} - 1 \right) - \frac{V + I R_S}{R_{sh}} \tag{1}$$

A pump is defined electrically and mechanically to store water from the bottom to the upper reservoir. First, the equivalent circuit for the electric field is shown in Figure 2. Inductance Lm stores kinetic energy and in Figure 2 the dynamics of the system is described.

$$L_m i_m = -R_m i_m + v - v_m \tag{2}$$

According to the Biot-Savart Law, the magnetic flux can be expressed as:

$$\emptyset_m = L_m i_m \tag{3}$$

The dynamics of the system, the q_m related to charge storage in the circuit are used. q_m is expressed as the ratio of magnetic flux to inductance.

In PV solar energy, a storage is needed due to the fact that the sun is not continuous, only for daytime production. A continuous supply of electricity can be provided by this solar-connected pumped hydro storage. In addition, the integration of pumped hydro storage with solar also supports supply and demand balance.

During low demand, the pumping process and hydroelectric generation are done during peak demand. Therefore, consumption during off-peak hours is covered by the sun. In the remaining period, power generation

is completed from hydro if insufficient solar production is confirmed. Excess solar energy that is not used for consumption in the system is used for storage. In this way, the purchase prices of electricity from the grid are likely to decrease [13]. In order to make the energy management very well in system design, the output power estimations of the PV system are made by methods such as ANN and Fuzzy Logic. The planning and operating process of the power system are a good measure to increase the reliability of these systems. These performance values are examined for the processes of meeting the load demand for hybrid renewable systems. This is due to the power imbalance of the hybrid renewable energy source. Optimization methods are used to correct this. While optimizing the reliability of the system, the process is taken as a constraint or a target to be achieved. The value of the reliability index (IR) can be checked using optimization methods to find the optimal size of the hybrid renewable resource's configuration.

Conclusion

The decrease in energy resources in the world and the search for alternative energy sources have increased the importance of energy storage systems. There is a need for new studies in the field of energy storage in order to ensure the efficiency of existing energy sources and to meet the energy need in a healthy way. This need can be met with new studies to be carried out in the field of energy storage by using developing technological opportunities. However, it is important to consider environmental factors, low cost and high efficiency in such studies. The pumped hydroelectric storage system, which is one of the energy storage systems, provides frequency and voltage stability, and it is predicted that it can meet the hourly energy needs with its integration with the PV solar system. A brief review of a solar coupled hybrid pumped hydro storage system is given. As a result of these investigations; It is said that optimization methods are used to solve the solar problems of the hybrid system and as a result, the ANN model is better. It is stated that this hybrid system provides good balancing in case of high supply-demand variability. The hybrid system can generate and store electricity at low cost in a self-contained solution that faces climate change and reduces its carbon footprint.

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Energy efficiency application using led lighting in demand side management

Behiye Sefa Akın*1 , Zafer Aydoğmuş 1 , Mehmet Rida Tür 2

1Firat University, Department of Electrical and Electronics Engineering, Elazig, Türkiye, behiyesefakin@gmail.com; zaydogmus@firat.edu.tr
2Batman University, Department of Electricity and Energy, Batman, Türkiye, mrida.tur@batman.edu.tr

Keywords
Demand side management
Energy efficiency
Energy saving
LED lighting

Abstract
Demand Side Management is the planning, implementation, and monitoring of service activities that affect the customer's electricity use. These solutions, named Demand Side Management (DSM), cover many methods for changing the usage profiles of consumers according to the benefits of the network. While making this change in Demand Side Management, the comfort conditions of the consumers should not be impaired. In this study, consumers are encouraged to consume less power by changing their electricity consumption habits and devices. The energy efficiency method has been applied within the scope of demand-side management. LED bulbs with the same light intensity and light color were chosen instead of saving bulbs.

Introduction

Reliable operation of power grid is primarily dependent on perfect balance between supply and load at each given time [1]. It is not an easy task to maintain balance, assuming there is very little control on the demand side. It gets even harder when distributed energy generation increases [2]. Therefore, it is important to use energy efficiency, one of the demand-side management techniques. Energy efficiency is emphasized in this study. Energy efficiency will be achieved by increasing the efficiency of household appliances.

It shows that demand side management consists of energy efficiency, demand response and strategic load growth. The technique we used in our study is energy efficiency [3]. In this study, consumers are encouraged to consume less power by changing their electricity consumption habits and devices. LED bulbs with the same light intensity and light color were chosen instead of saving bulbs.

The lighting system technology is one of branches in fast developing technologies. The lighting system should be considered in the aspect of the human health and environmental conditions. It is also performed in accordance with environmental standards. Otherwise, it causes to damage both human health and   the environment [4]. The lighting systems should be harmless and clean in terms of health and environment. On this way, LED lighting systems are very important for the clean energy. While LED lighting systems do not contain harmful substances, they make energy savings and environment friendly [5].

Increasing energy costs and demand for energy have made energy saving mandatory [6]. Lighting also has an important share in total energy consumption. Accordingly, scientists are working to get more luminous flux with less energy. This is due to the ever-increasing demand for lighting, as well as rising energy costs. For this reason, lighting elements that consume little energy have become the focus of attention of consumers. In today's world, LED-based lighting elements have taken the first place in the preference ranking. The main reason for this preference was the high energy consumption and inefficiency of the old lighting systems [7]. By changing only, the

lighting fixture, significant electricity savings can be achieved. In this study, the importance of energy saving, and energy efficiency was emphasized.

LED lighting systems have a lot of advantages. These are luminous efficiency, colors, size, on/off time, dimming, cool light, slow failure, lifetime, focus, and environmentally friendly [8]. LED (Light Emitting Diode) is a semiconductor, diode-based, light-emitting electronic circuit element. High-light LED chips, which are formed by combining many diodes in series parallel groups, are used at every stage of our lives. LEDs show themselves not only in appearance but also with their performance. Recently used in many places thanks to the advances in lighting technology, LED lighting systems offer innovative and beyond-the-century solutions. Currently, LEDs have gradually started to replace classic bulbs [6].

LEDs consume less energy compared to other lighting elements. Other lighting elements emit a significant portion of the power they draw as heat. Because other elements emit light by the principle of electric discharge or by heating the tungsten wire. However, the LEDs emit most of their power as light as soon as they heat up and convert more than 90% of the energy used to light. Thus, energy efficiency can be achieved with LED lighting.

Material and Method

It is important to control residential energy consumption in order to avoid loading points on the grid and to save energy bills by making conscious electricity consumption for consumers [7]. 25% of the total electricity produced in Turkey is used in lighting [9]. Since it is not possible to measure the electricity consumption used for lighting, kWh values were found by noting how much time the lighting was used by people living in the selected abode and multiplying the Watt values of the bulbs and their operating time. Energy efficiency from lighting in the residence will contribute to the budget of family members. An important energy efficiency potential can be mentioned when applied to all dwellings in Turkey. In lighting, significant energy efficiency can be achieved by using effective light sources and efficient luminaires.

In this way, energy efficiency will not only reduce the invoice costs of consumers, but also reduce peak loads and achieve a more stable structure of the network [7]. For this, the armature has been changed. The energy-saving bulbs in the residence have been replaced with LED bulbs.

Energy Efficiency in Residential Lighting

The "Energy Efficiency Law", which aims to increase efficiency in the use of energy resources and energy to use energy effectively, prevent waste, reduce the burden of energy costs on the economy and protect the environment, was published. Its aim is to use energy effectively, prevent waste, ease the burden of energy costs on the economy and increase efficiency in the use of energy resources and energy to protect the environment [10].

Since it is not possible to measure the electricity consumption used for lighting, kWh values were found by noting how much lighting was used by people living in the selected abode and multiplying the Watt values of the bulbs and their operating time. Energy efficiency from lighting in the example abode will contribute to the budget of family members. When energy efficiency from lighting in a residence is adapted to all residences in Turkey, an important energy efficiency potential can be mentioned. 12 ones saving bulbs with 20 watts of power were used in the selected sample house. It is possible to provide significant energy efficiency by using LED bulbs of the same light color and lumen value, which will not disrupt the comfort of the consumer instead of the saving bulbs used. In Demand Side Management, it is important that the comfort conditions of consumers are not disturbed for energy efficiency and load shifting. Therefore, it is important to choose LED bulbs with the same light intensity and light color instead of the energy-saving bulbs to be replaced. A total of 12 20W energy-saving bulbs in this residence were replaced with LED bulbs of the same light color and intensity with a total power of 10W. The characteristics of the energy-saving lamps used, their duration of use, and the characteristics of the LED lamps replaced with energy-saving lamps, their duration of use are given in Table 1 [7].

Table 1. Features of energy saving and LED bulbs used in the residence

Features	Saving bulb	LED
Power	20W	10W
Lumen	1220lm	1200lm
Light color	6500K	6500K
Weekly use	7 days	7 days
Hours	5	5
Month	33.6kWh	16.8kWh

As can be seen in Table 1, the lumen value of saving bulbs with led bulbs, which shows the light color and light intensity, is quite close to each other. In terms of lighting, before the energy saving bulbs are replaced, the electricity consumption for lighting is 33.6 kWh, while the energy consumption for lighting is 16.8 kWh when the energy saving bulbs are replaced with led bulbs. Table 1 shows the share of the bulbs replaced to provide efficiency in lighting on monthly electricity consumption.

Results

An important energy efficiency potential can be mentioned when energy efficiency from lighting in a residence is adapted to all residences in Turkey. This study is only the consumption efficiency obtained by changing the lighting product. In addition to lighting, the demand side will be managed by changing other electrical household appliances. In the demand side management, not only product replacement, but also maintenance and repair of the devices will balance the consumption side. For example, if the maintenance and repair of engines used in industrial enterprises is not carried out for a long time, the engines will heat up more due to dust and dirt. As the windings heat up, consumption imbalance will occur, starting to draw more power from the grid. For all enterprises, it will be a significant consumption, and production will not meet consumption, causing a decrease in frequency. As we mentioned in our study, consumption was reduced by increasing energy efficiency by using LED bulbs instead of other bulbs in lighting with a significant share in electricity consumption. However, the load factor will also improve.

In this study, energy efficiency method was applied within the scope of demand side management. Electricity consumption decreased from 33.60 kWh to 16.80 kWh by using LED bulbs in lighting. The use of efficient lamps has played a major role in the reduction in the total electricity consumption of the house. Trainings and incentives to be provided to consumers by electricity companies on the use and efficiency of lamps are of great importance. Given that the electricity used for lighting is usually consumed during the evening hours, the savings and efficiency from lighting will prevent point loads, especially during the evening hours. Production and consumption will be in balance and the frequency value will be in balance. The balance of production and consumption will also be ensured by changing the consumption habits of consumers.

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Detection of short circuit fault in axial flux machines with finite element method

Eyyüp Akcan[*1] ⓘ **, Mehmet Rida Tur** [2] ⓘ **Eklas Hossain** [3] ⓘ

[1] *Batman Vocational and Technical Anatolian High School, 72100 Batman, Türkiye, eyupakcan@hotmail.com*
[2] *Batman University, Electrical and Energy Department, Batman, Türkiye, mrida.tur@batman.edu.tr*
[3] *Oregon Tech, Department of Electrical Engineering & Renewable Energy, OR-97601, USA*

Keywords
Fault Detection
Axial Flux
Short Circuit

Abstract
Axial Flux Permanent Magnet (AFPM) machines have many unique features due to their high torque and power density motors. On the other hand, these machines have disadvantages such as short circuit, demagnetization and rotor eccentricity, which should be considered in application and maintenance. It is important to detect short-circuit faults that occur in axial flux permanent magnet machines before they occur. Failure of these machines will adversely affect their operation. In axial flux machines, both healthy and faulty analyzes can be made with the finite element method. Thanks to this analysis, it will be possible to see whether changes occur in the behavior of the machine. The axial flux permanent magnet machine to be designed can be tested by using the finite element method. The features of the stator output signals obtained by the finite element method are extracted by applying the fast Fourier transform (FFT), these features are kNN and RF, etc. It can be aimed to separate using classification methods.

Introduction

Electric motors have existed since the middle of the 19th century and have become an integral part of modern life by increasing its importance until today. Asynchronous motors, DC motors and synchronous motors are important motor types commonly used in industry. There are billions of different sizes and types of engines in the world and they are used everywhere in homes, vehicles, businesses and industries. These machines are generally produced as single-phase and three-phase and provide great convenience to human life in daily work. There are many studies to improve engine efficiency and usability, and research is still ongoing [1].

In the last decade, permanent magnet synchronous machines (PMSMs) have gained significant popularity in applications such as wind turbines and electric vehicles due to their higher efficiency, high output power, volume ratio and high torque, current ratio. Therefore, permanent magnet machines have an important place in industrial applications. In these mission critical applications, an unexpected machine failure or demagnetization failure can affect machine performance, resulting in very high repair or replacement costs or even catastrophic system failure. Therefore, a robust and reliable health monitoring and diagnostic approach is desirable that can help schedule preventive maintenance to prolong their life and prevent machine failure. Because offline machine diagnostics and diagnostic methods do not allow frequent testing and are financially impractical, many online methods have been proposed by researchers to reduce maintenance costs and provide more reliable diagnosis. A cost-effective way is based on the stator current spectrum, often referred to as motor current signature analysis (MCSA) [2].

Material and Method

In order to diagnose the short circuit fault that may occur in the machine, a correct short circuit analysis is required. Many researchers have examined these fault characteristics from different perspectives. Permanent magnet flux linkage estimates are reported for velocity hormonal analysis under different loads, speeds, and temperatures in [3]. When using these methods, using only one characteristic information may not be sufficient for fault detection [4]. Characteristic information such as magnetic flux, current, voltage, acoustic sounds,

temperature, vibration and torque are needed to detect faults. Many methods are suggested in the literature for short-circuit fault detection. Among these suggested methods, there are successful methods used for fault diagnosis.

In order to diagnose short circuit faults that may occur in the machine, current and voltage fault signals should be compared with healthy signals. In order to obtain current and voltage signals for healthy and faulty situations at different speeds and loads, analyzes are made with the finite element method. In this machine, one of them is healthy and one of them is short-circuit fault at different percentages. Figure 1 shows a 3D view of a machine.
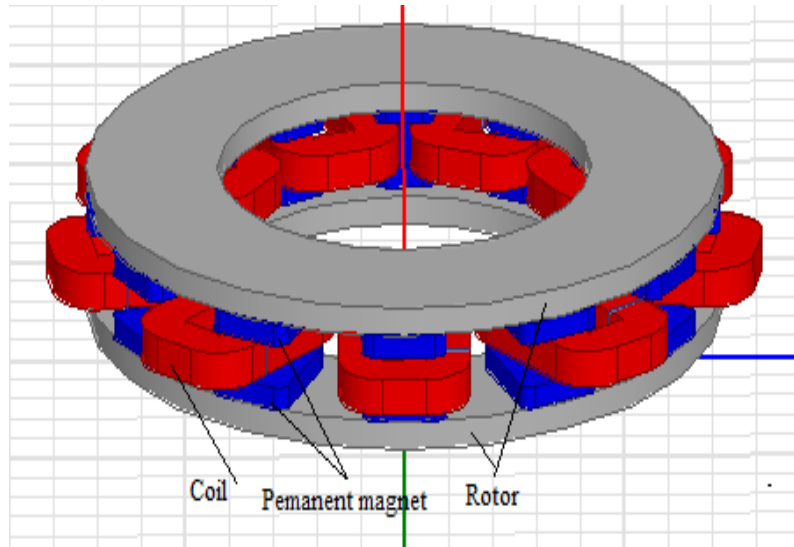
Figure 1. View of the axial flux permanent magnet generator. Permanent magnets: dark blue. Rotors: in gray color. Stator windings: in red [5]

Techniques of Fault Detection

With the developing computer technologies, the amount of data being used is growing rapidly; The rapidly increasing amount of data also makes it difficult to analyze these data. According to one estimate, it is stated that the amount of data in the world doubles every 20 months [6]. Obtaining information from a signal using the appropriate signal processing tool, followed by appropriate data mining technique, accurately specifying the engine condition is very important for additional diagnosis of the fault [7].

Nearest Neighbor K-NN

The K-NN algorithm is a classification method proposed by T. M. Cover and P. E. Hart, in which the class in which the sample data point is located and the nearest neighbor are determined according to the k value. This algorithm is one of the best known, old, simple and effective pattern classification methods and is widely used among machine learning algorithms. Classification of objects is an important research area and is applied in a wide variety of fields such as pattern recognition, data mining, artificial intelligence, statistics, cognitive psychology, medicine, bioinformatics. The K-NN algorithm is among the most basic example-based learning algorithms. In example-based learning algorithms, the learning process is carried out based on the data held in the training set. A newly encountered example is classified according to the similarity between the examples in the training set. In the K-NN algorithm, the samples in the training set are specified with n-dimensional numerical features. All training samples are held in an n-dimensional sample space, with each sample representing a point in n-dimensional space. When an unknown sample is encountered, the k closest samples are determined from the training set and the class label of the new sample is assigned according to the majority vote of the class labels of its k nearest neighbors [8].

Random Tree (RT)

Decision trees are a type of tree-shaped decision structure, whose classes are learned by induction from known sample data. A decision tree is a structure used by dividing large amounts of records into very small groups of records by applying simple decision-making steps. With each successful division, the members of the result groups become more and more similar to one another. Decision trees are a useful solution for many classification problems using large databases and complex or error-prone information. Decision trees, which have predictive

and descriptive features, are the most widely used technique among classification models because they are easy to set up, easy to interpret, easily integrated into database systems, and have better reliability [9].

Short-circuit Fault in Axial Flux Machine

The short circuit faults that occur in the axial flux machine are the faults that occur between the windings. It affects the required performance and efficiency of a machine with a short circuit fault in the stator. A short-circuit fault in the machine causes an increase in temperature between the windings and creates a short-circuit with other windings and negatively affects the operation of the machine. In this study, the short-circuit fault created will cause the machine's features to be lost to some extent. Based on the current signals generated as a result of the short circuit fault, k-NN and RT classification methods were used. Comparison of this classification method in Table 1.

Table 1. Comparison of short-circuit fault classification methods in axial flux machines

Axial Flux Machine Classification	K NN	RT
Accuracy Percentage (%)	98,76	100

Results

In this study, fault diagnosis is made for short circuit fault in axial flux permanent magnet synchronous machines. It is very important for the early detection of malfunctions in electrical machines. It both reduces maintenance costs and prevents major malfunctions that may occur in the machines. Therefore, the current and voltage signals obtained by the finite element method will be featured by applying fast Fourier transform (FFT). These features are decomposed using k-NN and RT classification methods. These results have been shown to be a useful method for short-circuit fault detection in axial flux permanent magnet synchronous machines. A comparison of the classification methods used for this method was also made. As a result of these comparisons, it can be said that the defective signals are completely separated from the healthy signals in the k-NN and RT classifications used.

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Application and cost analysis of different roof types of photovoltaic energy generation systems integrated to buildings for Mardin Province

Fevzi Çakmak[*1] , **Zafer Aydoğmuş** [2] , **Mehmet Rida Tür** [3]

1Mardin Artuklu University, Midyat Vocational School, Türkiye, fcakmak72@hotmail.com
2 Firat University, Faculty of Technology, Electrical and Electronics Engineering, Türkiye, zaydogmus@firat.edu.tr
3 Batman University, Vocational School of Technical Sciences, Türkiye, mrida.tur@batman.edu.tr

Keywords
Photovoltaic panel
BGS
GGD
inverter
Battery

Abstract
In recent years, the use of renewable energy sources such as solar and wind has increased in order to reduce the dependence on fossil fuels. Southeastern Anatolia region is the richest region of our country in terms of sunshine duration. The province of Mardin is one of Turkey's priority regions that receive a high amount of sun. In this study, it is aimed to provide electrical energy from the sun by placing roof type solar panels on the terrace floor of Şatana Mansion, which serves as a Social Facility and Application Hotel affiliated to Mardin Artuklu University.

Introduction

Today, it is seen that energy production and consumption increase in parallel with the development of technology. Since fossil energy resources are limited and will run out after a certain time, people have directed them to different renewable energy sources. The most important features of renewable energy sources are; They reduce carbon dioxide emissions, help protect the environment, contribute to the reduction of foreign dependency in energy, increase employment, and receive widespread and strong support from the public [1]. Among the renewable energy sources, the most striking one is photovoltaic systems, which provide electricity generation by using unlimited solar energy [2]. The reasons for this are noiseless, clean, low maintenance costs, modular structure and not harming the nature. PV systems, whether directly connected to the grid or independent from the grid, are systems that should be used with maximum efficiency when their costs are considered [3].

Photovoltaic Systems (PV)

In terms of connection, PV systems can be applied in three different ways as grid-connected (non-storage) (on-grid), off-grid (with storage) and hybrid (grid-connected and storage) systems. The solar panel can be positioned as fixed or can be designed as mobile systems. Studies in the field of PV systems can be listed under sub-headings such as modeling and design of the system, keeping the maximum power from solar cells constant at the voltage, optimum solar panel angle, controlling the devices used in PV systems [4,5].

Hybrid systems (grid connected and storage)

These photovoltaic systems are primarily established to provide their own energy needs. However, on the days when there is no sun (cloudy days), the energy stored in the batteries is used, and on the days when the sun is too long, it gives the excess energy to the grid. With smart grids, these photovoltaic systems will enable to make the electricity generation and distribution structure decentralized.

Material and Metod
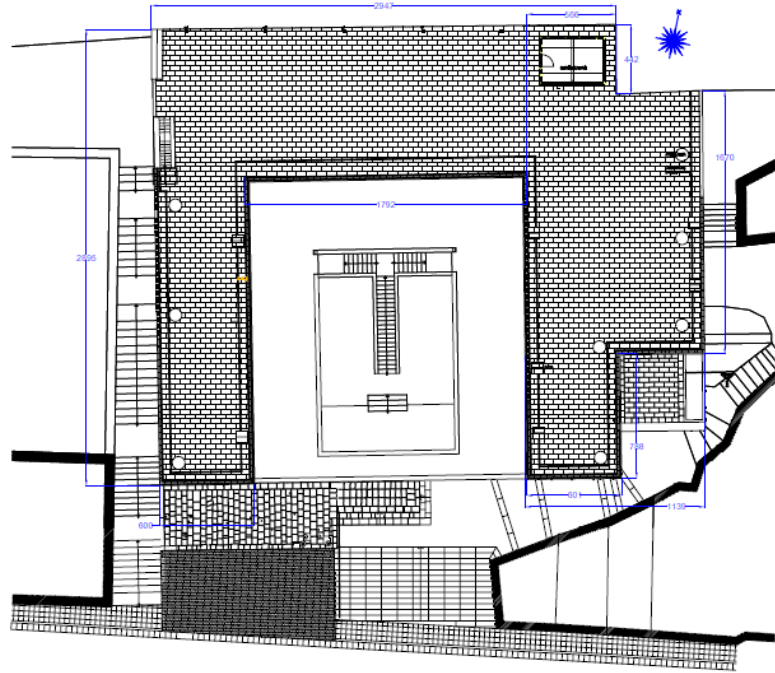
Figure 1. Terrace floor plan with scale

Mardin houses are generally built with their fronts facing south. When we look at the direction figure on the upper right in the same figure 1, the application hotel faces south. In this case, it faces the appropriate direction for the PV system to be applied to the building. Here; The application will be made by placing the solar panels on a flat roof (in the form of a terrace roof).

Photovoltaic systems are mostly applied on vacant land, building facades and roofs. Here, an example of a different roof application (on a flat roof) with an installed capacity of approximately 66.6 KW in order to place roof type solar panels on the terrace floor of Şatana Mansion, which serves as a Social Facility and Application Hotel affiliated to Mardin Artuklu University, is discussed. Photovoltaic systems installed in buildings are normally calculated over the installed power. In this study, it is aimed to place the maximum panel by calculating the total area of the existing terrace floor. The total usable area of the terrace floor is 671 m^2. The panel to be used here is SHARP brand with a capacity of 330 Watts and has a polycrystalline cell structure.

According to the monthly radiation and sunshine duration values obtained from meteorology for Mardin province, the average radiation value for Mardin is 4,635 kWh/m^2. The daily sunshine value is 7.6483 hours [6]. Considering these values, Mardin has very good values in terms of solar energy.

Used SHARP 330WP/POLY:NDAF330C panel features[7]:
Number of cells: 72
Yield: 17%
Open circuit voltage (VAD): 45.9 V
MPP voltage(VMPP):39.1 V
Short circuit current(IKD):3.91 A
MPP current(IMPP):8.45 A
Weight: 22.5 kg
Dimensions: 1960*992*40mm

- The area covered by a panel is =1.96*0.992=1.95 m^2.
- Number of panels to be placed on the terrace floor = 237 panels will be used.
- Number of modules to be connected in series (ns)= Inverter DC max trip voltage / Panel open circuit voltage
- ns= 1000 / 45.96 = Panels less than 21.75 modules will be connected in series. For this, 20 panels will be connected in series.
- Number of modules to be connected in parallel (np)= 237/ 20=11.85 approximately 12 branches (array)
- Max DC input voltage for inverter= VMPP * ns =39.11*20=782.2 Volts
- But the inverter to be used mpp DC input voltage value 400≤ VMPP≤800 V will use 782 V here.
- Power produced by a PV module arm(array) = VMPP * IMPP =782*8.45=6608 W

- Total generated power =6608*12= 79296 W= 79,296 KW
- If it is calculated that there will be a total power loss of 30% in the panels;
- Total power produced in PV Panels =79,296 -(79,296 *0.3) =55.5 KW power will be produced.
- 1.2 times the power produced is taken for the inverter to be used [8].
- 55.5 * 1.2 = 66.6 KW approximately 75 KW inverter will be used.

3 ABB inverters TRIO-20.0/27.6 TL-OUTD branded inverters will be used. The purpose of using 3 instead of a single inverter here is not to affect the whole system due to errors that may occur in a string. Max. Our PV system continues to work efficiently.

- Energy produced (consumed / produced) for 1 hour during the day = 55.5 kWh (power produced by the panels)
- Battery losses: 20% Efficiency: 80% Discharge depth: 50%
- The number of cloudy days (BGS) = 1 for Mardin province. Battery voltage will be 48 Volts. Because the battery charger will be designed at 480 volts and 100 amps.
- The daily sunshine value (GGD) is 7.6483 hours.
- Battery capacity = [Daily produced energy* BGS*GGD] / [Battery efficiency*Discharge depth*Battery voltage]
- Battery capacity =[55.5*1*7.65]/[0.80*0.50*48]= 88453.125 AH
- The battery to be used is 12 Volt 100 AH Deppower brand dry type battery

Number of batteries =88453 /100 = 884,53 approximately 885 batteries will be used. A battery charger will also be used for every four batteries. In other words, by connecting each 40 batteries in series, 480 V DC voltage will be obtained. There will be 885/40=22,125=22 parallel arms in total. Weight due to the panels on the terrace floor = 237*22.5kg = 5332.5 kg. (Steel construction is not included in this weight.) Battery group and inverters will be mounted next to the main distribution panel (energy room). It will not be a burden on the building and it will be easier to reach in a possible situation. In the calculations, an additional load of 5.5 tons was added to the dead load of the building of the panels. In Figure 2, the building area is used at the optimum level.
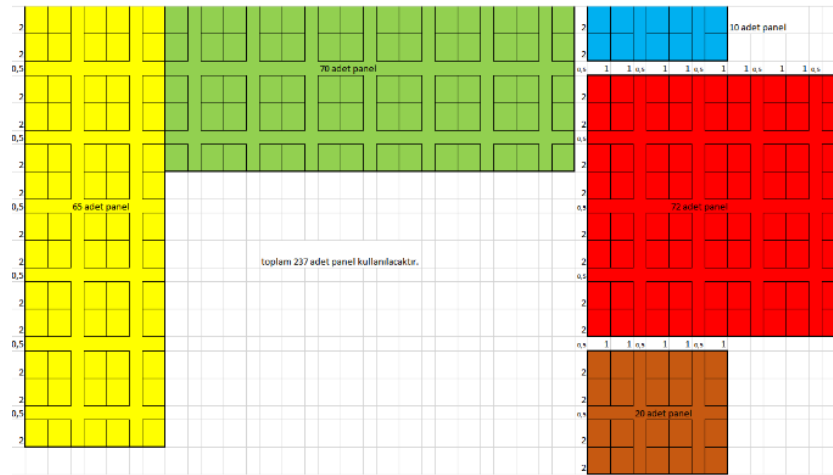
Figure 2. Panel layout with scale

Conclusion

In the study, the establishment costs of solar energy, which is suitable for the geological and geographical features of Mardin among renewable energy sources, were investigated. Solar energy systems have proven to have very high initial investment costs. It is inevitable that these costs will be lower if the main components of photovoltaic systems, such as panels and inverters, are domestically produced. Considering the average of the last six months' summer period consumption values of the Şatana applied hotel, which is affiliated with Mardin Artuklu University, it is seen that the system pays for itself in 11 years thanks to the photovoltaic system to be installed. If a solar energy system is installed in our region, where the consumption is higher in the summer months, it will further shorten the depreciation period by selling the excess energy that it both pays for itself and does not use in a very short time. Considering the costs of investments and environmental effects in solar energy systems, it will be possible to say that they are systems that produce sustainable, clean, cheap and reliable electricity.

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Smart grid power quality problems

Gamze Kucur*[1] , Gungor Bal [1] , Mehmet Rida Tur [2]

[1]*Gazi University, Electrical & Electronics Engineering, Ankara, Türkiye, gamze.kucur@gazi.edu.tr; gungorbal@gmail.com*
[2]*Batman University, Electrical & Energy Engineering, Batman, Türkiye, mridatur@batman.edu.tr*

Keywords	Abstract
Smart Grid Power Quality Power Quality Problems and Measures Power Quality Monitoring and Measurement Future of Power Quality	The availability of energy in uninterrupted, ideal-friendly conditions is a critical issue with multi-layered dimensions, such as financial, industrial and security for both consumers and manufacturers. This can also depend on the power quality. With the increased renewable energy sources in modern power networks, the bidirectional energy flow, increased nonlinear loads, and power quality problems increased. Power quality problems affect a very large frame that also encompasses everyday life, and is also a complex topic that requires special terminology to accurately identify situations and problems. However, when the correct information is provided, the right solutions can be produced. Therefore, the detection and monitoring of power quality problems is critical for the future development of both today and the power grid. This article discusses power quality problems in smart grids.

Introduction

Strong power quality in electrical networks; it is necessary to minimize the risks caused by deviations from nominal conditions, as well as affecting the efficiency of industrial activities, the performance of electrical equipment. The development of new technologies is important for energy providers as poor power quality has high financial implications. Since it is not possible to maintain the ideal sinusoidal current and voltage at all nodes of the networks, it is aimed to keep them within the limits set by the standards already established. This article reviews the role of power quality impacts on smart grids.

Reactive power flow and loads and harmonics caused by high power switching circuits causes voltage instability, interference, and wave distortion [1]. Power quality is the ability to provide a continuous and stable power flow with a noiseless sinusoidal waveform, within the voltage and frequency tolerances specified in the standards for electrical networks. Power quality aspects are shown in Figure 1. The evolution of grids into smart grids, with the increase in power electronics interfaces such as renewable energy sources, smart metering technologies, electric vehicles, demand side management, photovoltaic panels, batteries or direct current loads in power systems and this has made networks complex and vulnerable in terms of power quality [2].
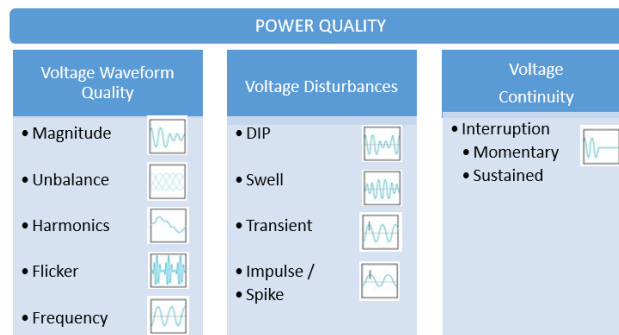
Figure 1. Power quality aspects

Power Quality Disturbances

Power quality problems can cause serious problems in banking, process control, security and monitoring systems, health network, hospitals, public safety, critical industrial processes and basic public services.

Adequate power quality ensures that all equipment connected to the grid network works in harmony. There can be two groups of deterioration in power quality; variations and events. Slow voltage changes, harmonics, vibrations and imbalances according to EN 50160 standard; continuous measurable and assessable changes are defined as variation. Unpredictable situations such as rapid voltage changes, dips, swells and interruptions are considered events. Actual power quality, ie distortion levels, is caused by the interaction between the grid and grid-connected equipment, as shown in Figure 2 [3].

Generating equipment : Although the microgeneration effect is expected to increase continuously in low voltage networks, the emission of low level harmonics can be neglected unless it shifts to the frequency range between 2 – 9 kHz. Also single-phase connection of microgeneration components can increase negative and zero-sequence voltage in low voltage network. This can cause limits on weak distribution networks to be exceeded quickly [3].

Consumer equipment : New and more technology in consumer equipment causes harmonic currents to increase while reducing the fundamental current in the network. It is undesirable for low-order harmonics, especially the fifth harmonic voltage, to rise above their compliance level. Discussions continue in IEC working groups regarding new emissions requirements for new technologies such as new low-voltage lighting technologies, energy-efficient drives, photovoltaics, battery chargers for electric and hybrid cars. However the negative differences caused by new technologies on power quality should not result in unnecessary obstacles, and efforts to increase compatibility levels should be increased [3].

Distribution network : In future grids, it will be possible to self-balance despite its high generation; however, this may cause more variation in short-circuit power compared to today's networks. In this case the approach based on fixed reference impedances will be insufficient. In addition the use of high emission loads may be acceptable in conjunction with certain grid operation or power quality regulators only. Damping stability problems with continuous decrease in resistive loads in low voltage networks, decrease in resonance frequencies due to increase in capacitive loads and EMC filters and appearance of resonance points with lower damping; will appear as problems [3].

Power Quality Components

Deviations from sinusoidal waveforms in current and voltage feeding distribution systems can harm users and cause overall performance degradation of distribution operators. Indicators of poor power quality shown below [4] and in Figure 2.

- Voltage magnitude variations (e.g., short-term spikes or dips, longer term surges,or sags)
- Frequency variations
- Low power factor
- Harmonics
- Interruptions in service.
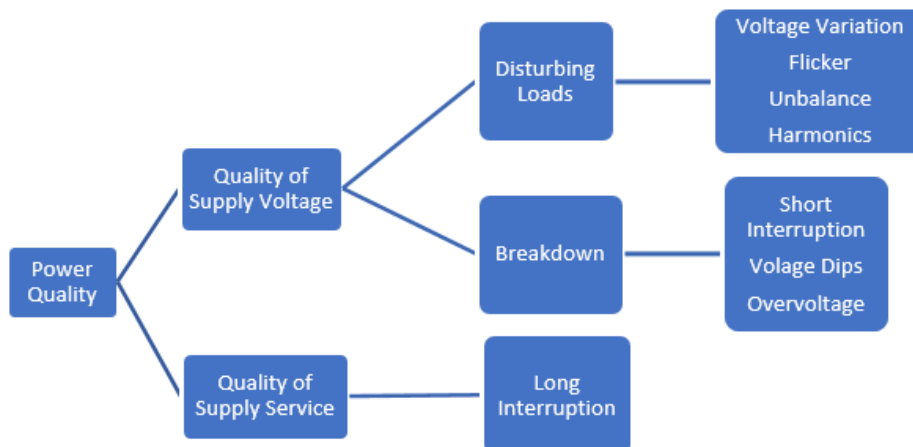
Figure 2. Power quality components

Power Quality Monitoring

Monitoring is necessary to analyze the power quality. There is simple classification approach:
- *Local monitoring* is on a single customer.
- *System monitoring* can determine general behavior and power quality status of wide grid system.

The objectives of the PQ monitoring system are to follow for measures to be taken to ensure network degradation, continuous evaluation of power quality changes, performance of power conditioning equipment, monitoring harmonic interactions between networked devices, and taking precautions for sudden changes.
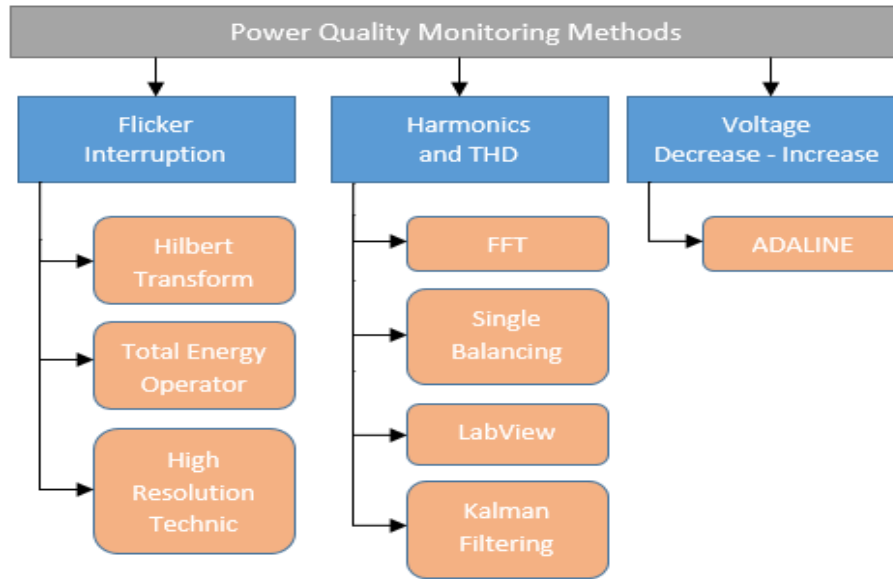
Figure 3. Power quality monitoring technics [5]

Power Quality Measurement

Measurement could be requirement of contractual conditions, corrective maintenances, electrical installations operations optimization, advanced monitoring systems.

- *Contractual conditions:*
Contract relations can be between electrical transmission, distribution and end user. For each party involved in the contract, the parameters relating to power quality must be clearly set. It should be considered whether these parameters are provided.
- *Corrective maintenances:*
The deterioration may not be considered or correctly estimated. Installation may have been modified due to new loads or modifications. Actions to get results as soon as possible can cause errors.
- *Optimization of operations:*
Energy management is required and depends on power quality to increase productivity gains by reducing operating costs.
- *Monitoring systems:*
Power quality monitoring systems are captured by a significant amount of data, power quality monitoring systems to determine the performance of the Power System and the condition of the equipment. With technology advancements, this data is made available in real time.

Conclusion

It is important to have high power in power systems in developed and developing countries. High power quality will prevent losses from consumers, manufacturers and suppliers, and will provide economic and performance-satisfactory results for all parties involved. It is therefore very important to accurately monitor, measure and analyze power quality. This paper provides a brief assessment of power quality defects, issues and the impact it has on network efficiency and reliability. Power quality compensators based on power electronics converters, emission levels caused by interaction between the mains and the mains, interactions of renewable energy sources with the mains, power quality monitoring and control methods at large distributed power plants, broadband semiconductors, or multi-level modular technology, Active power quality controllers such as solid-state circuit breakers and transformers, MMC-HVDC are priority issues for power quality research on smart networks.

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Determination of optimum reserve based on wind energy in power systems

Serdal Atic*1 , Ercan İzgi2 , Mehmet Rida Tur 1

1Batman University, Electricity and Energy Department, Türkiye, serdal.atic@batman.edu.tr; mrida.tur@batman.edu.tr
2Yildiz Technical University, Department of Electrical Engineering, Türkiye, izgi@yildiz.edu.tr

Keywords
Wind Power Uncertainty
Reliability
Optimal Spinning Reserve
EENS
VOLL

Abstract
In power systems, unforeseen imbalances between load and generation may occur due to sudden interruptions of generation units, errors in load forecasting, or deviations of generation units from the planned schedule. Spinning reserve (SR) allows system operators to compensate for these imbalances. Today, the share of wind farms in the power system is increasing rapidly. This makes it even more difficult to accurately estimate the total amount of power in the power system. This uncertainty due to wind energy estimation should be taken into account in determining the SR. This study is not only about the production cuts in determining the reserve; It focuses on determining the optimum reserve amount for the case where the error in the wind forecast is also taken into account.

Introduction

Wind energy is one of the important renewable resources used to generate electrical energy. In recent years, electricity generation with wind energy has been increasing rapidly around the world. The high penetration of wind energy generation in the power system also negatively affects the distribution of energy from conventional generation units. However, uncertainty in wind energy also negatively affects power system reliability. Therefore, an appropriate amount of SR must be provided to restore reliability in power systems with large amounts of wind power.

The nature of the wind is uncertain and variable, which causes wind energy to be unpredictable. Therefore, the significant increase in the rate of power generated from wind poses planning and management challenges for the power system. The uncertainty in wind power generation also increases the uncertainty on the demand that must be met by conventional generation plants [1]. This increased uncertainty needs to be taken into account when determining the SR, as the SR system is intended to protect against unforeseen events such as generation interruptions, sudden load changes, or a combination of both. Therefore, it can be expected that large-scale penetration of wind generation in the power system may require a significant increase in the SR requirement.

However, SR has a cost that cannot be neglected. If higher amounts of SR are required due to higher wind energy penetration, more conventional generation units in the power system will need to be included in the planning. This will continue until the expected downtime costs are less than the cost of providing the SR. Therefore, determining the optimum amount of SR considering the system conditions is an important and current issue. However, SR has a cost that cannot be neglected. If higher amounts of SR are required due to higher wind energy penetration, more conventional generation units in the power system will need to be included in the planning. This will continue until the expected downtime costs are less than the cost of providing the SR. Therefore, determining the optimum amount of SR considering the system conditions is an important and current issue [2].

It should be ensured that the optimum amount of SR and the cost of the extra reserve are equal to the benefit provided by this reserve. Here is the benefit; can be expressed as a reduction in the expected downtime cost. Ideally, the energy and SR quantities should be optimized simultaneously. There are two problems in solving this problem. First, net demand is stochastic due to demand and wind forecast errors. The second problem is that there is no direct way to include in the optimization procedure the probability distribution of current capacity cuts. It should be ensured that the optimum amount of SR and the cost of the extra reserve are equal to the benefit provided by this reserve. Here is the benefit; can be expressed as a reduction in the expected downtime cost.

Ideally, the energy and SR quantities should be optimized simultaneously. There are two problems in solving this problem. First, net demand is stochastic due to demand and wind forecast errors. The second problem is that there is no direct way to include in the optimization procedure the probability distribution of current capacity cuts [3].

In the study of Doherty and O'Malley [4]; He proposed a method in which the SR requirement is adjusted such that the system reliability criterion is equal to or better than a predetermined target, taking into account the installed wind capacity. However, since the reliability criteria are not comparable for the systems, there is no way to predetermine the reliability target of the system. In addition, determining a single level of reliability in all phases of the optimization process will result in inappropriate solutions. Because the cost and benefit of SR; It varies for each period depending on the demand, wind generation and the committed generation units. In [1] and [5], the wind forecast uncertainty was considered in the study by Black et al. In the study, the SR requirements are set as the product of the standard deviation of the difference between net demand and wind forecast error, and a constant λ. This semi-fixed approach does not consider the probability and extent of system contingencies. In this case, larger quantities of SR will be supplied with the increase of wind power generation and installed capacity. In the study of Bouffard and Galiana [5], a method formulated as a stochastic optimization problem in which the net estimated demand error is modeled as a normally distributed random variable is proposed. The disadvantage of this study is that the number of scenarios to be considered increases rapidly during the optimization process. This study proposes estimation of SR requirements by taking into account wind power generation forecast and load forecast errors.

Problem Formulation

This study deals with a unit allocation problem that takes into account the uncertainty of wind energy. In the proposed method; Along with the unit status and optimum production output, the SR provisioning status of the committed generation units are also given. The SR considered in this formulation consists of two parts, traditional SR due to load forecast uncertainty and SR due to wind energy uncertainty. The SR for each hour can be calculated as a fixed percentage of the system hourly load. The SR resulting from wind energy uncertainty is determined by a reliability criterion known as the Expected Energy Not Served (EENS) [6, 7]. The objective function of this problem is to minimize the total cost (TC), which consists of the operating cost (OC), the total SR cost (CSR) of the conventional generating units, and the Undelivered Energy Expectation cost (Cwfe) due to wind energy uncertainty as shown in equation (1). The operating cost consists of the operating costs of the committed production units. The EENS cost is the cost related to the load losses obtained by multiplying the EENS criterion, which is the Lost Load Value (VOLL) over the entire period, and the wind energy uncertainty. k production units cost to provide SR; m_k is the cost of SR provided due to load uncertainty; $SR_{l,k}^t$ is the cost of SR provided due to load uncertainty; $C_{SR,lu}$ is written as.

$$C_{SR,lu} = \sum_{t=1}^{T} \sum_{k=1}^{G} \left(m_k SR_{l,k}^t \right) \tag{1}$$

SR from k generation units due to wind energy uncertainty; $SR_{w,k}^t$ is the cost of SR provided due to wind energy uncertainty; $C_{SR,wu}$ is written as follows.

$$C_{SR,wu} = \sum_{t=1}^{T} \sum_{k=1}^{G} \left(m_k SR_{w,k}^t \right) \tag{2}$$

Undelivered energy expectation due to wind energy forecast error; $EENS_{wfe}$ is the energy cost that cannot be provided due to wind forecast error; C_{wfe} is written as follows.

$$C_{wfe} = VOLL x EENS_{wfe} \tag{3}$$
$$k = 1, \dots, G; t = 1, \dots, T$$

fuel cost of k conventional production units; C_k, Power supplied by k generating units during t; $P_{G,k}^t$, working status for unit k; u_k^t ($u_k^t = 0$ ya da $u_k^t = 1$) is the objective function; $minTC$ is written as follows.

$$minTC = \left\{ \left(\sum_{t=1}^{T} \sum_{k=1}^{G} C_k \left(P_{G,k}^t \right) u_k^t \right) + C_{SR,lu} + C_{SR,wu} + C_{wfe} \right\} \tag{4}$$

where G is the number of production units and T is the planning time. Estimated wind power output during t; P_{wf}^t, Estimated wind power output during t; P_l^t, k maximum power capacity of k generating units; $P_{max,k}$, the total number of sections of the normal distribution curve for the wind energy output; P, is the wind power output of the section p during t; $P_{wf,p}^t$ and maximum undelivered energy expectation; The constraints for the optimization problem $EENS_{max}$ are given by the following equations

$$\sum_{k=1}^{G} P_{G,k}^t u_k^t + P_{wf}^t = P_l^t; \quad t = 1, \dots, T \tag{5}$$

$$P_{G,k}^t + SR_{l,k}^t + SR_{w,k}^t \leq P_{max,k} u_k^t; \quad k = 1, \dots, G; \ t = 1, \dots, T \tag{6}$$

$$EENS_w = \sum_{t=1}^{T} \sum_{p=1}^{P} \left(P_l^t - \left(\sum_{k=1}^{G} \left(P_{G,k}^t + SR_{w,k}^t \right) u_k^t \right) - P_{wf,p}^t \right) Pb_p \ AS_p^t \tag{7}$$

$$AS_p^t = \begin{cases} 1; \left(\sum_{k=1}^{G} \left(P_{G,k}^t + SR_{w,k}^t \right) u_k^t \right) + P_{wf,p}^t < P_l^t \\ 0; \left(\sum_{k=1}^{G} \left(P_{G,k}^t + SR_{w,k}^t \right) u_k^t \right) + P_{wf,p}^t \geq P_l^t \end{cases}; \quad p = 1, \dots, P; t = 1, \dots, T \tag{8}$$

$$0 \leq EENS_w \leq EENS_{max} \tag{9}$$

The production output of conventional generation units is given by the power equation (5) related to wind energy and system load. The sum of the production output from each unit and the SR from the unit should not exceed the maximum limit as expressed in equation (6). To calculate $EENS_w$'yi in Equation (7), the normal distribution curve is divided into seven parts (P=7) with their calculated probabilities (Pb_p). A normal distribution curve representing the wind power uncertainty was applied to the wind power output at each time t. At each time t $EENS_w$, is the sum over all parts of the division probability multiplied by the amount of lost load due to wind power uncertainty. The amount of lost load is calculated from the system load at time t by subtracting the sum of the generation output from the committed units, including the SR and the wind power output in the p section. ($P_{wf,p}^t$) value is the mean value of each part of the normal distribution curve, which is the mean value; μ and standard deviation; Calculated from σ. If there is no load loss, the adequacy status is taken as zero as written in equation (8). Total undelivered energy expectation calculated over the entire planning period; $EENS_w$, is constrained by $EENS_{max}$ as shown in equation (9).

For load uncertainty, hourly SR is assumed to be 9% of hourly load. Four cases will be considered to examine the relationship between SR and EENS resulting from wind energy uncertainty. Case 1 is when there is no wind energy in the system. In this case, the loads are provided by conventional generation units, which are stable. Case 2 is when there is wind energy in the system. The energy expectation that could not be provided for this situation did not reach the maximum limit. Case 3 is when there is wind energy in the system. In this case $EENS_{max}$, is set from Case 2 to 50% of EENS. Case 4 is the case where there is wind energy in the system. In this case $EENS_{max}$ is set to zero.

Conclusion

In this study, an approach that incorporates load and wind energy uncertainties into the optimization problem is proposed. SR reserve capacities to be provided due to load and wind uncertainties in the approach are added to the objective function to minimize the total energy cost. Simulation studies to be carried out in future studies will show how power system reliability, total cost and reserve provision are affected by the inclusion of wind energy in the system. The main contributions of this study are to develop an approach that incorporates the total SR to be provided as a result of load and wind uncertainty into the objective function, and to determine the optimum reserve for different situations, taking into account the undelivered energy expectation resulting from the wind forecast error.

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Magnetite geochemistry of Beshhi-type Cu-Zn mineralizations in Central Pontides (Kargı-Çorum)

Cihan Yalçın[*1] , **Nurullah Hanilçi** [2] , **Mustafa Kumral** [3] , **Mustafa Kaya** [3]

1Ministry of Industry and Technology, General Directorate of Industrial Zones, Ankara, Türkiye, cihan.yalcin@sanayi.gov.tr
2İstanbul University-Cerrahpaşa, Geological Engineering, İstanbul, Türkiye, nhanilci@gmail.com
3İstanbul Technical University, Geological Engineering, İstanbul, Türkiye, kumral@itu.edu.tr; kayamusta@itu.edu.tr

Keywords
VMS
Stratiform
Magnetite
LA-ICP-MS
Besshi Type

Abstract
Gökçedoğan Cu-Zn massive sulfide deposit (VMS) in the Central Pontides is a syngenetic stratiform deposit observed in metamorphic rocks. The ore paragenesis contains pyrite, chalcopyrite, sphalerite, magnetite, hematite, covellite, malachite, and goethite respectively. Because of its physicochemical properties, in-situ laser-ablation inductively coupled plasma mass-spectrometry (LA-ICP-MS) analysis of magnetite in the ore zone was performed and a new perspective was promoted to the deposit. Analyzes were checked out in both Cu/(Si+Ca)-Al(Zn+Ca) and Cu/Ca-Al(Si+Zn+Ca) diagrams and it was decided that they exhibit similar distributions to VMS deposits in the world. In the spider diagram drew up, it has been showed that Gökçedoğan VMS deposit is close to Besshi Type Windy Craggy deposit with its high Si values.

Introduction

Due to its crystallographic structure, magnetite has an inverted spinel structure where a number of trace elements can replace Fe^{2+} or Fe^{3+} [1]. It also hides important clues as it preserves the magnetite composition, which has a stable structure due to its physicochemical properties [2]. This mineral, which is observed in igneous, sedimentary and metamorphic rocks, is found in paragenesis in many mineral deposits [3-4]. The geochemical content of magnetite [5], which is generally observed in VMS-type deposits, is used both in the classification and exploration of mineral deposits by in-situ laser-ablation inductively coupled plasma mass-spectrometry (LA-ICP-MS) method [6]. Volcanogenic massive sulfide (VMS) deposits are separated into 3 major types as Kuroko, Besshi and Cyprus Type [7]. It is recognized that there are areas similar to the Besshi type deposit, the typical example of which is in Japan, in various districts around the world. The world's largest Besshi type deposit is the Windy Craggy in northwestern of British Columbia [8].

Significant Volcanogenic Massive Sulfide deposits (VMS) are formed along the Pontide orogenic belt, which is one of the main tectonic belts in Turkey. Kuroko or Black Sea type deposits were classified in the Eastern Pontides [9-11] and Cyprus [12] and Besshi type deposits [13-14] in the Central Pontides. There are rock groups consisting of specific tectonic slices [15] in the Gökçedoğan (Kargı-Çorum) district (Central Pontide). In this district, which is in the subduction-accretionary complex as a tectonic location, units existing to the Kunduz metamorphics mostly crop out [15]. In these metamorphics, Besshi Type Cu-Zn mineralization is observed in parallel with the schistosity within the metabasite and quartzschist alternations [13]. Mainly chalcopyrite, sphalerite, pyrite, magnetite, hematite, covellite, malachite and goethite minerals are observed in ore paragenesis. In this paper, we mention new data gathered from trace element geochemistry of magnetite using LA-ICP-MS.

Material and Method

Electron probe microanalysis studies (EPMA) of magnetite detected in ore paragenesis were carried out in CAMECA SX100 device at ITU ATUM Research and Application Center. Diagrams were set up with the gained data.

Petrography

Gökçedoğan Cu-Zn mineralization was formed in metabasites belonging to Kunduz metamorphics. Mainly actinolite, chlorite, epidote and quartz minerals are observed in the rock with nematoblastic texture. In the ore petrography, it was seen that sphalerites replaced chalcopyrite and pyrite, and pseudocubic magnetites were transformed into hematite. For mineral chemistry, magnetites, which were arranged parallel to the foliation and underwent deformation, were used (Figure 1).
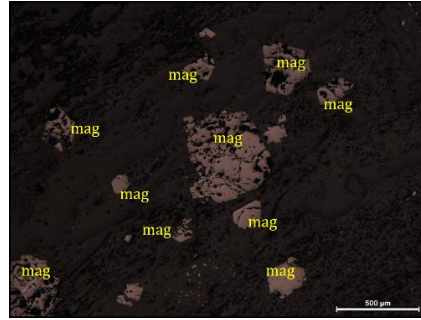
Figure 1. Deformed magnetite minerals

Results

LA-ICP-MS analysis results of magnetite mineral are given in Table 1. Most trace element abundances in magnetites are less than 0.1 ppm (Table 1). In the samples whose trace element compositions are exceedingly variable, Fe is between 72.06-73.39 and O is between 20.78-21.15 respectively. V is approximately higher than the other elements. Gökçedoğan mineralization shows a similar distribution with VMS type deposits on both Al/(Zn+Ca) vs. Cu/(Si+Ca) and Al/(Si+Ca+Zn) vs. Cu/Ca diagrams (Figure 2 a, b). In the spider diagram, Gökçedoğan mineralization has high Si, identical to the character of the VMS type deposits, and exhibits a distribution similar to the Windy Craggy deposit, which is the largest Besshi Type Deposit (Figure 2c).

Table 1. LA-ICPMS results for trace elements (%) in magnetite from the Gökçedoğan Cu-Zn deposit

%wt	KGD-317	KGD-317	KGD-317	KGD-317	KGD-317
Mg	0,01	0,01	0,01	0,01	0,01
Al	0,02	0,02	0,08	0,01	0,02
Ti	0,02	0,01	0,01	0,01	0,01
V	0,11	0,12	0,06	0,07	0,11
Mn	0,03	0,08	0,02	0,03	0,05
Ni	0,01	0,01	0,03	0,01	0,01
Zn	0,06	0,11	0,28	0,35	0,05
Sn	0,02	0,01	0,02	0,02	0,02
Cr	0,01	0,1	0,1	0,01	0,04
Fe	72,69	73,39	72,07	72,06	72,66
O	20,93	21,15	20,86	20,78	20,92
Cu	0,032	0,045	0,025	0,03	0,03
K	0,002	0,001	0,001	0,002	0,001
Ca	0,055	0,003	0,042	0,031	0,01
Si	0,008	0,6	0,05	0,055	0,013
Total	94,007	95,659	93,658	93,478	93,954

Conclusion

Trace element analysis of magnetite in the paragenesis of Gökçedoğan VMS deposit observed in the Central Pontides was carried out. As a result of this study, it was decided that Gökçedoğan Cu-Zn deposit exhibits similar geochemical characteristics with Windy Craggy Besshi Type deposit.
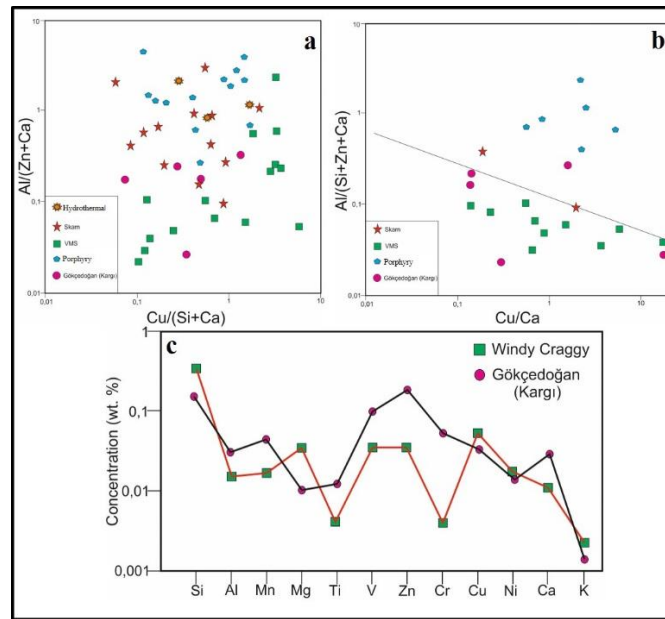
Figure 2. a) Al/(Zn+Ca) vs. Cu/(Si+Ca) diagram, b)
Al/(Si+Ca+Zn) vs. Cu/Ca diagram, c) Spider diagram for Besshi Type deposits.

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Preliminary Datas of Carbonate-rock hosted barite Mineralization in Dadağlı (Kahramanmaraş) area, Turkey

Cihan Yalçın[*1]

[1]*Ministry of Industry and Technology, General Directorate of Industrial Zones, Ankara, Türkiye, cihan.yalcin@sanayi.gov.tr*

Keywords
Amanos
Barite
Paragenesis
Vein Type
Dadağlı

Abstract
There are units existing to the Amanos Group in the vicinity of Dadağlı (Kahramanmaraş). Paleozoic aged rocks and Mesozoic aged carbonates are observed on them. There is vein type barite mineralization in the fracture lines of the Upper Triassic-Lower Jurassic Küreci dolomitic limestones in the north of Dadağlı. Paragenesis consists of galena, sphalerite, pyrite, smitzonite, calcite and quartz, individually. The mineralization is roughly 1 m thick and 200 meters long. The BaO value amounts to a peak of 65.07% in the specimens gathered from the ore zone. Although the ore zone is poor in SrO, it is rather rich in SiO_2. It is concluded that the mineralization, which is particularly close to the left-lateral strike-slip East Anatolian Fault (EAF), forms in fractures and cracks set up as a result of deformations.

Introduction

Barite ($BaSO_4$) is an essential industrial raw material because it is an intense mineral. Barite, which generally observed in marine environments [1-2], is still involved in the paragenesis of Pb, Zn, Cu and Au deposits in low, medium and high sulfidation classes [3-4].

Turkey's important barite deposits were formed as a result of the Alpine and Hercynian Orogeny [5]. For this reason, barite mineralization is located in major tectonic belts. Among these deposits, the Isparta barite deposits, which have the largest distribution, are observed in Paleozoic aged carbonate and pelitic rocks in the Western Taurus [6-11]. Cansu and Öztürk [12] explained the formation and origin of barite deposits associated with Paleozoic sediments located in both the Tauride-Anatolide belt (Şarkikaraağaç, Hüyük and Tordere deposits) and the Arabian platform (Şekeroba and Önsen deposits, Kahramanmaraş). The barite mineralization observed in the Dadağlı region is very close to this district. In this paper, we present preliminary geochemical data obtained from Dadağlı barite mineralization using X-ray fluorescence (XRF) methods.

Material and Method

In terms of its geological structure, Kahramanmaraş is a complex region where various tectonic units are observed simultaneously. Many thrust and fault zones identified with the closure of the southern branch of the Neotethys Ocean are observed in this region [13]. Suture belts were formed by both the closure of the ocean and the convergence of the Tauride and Arabian plates [14]. With the depletion of the ocean floor, allochthonous units were thrusted onto the Arabian platform in the south and suture belt and suture belts were formed between these two continents [15]. Rigo De Righi and Cortesini [16] and Gül [17] divided the tectonostratigraphic units in the Southeastern Anatolia Region into orogenic belts.

The Dadagli barite mineralization is situated in the margin fold belt of the Arabian Platform in the south of the Taurus Orogenic Belt (Figure 1). In this region, Upper Triassic-Lower Jurassic Küreci limestones overlie the

Paleozoic basement with angular unconformity. Vein type barite mineralizations are observed in the limestones in the north of Dadadağlı (Figure 2a, b). In the mineralization with epigenetic formation, quartz, calcite and smithsonite are still observed along with galena, sphalerite and pyrite, respectively.

In this region, 8 samples were taken and geochemical analyzes were made. Major oxide and trace element analyzes were carried out in ITU-JAL. Analysis results are given in Table 1.
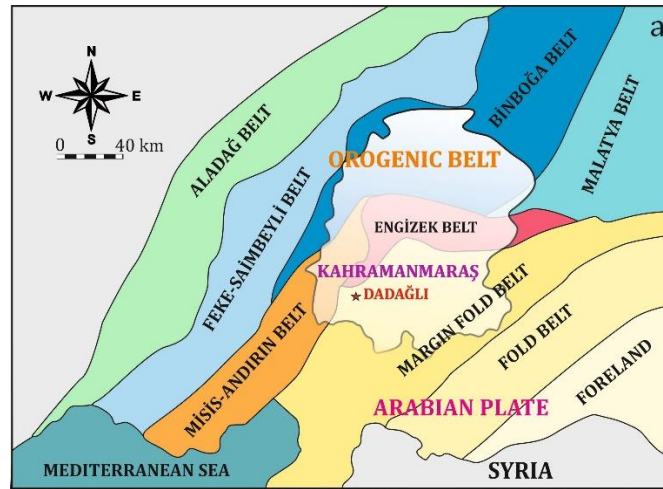
Figure 1. Tectonic location of the study area (Modified from Gül [17]).

Figure 2. General view of barite minearalization.

Geochemistry

As showed in Table 1, BaO is between 0.49-65.07% (average 29.52%) and SrO is between 0.06-1.78% (average 0.64%) in the ore zone. Some of the compiled samples are rather rich in SiO₂. CaO is between 0.26-12.77% (average 2.88%) and Fe₂O₃ is between 0.12-15.97% (average 4.15%).

Table 1. Major oxide analysis of barite mineralization.

Formula	K1	K2	K3	K4	K5	K6	K7	K8
Na_2O	0,13	0,89	0,48	0,48	0,05	0,33	0,00	0,38
MgO	3,95	0,82	0,20	0,05	0,42	0,13	0,61	0,12
Al_2O_3	1,80	22,70	1,27	0,25	1,28	0,45	1,72	0,65
SiO_2	38,79	42,44	6,62	2,32	87,74	32,18	86,78	9,28
P_2O_5	0,27	0,66	0,03	0,00	0,02	0,04	0,03	0,03
K_2O	0,47	5,51	0,10	0,00	0,24	0,10	0,28	0,10
CaO	12,77	0,26	1,13	0,61	1,46	2,23	2,32	2,31
$TiO2$	0,13	3,97	0,12	0,01	0,06	0,16	0,06	0,10
MnO	0,20	0,03	0,02	0,00	0,81	0,00	1,84	0,07
Fe_2O_3	2,41	15,97	0,30	0,12	0,86	11,38	1,63	0,53
SO_3	8,56	0,13	26,77	28,44	1,47	17,43	0,31	25,58
BaO	16,71	0,49	60,97	65,07	2,51	31,07	0,96	58,41
Cr_2O_3	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00
SrO	0,57	0,06	1,12	1,78	0,06	0,57	0,02	0,94
LOI	13,22	5,86	0,83	0,81	2,96	3,89	3,38	1,47
TOTAL	99,99	99,80	99,96	99,94	99,94	99,97	99,93	99,97

Conclusion

The Dadagli region is located within the margin fold belt of the Arabian plate. There are vein type epigenetic barite mineralizations in the Mesozoic aged carbonates from the Amanos Group units here. The mineralization observed in the fractures and cracks of the carbonates in this region is 200 meters long, with an average thickness of 1 meter. Corresponding to the preliminary data, lead-zinc minerals and their carbonated forms are observed in the ore paragenesis. Major oxide results indicate a mineralization that is poor in Sr but rich in silica. Rich Al_2O_3 values in specimens with poor BaO content may be associated with argillization in fault zones. The positive correlation between SO_3 and BaO in the analysis results is remarkably strong to be ignored.

Since this region is extremely close to EAF, it is considered that EAF may have an effect on barite formation in fractures and cracks.

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Rear bumper design and structural analysis study in compliance with ECE R58.03 regulation

Mehmet Ali Kurgun*[1] , İskender Özkul [2]

1 Koluman Otomotiv Endüstri A.Ş., Mersin, Türkiye
2 Mersin University, Faculty of Engineering, Department of Mechanical Engineering, Mersin, Türkiye

Keywords
Bumper
ECE R58.03
N Category Vehicles
Ansys

Abstract
In this study, it is aimed to construct and equip rear bumpers to provide effective protection against the rear entry of vehicles with the updated regulation on rear protection equipment of motor vehicles and their trailers. Structural analysis was carried out with the help of Ansys program to the bumper designed for an N category vehicle, and forces of 100 kN and 180 kN, which are the regulation conditions, were applied. Design verification has been made and the study has been commissioned.

Introduction

Recently, there has been a serious increase in the number of vehicles in the traffic, and as a result, it is seen that traffic accidents have increased at the same rate. Although this situation is not only related to the number of vehicles but also to the road condition, it is possible to say that there is an increase in the number of traffic accidents all over the world.

It is known that with the increase of safety technologies in the automotive sector, deaths can be significantly reduced. One of these measures is undoubtedly the bumpers on the back of the trucks and it can be said that these bumpers are durable. In the event that a car hits the truck from behind, this system prevents people from getting under the truck, and fatalities can be prevented to a great extent. Figure 1 shows the impact of a truck without a rear bumper and a car crashing into another truck with a rear bumper.

Figure 1. Crush Test [1]

The regulation with the code R58.03 has been published by the European Economic Commission (ECE) in order to standardize the required strength in these units [2].

Truck rear bumpers, which have been produced for a long time, are seen as the most important solution to prevent deaths in rear-end collisions. Picture 2 shows the rear bumper designed for the truck with the Koluman brand concrete pump superstructure.
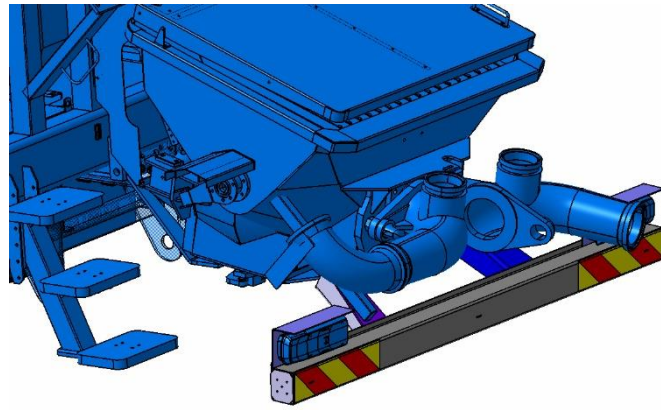
Figure 2. Rear Bumper of Concrete Pump

Results and discussions

As a result of the regulations determined by the European Economic Commission (ECE), the protective equipment that must be mounted on the back of the truck must meet some conditions. Under these conditions, the durability of the material is tested by applying forces to the areas determined on the bumper. The regulation with the code R58.03 has been published by the European Economic Commission (ECE) in order to standardize the required strength in these units. The values included in the regulation are shown on the bumper in Figure 3.
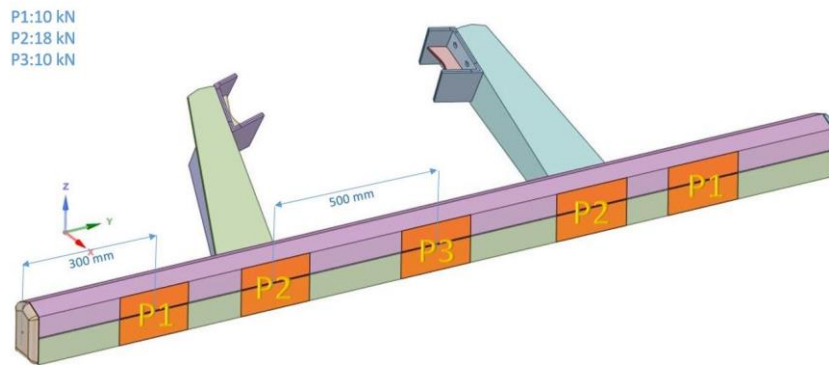
Figure 3. Rear Bumper of Concrete Pump

In the designed rear bumper, the material has been prepared for static analysis in Ansys program. The visual of the prepared material is shown in Figure 4.
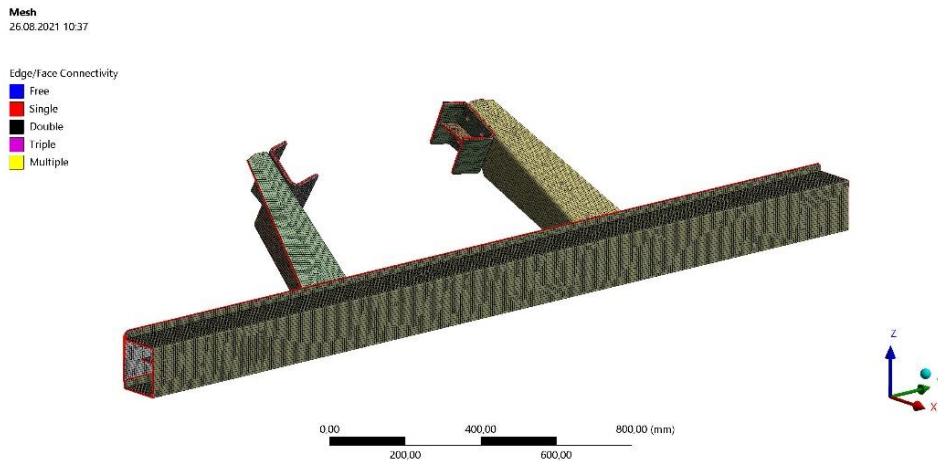
Figure 4. Mesh Structure of Rear Bumper

In the designed rear bumper, 10 kN of P1 load was applied to the material. The result of the tension in the material after the application is shown in Figure 5.
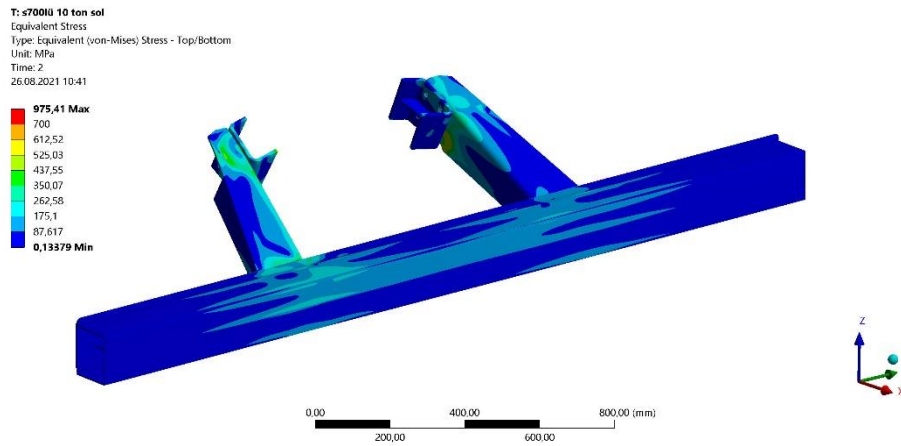
Figure 5. P1 Force Application

In the designed rear bumper, 18 kN of P2 load was applied to the material. The result of the tension in the material after the application is shown in Figure 6.
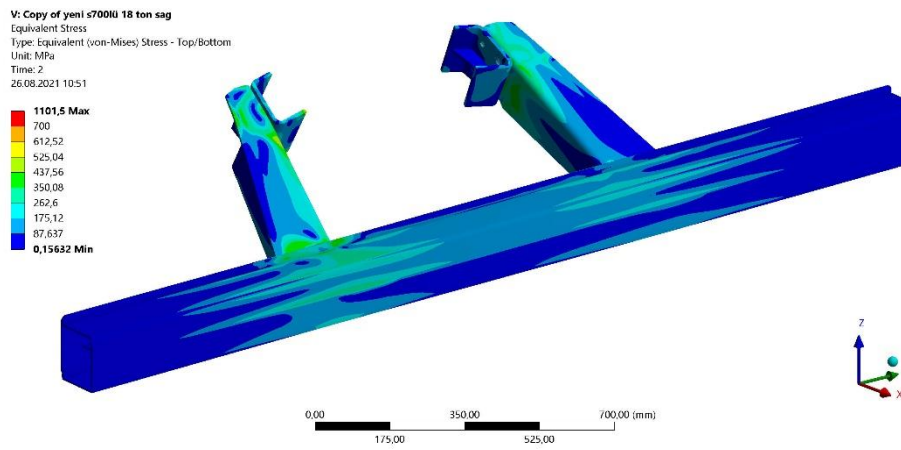
Figure 6. P2 Force Application

In the designed rear bumper, 10 kN of P3 load was applied to the material. The result of the tension in the material after the application is shown in Figure 7.
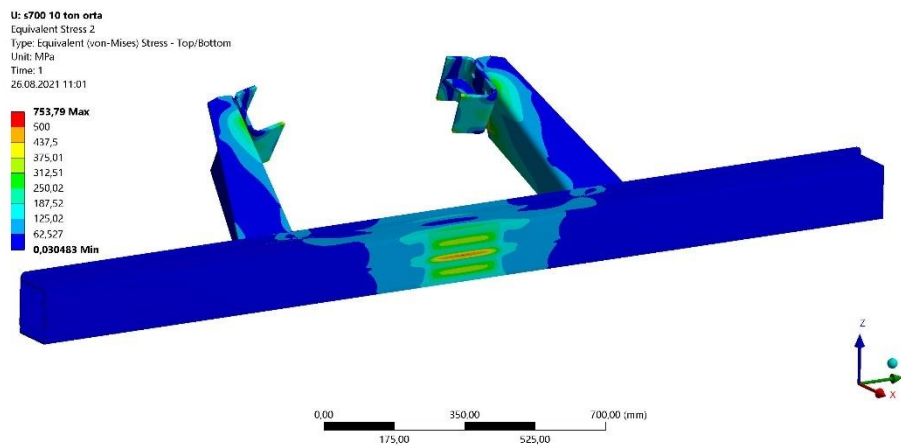
Figure 7. P3 Force Application

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Conclusion

Recently, the regulation on rear protection equipment of motor vehicles and their trailers has been updated. In this case study, a structure equipped with a rear bumper to increase effective safety against accidents at the rear of the vehicles was designed and tested under 100kN and 180kN forces. As a result of this study, minimum strength values have been reached for the material to be used while designing the bumper.

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Pressurized gating system design and optimization in steel castings

Mustafa Murat Zor[1], **Alper Yoloğlu[1]**, **Serdar Kesim[1]**, **Ferhat Tülüce[1]**

[1]ÇİMSATAŞ Çukurova Construction Machinery IND. TRADE. A.S. Mersin, Türkiye, foundry@cimsatas.com

Keywords
Steel casting
Pressurized gating system design
Casting defect
Modeling and simulation
Spin Trap chamber

Abstract
The aim of this study is to establish a correlation between the proven version of the pressurized gating system for steel castings and the cost-effective version of the pressurized gating system in industrial conditions. In the study, a computer-aided design solid modeling program was used in the design of the pressurized gating system for steel castings and the ratio of the pressurized gating system was selected as 1: 3: 1. Flow simulation of the gating-designed casting part was made in computer-aided design metal casting simulation. In the study, calculations used in the design of the pressurized gating system were made based on the weight of the part and effective casting height. The study clearly shows that the well-designed pressurized gating system has revealed that it plays a significant role in preventing non-metallic casting defects in steel castings, such as sand, gas, and slag. In addition, the '' Spin Trap '' that is recommended to be used in gating systems in ferrous based castings in the literature, was used for the first time in the ÇİMSATAŞ foundry in the steel castings at the end of the runner in the pressurized gating system and the appropriate result was obtained. Computer-aided flow and solidification simulation was used in the design of the gating system containing Spin Trap

Introduction

In steel castings, all the cavities created in the sand mold are called the gating system for the liquid metal to fill the mold cavity without any problems. As important as the effective use of feeders in a cast part is, the correct design of the gating system is just as important. The basic components of the gating system in the casting processes; casting chamber (casting countersink), vertical runner, horizontal runner, and ingate consists of four parts. Although the main task of the gating system is to direct the molten metal and fill the mold with molten metal, a well-designed gating system plays an important role in preventing various casting defects (non-metallic inclusions such as sand, gas, and slag) that may occur the casting part [1-3]. Likewise, a poorly designed gating system can cause defects in the last part that may require repair, or cause the part to be scrapped. Well-designed gating system; should be able to fill the mold at the appropriate time, direct the liquid metal to the desired and/or targeted location, allow air and gases to escape from the mold, prevent non-metallic inclusions from entering the mold, not cause the mold to deteriorate with erosion, not cause gas suction due to turbulence, and should be minimum weight [3-9].

Pressurized Gating System

The tightest cross-sectional area of the pressurized gating systems used in steel casting processes is the ingate. In the pressurized gating system, the total cross-sectional area decreases towards the mold cavity, and back pressure formation is prevented by the pressure of the liquid metal in the runner. In the pressurized gating system, the gas absorption is significantly reduced because the horizontal runner remains constantly filled throughout the casting period. In addition, the use of a pressurized gating system in steel castings ensures uniform filling in the ingates and minimum runner weight for high runner efficiency. Typical ratios used in pressurized gating system design are 1:3:2 and 1:3:1 [3-6].

Spin Trap System

There are many versions of various slag capture systems in the literature for steel castings. In recent years, the use of a Spin Trap chamber at the end of pressurized gating systems for steel castings has been recommended by many authors in the literature. The main purpose of the Spin Trap system is; to obtain a cleaner casting part by grabbing non-metallic inclusions such as sand, gas, and slag that the gating system cannot prevent from entering the part, and to optimize the gating system [6-15].

Material and Method

In this study, it is aimed to develop a pressurized gating system for steel castings by using a computer-aided solid modeling program. The pressurized gating system design of the fork part is based on the total weight of the part. The part was molded in the green sand molding system and cast in the ÇİMSATAŞ foundry. In the study, the material of the part was determined according to the TS EN 10293 standard (material of the casting part is G17CrMo9-10 + QT). Due to the high carbon equivalent of this material and the visuality of the part, it is aimed to minimize non-metallic inclusions such as sand, gas, and slag that may occur on the surface of the part during casting. The pressurized gating system design of the part was made in the computer-aided solid modeling program and the flow simulation of the part was made in the computer-aided metal casting and solidification program.

Table 1. Pressurized gating system ratio and dimensions

Gating system ratio	Vertical runner	Horizontal runner	Ingate
1:3:1	1	3	1

The filling and solidification simulation of the casting part was made with a lip pouring ladle at 1600 °C . The nominal chemical composition of the casting part was selected as shown in table 2 and the metal flow and filling simulation was performed.

Table 2. Nominal chemical composition of the casting part

Contents	% C	% Mn	% S	%P	% Si	% Ni	%Cr	% Mo
Min.	0.13	0.5	0	0	0.4	0	2,0	0.9
Max.	0.2	0.9	0.02	0.02	0.6	0.3	2,5	1,2

After simulating metal flow on the part, 12 parts were molded in the green sand molding system in the ÇİMSATAŞ foundry and the castings were carried out with a lip pouring ladle at 1586 °C as shown figure 1.

Figure 1. Image of the metal flow and filling simulation and the pouring parts

By using the metal flow and filling simulation data of the part for which the pressurized gating system was designed, the Spin Trap chamber was placed at the end of the gating system without changing the dimensions of the part gating system, and the part was simulated again under the same conditions . After simulating metal flow on the part, 12 parts were molded in the green sand molding system in the ÇİMSATAŞ foundry and the castings were carried out with a lip pouring ladle at 1586 °C as shown in figure 2.
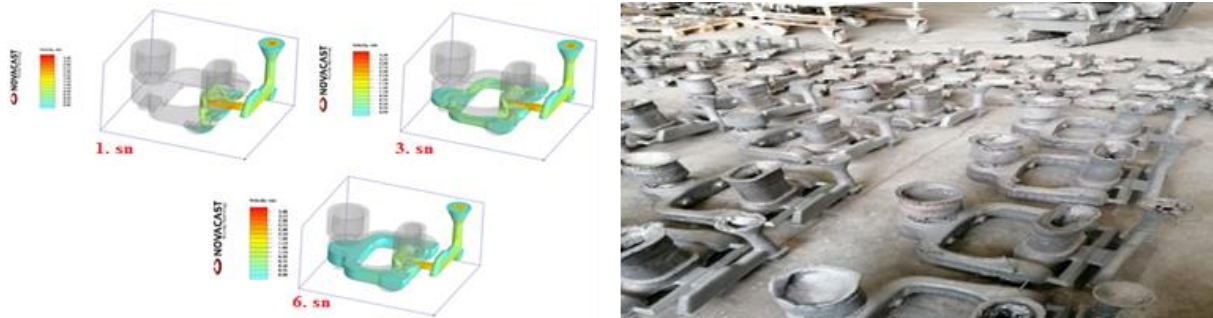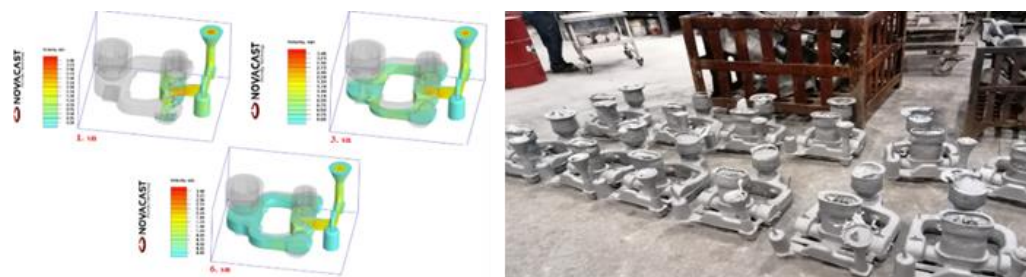

Figure 2. Image of the metal flow and filling simulation and the pouring parts with Spin Trap chamber

Findings

- It is found that the simulation results highly represent the actual casting results.
- Although the pressurized gating system for steel castings minimizes the penetration of non-metallic inclusions into the part, it has been concluded that in some specific cases there may be situations where these inclusions cannot prevent their penetration into the part.
- Although the data that the part gating system could not catch slag was obtained, the presence of non-metallic inclusions that can be seen in the gating systems of the cast parts.
- It has been observed that the Spin Trap chamber significantly captures non-metallic inclusions in the part filling, and the results obtained revealed that the part simulation significantly confirmed the actual situation.
- Destructive inspection was performed on the Spin Trap chambers and the presence of non-metallic inclusions was detected in the cut pieces.

Figure 3. Images of inclusions captured in the Spin Trap chamber

Results

Although the pressurized gating system for steel castings minimizes the penetration of non-metallic inclusions into the part, it is concluded that it cannot prevent the non-metallic inclusions escaping from the ladle during casting to entering the part at the desired level.

With the design of the Spin Trap chamber pressure gating system in the ÇİMSATAŞ foundry, the surface quality of the cast steel parts has improved positively. The improvement in the casting part surfaces which get obtained by using a spin trap was reduced the rework needed (such as cosmetic welding, grinding, etc.).

The results of the study show that the Spin Trap chamber, which has been widely used in non-ferrous castings in recent years, has also given positive results in the steel casting process.

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The maritime industry and mobile applications

Ömer Aladağ*1 , **İshak Altınpınar** 1

1Bartin University, Transportation Services Department, Türkiye, oaladag@bartin.edu.tr; ialtinpinar@bartin.edu.tr

Keywords
Maritime
Mobile app
Seafarers
Sailor
Application

Abstract
Mobile applications are available in app stores on different platforms in order to make it easier and faster for sailors to do their duty. It has seen that mobile maritime applications prepared for seafarers are prepared to assist seafarers in the tasks included in the STCW. We use mobile technologies and devices in many areas to make our lives easier today. While meeting the communication needs of sailors, the variety and prevalence of use of mobile applications produced to relieve professional workloads are increasing. In this research, the data of maritime applications were collected by documentary scanning method, and the data obtained were examined by content analysis method. This study, which examines mobile applications that select individuals interested in maritime activities as a market, will guide the development of need-oriented applications in the field of maritime.

Introduction

Applications for maritime area in mobile device application markets are increasing day by day [1]. Millions of mobile apps are downloaded and used by users around the world [2]. All applications that can be downloaded to portable electronic devices can be evaluated within the scope of the mobile application. Various fee and free maritime applications are available in the application markets.

In addition to its qualities such as taking photos, watching videos, playing music, mobile devices that we support in our business life have an important place in our daily life. The rapid development of technology has allowed us to use multimedia features and applications necessary for business on a single mobile device. The new generation of mobile devices can perform the tasks not only of other electronic devices, but also of some mechanical devices (ruler, compass, sextant, thermometer, barometer, anemometer, etc.) that are often used in the maritime field. Some of these tasks are performed by mobile devices thanks to their internal hardware and some of them are carried out thanks to online internet access.

The rapid development of technology has significantly improved the methods of remote monitoring and monitoring of ships today [3]. Currently, many websites provide ship tracking using an automated identification system to view the ship's real-time location [4]. Thanks to mobile applications, sailors can access ship remote monitoring systems and learn about sea traffic in the region. Projects that provide real-time information about the movements of ships, ports and the current position of ships in ports are now implemented and monitored by users in the maritime sector. Users can access the information database about the ships, construction details, tonnage information of the ships and International Maritime Organization (IMO) numbers online.

Mobile applications are available in app stores on different platforms in order to make it easier and faster for sailors to do their jobs. It has seen that mobile maritime applications prepared for seafarers are prepared to assist seafarers in the tasks included in the STCW contract. Applications such as navigation, shipping, marine safety and ship safety, marine pollution, freight handling and cargo stacking, health, maritime English, collision regulations, communication at sea, freight operations, ship structure and balance, meteorology, maritime law, shipbuilding,

international maritime contracts have been evaluated as marine mobile applications. Mobile apps for the use of marines appear to be designed to assist sailors on one or more missions.

It is seen that the mobile applications offered to users for benefit in the field of navigation are designed to actively use the internal GPS function of the mobile device in hobby activities. Seafarers can use these applications to gain knowledge about the approximate location of the ship on the ships they work on. It is seen that most of the applications in the navigation area can make an amateur-level voyage plan, and the coordinates of the turning points can be printed out of the printers. Some of the applications are tailored for AIS support. When mobile applications are suitable for AIS support establish a connection with an AIS device with Wi-Fi, the targets received from the AIS device can be displayed on the map on the application. In this way, the name, MMSI number, IMO number, call sign, status, speed, route, coordinates, distance from your location can be displayed. There are mobile apps that offer the option of safe distance adjustment and hazard alerts. Marine mobile applications also include functions that allow sailors to measure possible changes in ETA. Applications for viewing route (COG), speed (SOG), maximum speed, road distance, speed average and magnetic route are available in the markets. Sailors can share location, COG, and SOG information with their friends thanks to these applications. In many applications, it is possible to customize map views, highlight shallow areas, mark fishing grounds.

Warnings are given to users by application manufacturers that it is not safe to use applications containing maps in the maritime area for navigation beyond obtaining information. Astronomical navigation calculations and corrections can be easily done thanks to the applications prepared to make astronomical navigation calculations. Mobile apps for sailors provide users with information about points of interest (POI) close to their destination, such as the port authority, marinas and moorings, gas stations, restaurants and bars, shops, taxis, repairs, and dealers. Information such as emergency access phone numbers and VHF channels for marinas is essential for sailors.

Within the application markets there are mobile applications designed to speed up and facilitate calculations related to shipload operations. Some applications are prepared open to ship-specific data entry and analyses are made after the information about the ship's capacity is entered manually into the applications. Thanks to draft survey applications, ballast water calculations, trim and incline calculations can be made, and units can be converted together. Applications support saving calculations as PDF and can connect with printers.

The applications prepared in the field of boat maintenance inform the seafarers about how to do the work, and some describe it with moving graphics. Mobile applications for monitoring machine failures and planned maintenance are available in stores.

Material and Method

Documentary scanning method was used in this study where qualitative and quantitative data were collected in order to determine the use of mobile applications in the maritime field and to determine the characteristics of these applications. The data obtained within the scope of documentary screening were examined by content analysis.

As part of the research, websites of leading applications in the maritime field, followed by mobile app stores on Android operating system and IOS operating system platforms were scanned. The universe of the research is the applications prepared in the maritime field in the app stores. Although it is impossible to examine all the applications prepared for sailors and shipmen in this study, the application download figures shared in the application markets were examined. The main popular applications in the field of maritime affairs were examined within the scope of this study.

Results

Applications produced in the maritime field are very popular. For this reason, the number of applications offered in application stores is increasing day after day. Some applications help seafarers communicate and socialize with each other, thanks to their data-sharing features. With the development of technology, the acquisition of new functions of the internal equipment of mobile devices has increased the frequency of using mobile devices in the maritime activities carried out by amateur sailors for hobby purposes. Applications prepared for navigational purposes in the marine field repeat each other and offer similar functions to users. The number of applications designed in the area of ship machinery on the application markets is less than the number of applications prepared in the field of ship deck. Shipmen who do not have access to the bridge can use mobile applications to track navigational information. The frequency of business use of mobile devices is increasing.

Discussion & Conclusion

There are warnings that some navigation charts in mobile applications are not safe to use as a primary source for seafaring, failure to follow these warnings may endanger navigational safety. As the number of maritime companies supporting the access and modification of security management forms from mobile devices increases,

the applications developed in the field of maritime is expected to enhance as well. It is thought that the effect of mobile applications for remote control and instant response will increase in the transition to fully autonomous sea vehicles and will guide new technologies to be developed in this area.

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Cyber-attack techniques in the maritime industry

Ünal Özdemir*[1] , Taha Talip Türkistanlı [2]

[1]Mersin University, Maritime Faculty, Maritime Transportation and Management Engineering, Türkiye
unalozdemir@mersin.edu.tr; tahaturkistanli@mersin.edu.tr

Keywords
Maritime
Cyberattacks
MCDM
Fuzzy Logic

Abstract
With the introduction of Industry 4.0, the digital integration of all industries became a significant issue. Concepts such as the internet of things, Blockchain, big data analysis were emphasized as the most popular digital integration instruments. In the maritime industry, globalization led to the most advanced trade networks that included the most advanced and fastest ships, robot-assisted ports and vast computer databases that track cargo. However, although the digital media leads to optimum cost, optimum time, optimum benefits, etc., it also increased the risk of cyberattacks to industry transactions. The rise in cyberattacks is predicted to have the potential to seriously damage the critical infrastructure in the future. Thus, the present study aimed to determine the types of cyberattacks on the maritime industry, and the possible measures that could be adopted to prevent or reduce these attacks with a quantitative approach. Since the data collected in the study were mostly oral data, expert opinions were required, and covariance, overlaps, dependencies between the criteria associated with the research problem, the study was conducted with a fuzzy multi-criteria decision-making (FMCDM) approach.

Introduction

In general, harmful behaviors and actions that could be conducted with viruses, trojans or similar codes, mostly planned and coordinated to attack internet systems are called cyberattacks (Craigen et al. 2013; Julisch, 2013; Rid & Buchanan, 2015). The review of recent cyberattacks would demonstrate that their targets were quite diverse, including hacktivism that aim financial or political gain or blackmail, or simply theft (Schaik et al. 2017; Teoh & Mahmoos, 2018). Furthermore, while certain cyberattacks have a purpose, other are conducted without any purpose, only to harm the victim or to satisfy the attacker's ego (Liu et al. 2020). The fact that national and international legal sanctions against cyberattacks are not really deterrent is also considered a significant factor in cyberattacks on the maritime industry (Pu and Lam, 2021). Furthermore, cyberattacks to the vessel navigation technologies such as AIS (Automatic Identification System), GNSS (Global Navigation Satellite System) and ECDIS (Electronic Chart Display and Information System) could lead to significant consequences such as rerouting the vessel (Egan et al. 2016). Another type of cyberattack in maritime industry entails rerouting the vessel with false GPS signals and routing the vessel to pirate prone areas. Even when this dangerous attack is noticed, the crew could not intervene to the deck and machinery automation technologies. Cyberattacks could not only target the vessels and navigational equipment, but also other maritime trade units. The attacks in the maritime industry include the alteration of cargo manifests such as renaming illegal shipments such as drugs or weapons as ordinary and non-hazardous freight (Gertzan, 2003; Fitton, 2015; Tucci, 2017; Sivilic et al 2019).

Material and Method

A comprehensive field study and a literature review was conducted to determine the cyberattacks on the maritime industry and to provide solutions. The analyses revealed a large number of written and verbal data. For the numerical analysis of these data, the data should be organized systematically. The authors preferred MCDM methodology to avoid the complex solutions obtained with classical mathematical models since the collected data was large, not systematic, and the verbal expressions and suggestions were significant for the scope of the study. MCDM methods are frequently employed in the literature, and generally provide more effective solutions for these types of problems, lead to a more practical and flexible solutions based on expert opinions (Ting Shih and Gwo-Hshiung, 2004; Özdemir & Güneroğlu, 2015; Wang and Peng, 2015; Özdemir an& Güneroğlu, 2017). Thus, an integrated model approach that included DEMATEL and TOPSIS methods was adopted in the study. In the model, the fuzzy DEMATEL technique was employed to determine the causalities and significance distributions in the study. Then, the fuzzy TOPSIS method, developed by Chen (2000), was employed to calculate the ranking of the solution hypotheses. The DEMATEL and TOPSIS methods were preferred since these are the most adequate methods for the structure of the study, and their implementation is simple and comprehensible.

Results and Discussion

The study findings revealed that the top three ranking cyberattack types were C10 (System Infrastructure Hacks), C4 (System hacks) and C12 (Phishing) on the maritime industry. It could be suggested that the most prevalent type of cyberattack, namely "hacking maritime company web-based systems to demand ransom for allowing access or sharing data with third parties," should be prioritized in future studies conducted by IMO (International Maritime Organization). The past cyberattacks on the maritime industry demonstrated that the main motivation in these attacks was extortion. C4 (System hacks - Changing, disrupting or destroying the content of valuable documents [bill of lading, freight plan, transport contracts, etc.] by hacking the systems of land operations such as the ports and agencies) was the second prevalent type of cyberattack. The study findings on alternative solutions demonstrated that the root solutions for the problem included K3 (Initiation of R&D work to develop mandatory software that would fully protect the land and vessel data systems under the coordination of IMO and inclusion of the employment of this system in international maritime conventions), K2 (Ensuring the reliability of the IT infrastructure of the International P&I Clubs Group, Bolero and essDOCS systems and the e-title system that provide international electronic bill of lading applications and approved by the International Group of P&I Clubs with approved virus protection systems) and K8 (Network production including software clustering, unauthorized access identification, software whitelists, access and user control mechanisms.) alternatives.

Based on the expert opinions, it was observed that the solution should be organized by IMO. Thus, it was concluded that, IMO should conduct R&D to develop a standard antivirus software compatible with the maritime industry databases and the software should be compulsory and this should be stipulated in international maritime conventions, especially in member countries. It is known that IMO has conducted significant studies on cyberattacks. It could be suggested that the most significant work was the "Guidelines for Cyber Security on board Ships". However, this is only a guide and implementation is voluntary. It is the alternative K2 with the second highest degree of importance that draws attention as a solution to the problem. The second ranked alternative was the K2(Ensuring the reliability of the IT infrastructure of the International P&I Clubs Group, Bolero and essDOCS systems and the e-title system that provide international electronic bill of lading applications and approved by the International Group of P&I Clubs with approved virus protection systems.)

Note

This study has been sent for review and publication to the *International Journal of Transport Economics* by paper author Associate Professor Dr. Ünal ÖZDEMİR . The peer-review process of the study continues.

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Fault tree analysis of accidents occurred in Van Lake

Bayram Aslan*1 , Devran Yazır1

1Karadeniz Technical University, Maritime Transportation and Management Engineering Department, Türkiye
cpt.bayramaslan66@gmail.com, dyazir@ktu.edu.tr

Keywords
Van Lake
Marine accidents
Marine incidents
Maritime activities
FTA

Abstract
Maritime activities are one of the most important activities around the world. While maritime activities are carried out, various accidents such as collision, grounding, flooding, and on-board accidents occur. The causes of the accidents are determined and recorded with reports. However, records of accidents in inland waters are rare. Since the maritime activities carried out in inland waters remain regional and the boats operating in inland waters are of small size or small tonnage, the accidents that occur are not recorded and detailed reports are not prepared. For this reason, to draw attention to the accidents in inland waters and maritime activities, this study has been prepared by examining the accidents of grounding, collision, and flooding in Van Lake. In the study, the causes of the accidents obtained by the questionnaire and the research were analyzed with the "Fault Tree". As a result of the analysis, it has been determined that factors such as carelessness, lack of information, overconfidence, bad weather conditions, and lack of communication equipment are the main causes of accidents.

Introduction

Maritime activities cover all the world's seas and inland waters. The share of seaway in transportation is quite high. 90% of the transportation in the world is carried out by sea [1].

Many events occur during maritime activities. The most important and most influential of these are accidents. Maritime accidents negatively affect cargo, personnel, and the environment. Although many conventions, rules, and standards have been introduced to prevent maritime accidents, accidents continue to occur [2]. It is important to examine maritime accidents and take necessary precautions. Investigations of maritime accidents are generally limited to the high seas. However, accidents occurring in inland waters should also be examined and necessary precautions should be taken. Especially in inland waters where fishing, transportation, and other maritime activities are carried out intensively, the authorities should take the necessary precautions by examining the marine accidents. Maritime activities are carried out in two important inland waters in Turkey. Van Lake is one of these inland waters.

Freight transportation activities are carried out intensively between Van in Van Lake and Tatvan district of Bitlis [1]. Van Lake is the largest lake in Turkey in terms of surface area. Various maritime activities are carried out on the lake. Activities carried out in the lake can be grouped as transportation, fishing, and other activities. In particular, the rail connection between Turkey and Iran between Van and Tatvan is provided by ferries over the lake, which led to the development of maritime activities. In the document published by the Chamber of Shipping Van Representation, "2 ferries, 33 passenger motors, 117 fishing boats, 27 private boats, 2 sea buses, 1 pier construction barge, 1 small boat shelter, and 14 berths" [4]. Considering this information, the size and importance of the maritime activities carried out in the lake emerges. The aim of the study is to deal with the maritime activities carried out in Van Lake, to determine the types and causes of accidents in the lake, to identify the missing/faulty sides of the activities carried out in the lake, and to offer solutions for the development of activities.

Material and Method

The fault Tree Analysis (FTA) method is one of the most used methods for risk assessment and finding the root causes of errors. With FTA, the main causes of the undesired event or situation are determined and expressed as a figure. In FTA, all causes that will pose a hazard are defined. This method is aimed to minimize or prevent risky situations by revealing all the sub-causes of the event. It can be stated that it is the most important method used in security analysis since the 1960s. It is also an effective method in the analysis of complex systems [5-8].

The FTA method basically consists of 3 stages: analysis of the system, creation of the fault tree, and evaluation of the fault tree. A survey was conducted to determine the grounding, collision, and flooding accidents in Van Lake. The data obtained because of the survey were classified and a fault tree was created for grounding, collision, and flooding accidents (Figure 1). In addition, the probability values of the causes of the accident were calculated according to the data obtained from the survey. The generated fault tree and calculated probability values (Table 1) were analyzed with OpenFTA software. The data obtained because of the analysis were examined and the results have been revealed.
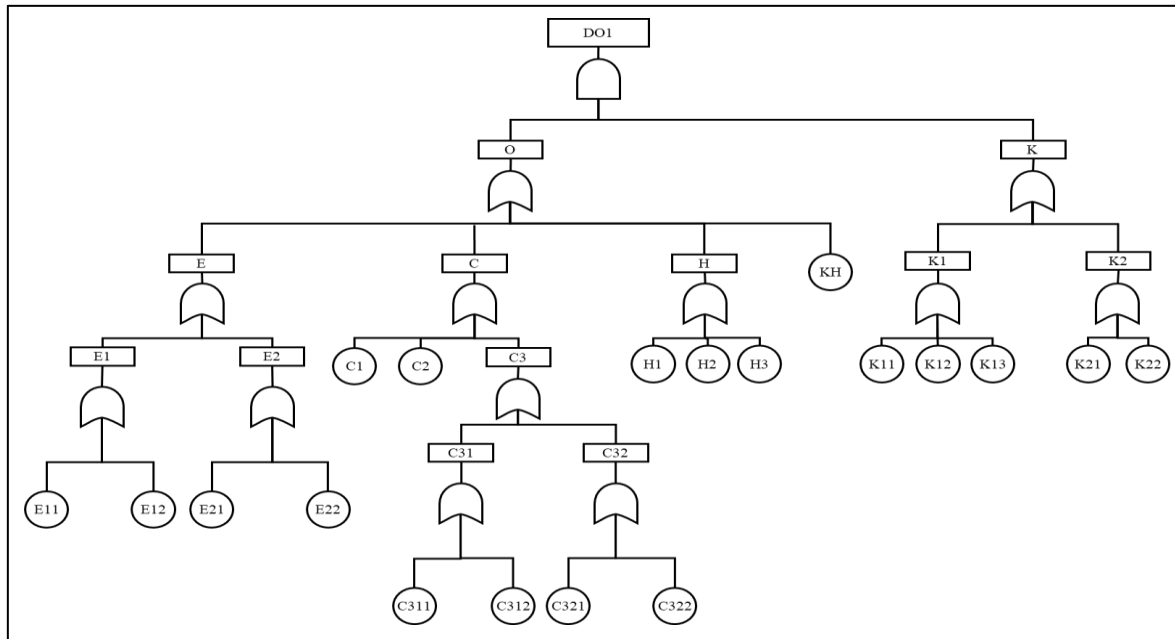
Figure 1. Fault tree for stranding, collision, and flooding accidents

Table 1. Code and probability values for grounding, collision, and flooding accidents

Code	Description	Probability	Code	Description	Probability
DO1	Grounding / Collision / Flooding	0,066100000	C32	Phone	0,061100000
O	Operational failures	0,373000000	C321	Malfunction of phone	0,019047619
E	Equipment failures	0,087600000	C322	Phone out of range	0,042857143
E1	Engine failure	0,028400000	H	Wrong loading	0,128000000
E11	Incorrect fuel use	0,014285714	H1	Calculation error	0,033333333
E12	Malfunction of part	0,014285714	H2	Unbalanced loading	0,038095238
E2	Equipment malfunction	0,061000000	H3	Overload	0,061904762
E21	Navigational equipment malfunction	0,023809524	KH	Bad weather conditions	0,066666667
E22	Rudder failure	0,038095238	K	Personal errors	0,177000000
C	Lack of communication equipment and failure	0,156000000	K1	Ability errors	0,088200000
C1	Lack of navigation equipment	0,014285714	K11	Disobeying rules	0,028571429
C2	Other equipment's	0,014285714	K12	Lack of information	0,052380952
C3	Lack of equipment	0,131000000	K13	Using the radio on the wrong channel	0,009523810
C31	Radio equipment	0,074800000	K2	Perception failures	0,097600000
C311	Lack of radio	0,047619048	K21	Carelessness	0,061904762
C312	Malfunction of radio	0,028571429	K22	Overconfidence	0,038095238

Results

As a result of the handling of the survey data, it was determined that 21 grounding, collision, and flooding accidents occurred in a period of approximately 10 years. As a result of the analysis of the detected accidents with a fault tree, taking into account the causes of the accidents, the contribution values of the causes and the minimum cut sets were determined.

When accidents such as grounding, collision, and flooding are examined in terms of their causes, the main causes that have the most impact are respectively K21 (Carelessness), K12 (Lack of information), K22 (Overconfidence), K11 (Disobeying rules), KH (Bad weather conditions). The is designated as H3 (Overload), C311 (Lack of radio), and C322 (Phone out of range).

When the minimum cut sets that must occur for the determined main causes to occur in combat accidents are examined, the cut set K21 (Carelessness) and KH (Bad weather conditions) that have the greatest effect are the minimum cut sets.

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Occupational health and safety in maritime education

İshak Altinpinar*[1] **Ömer Aladağ[1]**

[1]Bartin University, Transportation Services Department, Türkiye, ialtinpinar@bartin.edu.tr; oaladag@bartin.edu.tr

Keywords
Maritime Education
Occupational Health
Occupational Safety

Abstract
Occupational health and safety history extend back a long time. The concept, which has changed and renewed from the past to the present, is in a favored position as it should be today. ILO and WHO have made adequate and accepted definitions of occupational health and safety and stated that they attach great importance to the issue. As a workplace, maritime education and training institutions are included in the class of less dangerous workplaces according to the occupational health and safety legislation. However, considering the practical training such as fire training, life-saving training, abandon ship training, which is outside of the theoretical training given in these institutions, there are many risk factors for trainers and students. This study, which is planned as a theoretical study, emphasizes occupational health and safety in maritime education. As a result, occupational health and safety practices in education were discussed, and suggestions were made. It is aimed that this study will be a pioneer for future studies on the examination and development of occupational health and safety for institutions providing applied maritime education.

Introduction

Occupational health and safety have a long history. Even the laws of Hammurabi, which is one of the oldest law inscriptions, contain articles related to occupational health and safety [1]. Since then, occupational health and safety rules have aimed to protect employees from work accidents and occupational diseases, take necessary precautions for both health and possible safety problems, and inform employees about this issue. WHO states the definition of occupational health in its most detailed and accepted form as follows *"Occupational health is an area of work in public health to promote and maintain the highest degree of physical, mental and social well-being of workers in all occupations"* [2]. ILO has made a similar definition by adding environmental factors that may endanger occupational health and safety (OHS), health and safety in general [3].

The education sector is one of the major sectors that serve people from many different age groups, from kindergarten to graduate students. Education plays an essential role in the growth and development of a society. For this reason, societies that educate themselves and invest in this field at all costs are the societies that have the most say on the world scale. With this awareness, investments in education are increasing almost everywhere in the world today, and accordingly, the education staff is also growing. Education is not limited to the instructors' lessons in the classroom. Maritime education is somewhat different from other forms of education in this regard. There are detailed and challenging applied training during the maritime training, such as laboratory training, ship abandonment training, fire training, and survival at sea training. According to the occupational health and safety workplace hazard classes report, while higher education activities are evaluated in the less dangerous class, activities related to maritime courses are assessed in the hazardous category [4]. In addition, there are not enough seafarer trainers in many institutions for the education of the maritime profession. This situation brings with it problems that may occur in education [5-6]. The consequences of the dangers in this area can also be quite annoying.

Material and Method

In this study, in which qualitative data were collected, a general briefing was given in order to determine the hazard class of the applied training that comes to the fore in maritime education. The data obtained within the scope of documentary scanning were analyzed by content analysis.

Results

There are certain requirements to be a seafarer trainer, these conditions are clearly stated in the training and examination directive [4]. There are not many seafarers working in maritime training due to insufficient financial means compared to the personnel working at sea in the maritime field. The applied training have shown below, and much more, are conducted only by seafarer trainers.

Figure 1. Lifesaving equipment training platform

Figure 2. Training of survival at sea techniques

Figure 3. Firefighting training

In these training programs, both instructors and students are faced with some chemical and physical hazards, depending on the occupation they are trained for. Extra care must be taken, especially during the procurement of pyrotechnic materials and their practical training. Because many training programs use old machines donated by the industry or equipment that has expired, serious hazards may arise.

Conclusion

Practical training has always been a complement to theoretical training [6-8]. Practical training in maritime varies according to the content of the training received within the scope of STCW. Almost all crew working onboard must have the following STCW certificate.

- Personal Survival Techniques
- Personal Safety and Social Responsibilities
- Elementary First Aid
- Fire Prevention and Fire Fighting
- Proficiency in Survival Craft and Rescue Boats (PSC & RB) other than Fast Rescue Boats
- Proficiency in Security Awareness

The minimum theoretical training and practices are carried out in institutions providing maritime education. It is crucial to supervise these training and evaluate them regarding occupational health and safety in the hazardous class. In addition, the suitability of the equipment used during the training should be checked. It is essential for occupational health and safety not to use expired pyrotechnic materials or lifeboats. Pyrotechnic equipment and lifeboats are disposable materials. Although they are disposable, they are expensive products. Educational institutions that do not have enough financial means are trying to solve the problem with the help of sponsors. But in the meantime, high attention must be paid to occupational safety. Institutions should allocate budgets for these items, and the inspectors should collect the leftovers of the used products. The importance of maritime education for our world and our nation's seas should not be forgotten. The health and safety of trainers who receive training and are rare in our country should always be at the forefront.

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Marine transportation optimization for hazardous and noxious substances by implementing Fuzzy-AHP

Yunus Emre Nazligul*1 , **Devran Yazir** 1

1Karadeniz Technical University, Department of Maritime Transportation and Management Engineering, Türkiye
yunusemrenazligul@ktu.edu.tr; dyazir@ktu.edu.tr

Keywords
Marine transportation
Hazardous goods
Noxious substances
Fuzzy sets
F-AHP

Abstract
Carefully selected ship will be helpful to decrease fuel consumption at sea and minimize the companies' variable costs. The selection process can be very complex, which requires a lot of calculation and qualified people on maritime business and can be highly time-consuming to determine all available ships during the comparison has been made. To solve this problem questionnaires have been answered by qualified 30 experts who are already experienced in marine-field. According to both literature and marine experts selected "safety of cargo", "freight cost", "duration of transportation", "ease of transition to new cargo", "maximum load-carrying capacity in a single voyage" criteria have been pair-wisely compared and ranked. Criteria ranking has resulted as C1 > C2 > C5 > C3 > C4 > C6 > C7. The ranked criteria names accordingly are "Safety of cargo" > "Freight cost"> "Maximum load-carrying capacity in a single voyage"> "Duration of transportation"> "Ease of transition to new cargo" > "Cargo handling duration" > "Transportation of different cargo together". In further articles, it is believed that by adding the "frequency of voyage" and "total voyage length" criteria and comparing vessel types as alternatives may be very useful for literature.

Introduction

As the global trade and maritime transportation tends to increase, transportation of chemical products has emerged as the one of most important factors in the global economy. Because of this situation, these large quantities of goods flowed from production areas to consumption areas. Growth in the chemical industries has resulted in a significant increase in the proportion of maritime transportation by carrying dangerous and hazardous chemicals. According to research it has known that about 2000 of 37 million different chemicals used by the world population are transported regularly by sea [1]. Global chemical sales through 2009 and 2019 have increased from 1,832 billion Euros (€) to 3,669 billion €, which means that the chemical business overall has tripled its size in 10 years [2]. Packaged forms of these dangerous goods carried by sea consist of the 10% of containers transported around the world, and non-packaged liquid in bulk dangerous goods by chemical tankers are also consist of 2% of all vessels [3].

The incorrect vessel selection could have a great impact on the freight costs by increasing fuel oil consumption. Therefore, a suitable vessel selection would be dependent on including all available alternatives, criteria and defining them too as well. About the selection of vessels, research shows that the decision-making criteria of shippers are changed [4]. In the research, it has been stated that while the frequency of services and the cost of service were much more important, but the door-to-door transportation period becoming the only determining criteria. According to literature, it has been reached that these criteria could affect the choice of transportation type: cost, service characteristics, reliability, transportation time, transportation frequency, distance, speed, flexibility, infrastructure, vehicle characteristics, inventory, and cargo. It has been also determined that the company's characteristics, annual transaction volume, loss/loss ratio, traceability and previous experience that can affect the choice of a vessel [5].

Method

The F-AHP method has only emerged because of the human logic is not working as a binary logic system like yes or not. Binary logic does explain only in the 0 or 1 binary form, and it is inadequate to explain these in-between thoughts by using these forms. To solve this fuzzy logic the remaining gray area in the binary system complements with triangular fuzzy numbers. These triangular fuzzy numbers consist of triangular membership functions which are defined as, $x = \{l, m, u\}$ the m is being the vertex of this triangle.

Apart from the literature, in this research, the decision-making group is considered not equal and consists of different l decision-makers. All decision-makers are different from each other due to their relative importance and, the decision-makers are non-identical. Unequal decision-makers can be either less or more important than the other decision-makers due to their different experiences and knowledge. The weight vector of decision-makers is shown as $\lambda = \{\lambda_1, \lambda_2 \dots \lambda_l\}$ and explained as $\lambda \geq 0, k = 1,2, \dots, l$. The weight vectors of each decision-maker are expressed as λ.

Application

Step 1: The geometric average of the results of the questionnaire, which have been made in consultation with 30 experts, has combined and formed into a matrix. Then, all decision-maker's answers to are represented as geometrical means, which the decisions are pairwise compared of each criterion to another.

Step 2: Because of the pairwise comparison of each criterion to another, the weights of each criterion have been measured. The weights of all seven criteria are shown in Table 1.

Results

Table 1. Weights of criteria

	Criteria	Results
C1	Safety of cargo	0.2477
C2	Freight cost	0.2146
C3	Maximum load-carrying capacity	0.1138
C4	Duration of transportation	0.1554
C5	Ease of transition to new cargo	0.1248
C6	Cargo handling duration	0.0922
C7	Transportation of different cargo together	0.0515

According to the weights of criteria table, criteria ranking has resulted as C1 > C2 > C5 > C3 > C4 > C6 > C7. The ranked criteria names accordingly are "Safety of cargo" (24.77%) > "Freight cost" (21.46%)> "Maximum load-carrying capacity in a single voyage" (15.54%)> "Duration of transportation" (12.48%)> "Ease of transition to new cargo" (11.38%)> "Cargo handling duration" (9.22%)> "Transportation of different cargo together" (5.15%).

Discussion

In literature, there is not sufficient research has been conducted. Although studies have conducted by few authors, the vessel types are restricted to fewer criteria. Also, the existing literature on vessel selections is less consistent due to using of only the statistical data analysis method, in which we have been argued that previous literature suffers from a lack of "decision-makers" affect value on result." Therefore, the existing research has much the problem in representing of large section of criteria, alternatives and not able to address the problem of decision-makers' lack of experience. Even sometimes, the lesser-experienced decision-makers have been represented more on the results in literature.

Conclusion

While the chemical tanker market cap was United States Dollar (USD) 25.59 billion in 2016, the expectation in 2022 is it will reach USD 33.11 billion with an annual growth of 4.5 percent. It is estimated that the most growth will be in the Asia-Pacific and Middle East-Africa regions [7]. So, it can be referred from that research, on selecting the most suitable merchant vessel type could be useful to minimize the true effort, reduce costs and increase efficiency for charterers and brokers who are working in the carriage of bulk hazardous liquid and noxious liquid substance cargoes.

According to the weights of criteria table, criteria ranking has resulted as C1 > C2 > C5 > C3 > C4 > C6 > C7. The ranked criteria names accordingly are "Safety of cargo" (24.77%) > "Freight cost" (21.46%)> "Maximum load-carrying capacity in a single voyage" (15.54%)> "Duration of transportation" (12.48%)> "Ease of transition to new cargo" (11.38%)> "Cargo handling duration" (9.22%)> "Transportation of different cargo together" (5.15%).

In further articles, it is believed that by adding the "frequency of voyage" and "total voyage length" criteria may be useful for literature. Also, in future research it is kindly advised to authors that making a pair-wise comparison of Baltic and International Maritime Council Charter Party Agreements (BIMCO C/P) such as BIMCHEMVOY2008, BOXLEASE, ROPAXTIME, and using of some type of newly constructed methods such as intuitionistic fuzzy TOPSIS method or newer equivalent method may be beneficial to the literature.

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A study of seismic isolators used in buildings and their properties

Erden Ozan Karaca *[1] , **Muhammed Tanyıldızı** [1] , **Nusret Bozkurt** [1]

[1] *Bitlis Eren University, Engineering and Architecture Faculty, Civil Engineering Department, Turkey, eokaraca@beu.edu.tr; mtanyildizi@beu.edu.tr; nbozkurt@beu.edu.tr*

Keywords
Earthquake
Seismic isolator
Structural engineering

Abstract
The differences in soil properties, inadequacy in inspections and workmanship errors negatively affect the earthquake performance of the structures. Similarly, the complexity of earthquake forces that cannot be formulated adequately makes structural engineering solutions difficult. One of the solutions that will reduce the loss of life and property during an earthquake is the use of seismic isolators. In this study, the types of insulators used today and their properties were examined.

Introduction

Earthquakes are a natural disaster that does not show any symptoms before and can cause great loss of life and property due to the lack of an early warning system [1]. Alpid Belt, one of the two important earthquake belts in the world; It extends from Spain, Italy and Greece to Northern India and Afghanistan, and Turkey is located in the so-called Mediterranean Earthquake Belt on this belt. There are two major fault zones in Turkey, 92% of which is on this seismic belt. These are East Anatolian and North Anatolian faults. Turkey can be divided into the following four seismotechnical regions [2]

1. North Anatolian Fault Zone
2. East Anatolian Fault Zone
3. Bitlis Thrust Zone and East Anatolian Compression Zone
4. Aegean (Western Anatolia) Grabens Zone.

The fact that most of the existing building stock in Turkey is not built in accordance with the current earthquake regulations, workmanship-material defects, the inhomogeneity of the soil properties and the lack of public awareness about earthquakes increase the loss of life and property in earthquakes. Reasons such as increasing urban population, unplanned construction considering today's facilities and technology, it is not acceptable to experience loss of life in a possible earthquake. This situation causes the concept of earthquake resistant building design to gain importance. Contemporary regulations prepared to meet current needs allow for quality building design and production, and our latest earthquake regulation [3], which came into force in 2018, is a good example of this. However, the fact that the earthquake has a complex structure limits its deterministic features to be used in engineering solutions. For this reason, it is necessary to use approximate data in engineering calculations and to stay on the safe side at the highest degree in proportion to these. This undoubtedly increases the cost. Earthquake resistant building design can be roughly summarized for two purposes and these are; The structure is of sufficient quality and the cross-sectional forces that will occur during the earthquake are calculated in such a way that they can be met at a sufficient rate [4]. In the traditional design approach; It is expected that the seismic energy coming into the structure will be damped by the inelastic deformations that the structure will exhibit before it collapses. It is expected that the structure designed for this purpose will be damaged at a level that can be repaired in a moderate earthquake, and that collapses that will cause loss of life in a severe earthquake will not occur [5]. In summary, the traditional approach aims to meet the seismic loads that will affect the structure with

damage that will occur at a level that will not collapse. Increasing the rigidity of the structure for less damage; It will also increase the earthquake forces that will affect it. This situation creates the need for a different way to design earthquake resistant structures. Today, this need has been met by means of special elements that absorb the energy that affects the structure in the event of an earthquake. The techniques for protecting the structure from seismic loads acting on it can be divided into active and passive protection systems. Active control methods, in general terms, are systems in which an energy source is used to keep the displacement of the structure at the desired level. Passive control methods mentioned above; It provides the energy acting on the structure with special elements that absorb and absorb it [6]. In this study, seismic isolation systems, which are one of the passive protection methods, are emphasized and an example image of them is presented in Figure 1 [7].

Normal structure   **Seismic isolated structure**
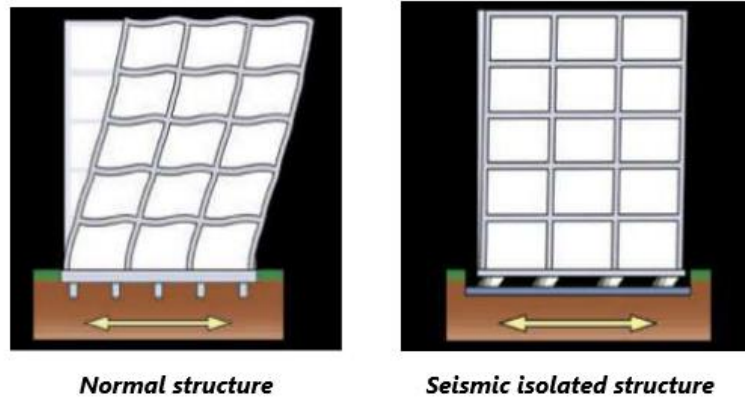
Figure 1. Behavior of normal and seismically isolated structures during an earthquake

Protecting from the devastating effects of earthquakes has been a problem that all civilizations established in earthquake regions wanted to solve, and they sought a solution to this issue. The seismic isolation provided by today's special elements has tried to be applied in different ways in historical buildings. Considering that the working principle of the seismic isolator in the building is to roughly separate the ground and the building, reducing the effect of the shaking on the building, it is possible to see an application in this logic in the Dikili Taş monument in Istanbul. The granite stones under the pedestal can be considered as a historical isolation system made in order to reduce the shaking that will occur on the monument during earthquake shaking. [8]. Today, in parallel with the development of the properties of insulators, the number of structures using isolators against earthquakes is increasing rapidly. If the advantages of seismic isolators are examined; minimizing the damage to the structure, protecting the goods-equipment inside the building and reducing the relative floor acceleration. Also, as disadvantages; high cost, the presence of nearby buildings, and the difficulties encountered in the design of water and natural gas installations in a structure where insulators are used [9]

Types of Seismic Isolation

Seismic isolators can generally be grouped under three headings. These;

1. Elastomeric base isolation tools,
2. Insulation tools designed on slip
3. They are spring type systems.

The insulator types under general headings can be briefly explained as follows [10].

Low damping natural and artificial rubber insulators; It gives high vertical rigidity to the rubber structure between two steel plates and is highly resistant to the effects of temperature and time.

Lead core rubber insulators; It is similar to low damping rubber insulators and can be thought of as several layers of this, and horizontal flexibility is provided by rubber. The elastic behavior of lead up to 11 MPa also contributes to this flexibility.

Highly damped rubber insulators; similar to lead core insulators, the difference between them is that they exhibit high damping properties.

Figure 2. Highly damped rubber insulator

Neoprene insulators with steel plate layer; It consists of rubber between steel and a lead-bronze alloy. It is generally used in nuclear power plants and bridges.

Friction pendulum system; This system, which exhibits pendulum movement on spherical stainless steel, protects the structure from earthquake forces.

Flexible-friction sole insulation system; It reduces the friction problem with many sliding interfaces and provides isolation with the rubber in the center.

The GERB system is; it is generally used in nuclear turbines and provides insulation in three dimensions.

Conclusion

Minimizing the damage to the structure against earthquake effects is an important issue in the field of structural engineering. With the help of today's advanced technology, the use of insulators related to this subject has been developed and started to be applied. The use of seismic isolators, especially in special structures such as bridges and hospitals, which reduce the damage to the structure during an earthquake and which should be used during and immediately after the earthquake, is an effective solution that is becoming increasingly common.

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An investigation on the effect of cement replacement with waste materials on the strength properties of concretes

Muhammed Tanyıldızı*1 , **Erden Ozan Karaca 1**

1Bitlis Eren Universitesi, Engineering-Architecture Faculty, Civil Engineering Department, Türkiye
*mtanyildizi@beu.edu.tr; eokaraca@beu.edu.tr

Keywords
Concrete
Cement
Sustainability
Waste

Abstract
This article presents pieces of information obtained from the literature reviews related to the effect of cement replacement with waste materials in various ratios on the strength performances of concretes. Eggshell powder (ESP), ceramic waste powder (CWP), rice husk ash (RHA), and corn cob ash (CCA) are waste materials that were the subject of this paper. One of the aims of this study is to indicate the usability of these materials as cement substitutes is a beneficial way both reducing the possible threat of them to the environment and living health and reducing greenhouse gas release to the ecosystem by minimizing cement production. It is also aimed with this study to create an awareness in the concrete industry and researchers to support developments in the sustainability of concrete.

Introduction

Sustainability is very important for societies as it helps to protect the ecosystem, increase our quality of life, improve the welfare of societies and prevent excessive depletion of natural resources [1]. In the construction industry, the sustainability of construction materials is very important due to the huge amount of natural resources consumed in the production phase. Concrete is the most widely used construction material in almost all civil engineering sectors due to its versatility and availability worldwide [2]. Because concrete has such a wide usage area in the construction industry, its sustainability is the topic of interest among researchers and sector representatives. The sustainability of concrete is provided with its constituents, especially cement, and cement which is the main ingredient of concrete affects both the cost of concrete and a threat to the environment because of releasing the noteworthy amount of greenhouse gas of CO_2 in production of it. So, the construction sector faces up some challenges in bringing sustainability to their production processes, especially cement. This may be carried out either by searching a new raw materials and products more environmentally friendly contributing the minimize of greenhouse gases releasing to nature. In this regard, wastes from other industrial activities can be a good solution to this goal [3,4].

An increase in population and growing industrialization with urbanization generate plentiful waste. It is claimed that approximately 2 billion tons of waste are produced annually all over the world, and it is estimated that 3.4 billion tonnes of waste will be generated annually worldwide by 2050 [5]. Approximately 62% of these wastes are not properly handled, which causes pollution of the environment and public health as well as global warming [6]. Recycling these wastes is an effective way for creating sustainable waste management [7]. Recently, there is a growing interest in the usage of waste materials in the construction industry, especially in concrete production as cement replacement and remarkable results have been obtained [8]. In this study, waste materials such as eggshell powder (ESP), ceramic waste powder (CWP), rice husk ash (RHA), and corn cob ash (CCA), have been subject to this review study. In this regard, the latest studies performed about this concern were reviewed and their results were presented succinctly. The main goal of this study is to arise consciousness for sustainable waste management in the construction industry and light the way of researchers and sector representatives.

Waste materials used as cement substitute

Eggshell powder (ESP)

Eggshell is a biowaste material obtained from bakeries, patisseries and poultry farms. The disposition of this waste into landfills causes toxic gases and environmental pollution eventually poses a threat to living health [9]. The utilization of eggshell powder as a cement replacement material is a beneficial solution to recycle it. In this regard, Yerremala [10] conducted a study to investigate the effect of cement replacement with ESP in ratios of 5-15% with 5% increment on concrete strength properties. At the end of 28-days of water curing, the concrete with 5% ESP content gained strength more than 7.62% compared with control concrete. However, the decrease in compressive strength emerged as 15.25% and 27.80% with 10% and 15% ESP content respectively. As for splitting tensile strength, it did not change for a 5% replacement ratio but decreased steadily with the increasing content of ESP compared with control concrete. The author indicated concerning the results that 5% ESP is optimum for maximum strength. In another study, Jhatial et al. [11] that the 10% ESP content among 5-20% is optimum content to achieve higher strength compared to the control concrete. Arif et al. [12] performed a study to investigate the strength performances of concretes containing eggshell powder as partial cement replacement. They prepared four mix proportions namely with 0%, 5%, 10% and 15% ESP content. Test results indicated that the compressive strength of concrete with 10% ESP showed 10% higher strength when compared with control concrete.

Ceramic Waste Powder (CWP)

Ceramic wastes powder are collected from factories and construction sites during the packing and labor process from crushed ceramics in noteworthy amount. Ceramic waste poses a threat to the environment and recycling it as a cement substitute in concrete in the building sector is a good way [13]. Herein, El-Dieb et al. [14] performed a study to investigate the CWP effect on the compressive strength of concrete specimens. They declared the compressive strength increase at 20% replacement ratio. However, substitutes above 20% resulted in a decrease in compressive resistance of concrete specimens. From another study, Arthi [15] searched the change in compressive strength of concrete specimen when its cement content was replaced with CWP in levels of 15%, 30%, 35% and 45%. It was noted that compressive strength increased with CWP content up to 35%, but after this replacement ratio, the increase in CWP content resulted in a decrease in compressive strength. Bhargav and Kansal [16] tested the flexural strength of concretes that cement contents replaced with CWP at 5-20%. According to the results, flexural strength increased with CWP content and the optimum substitute ratio was noted as 15%.

Rice Husk Ash (RHA)

Rice husk is a waste produced from the rice mill process and burned in the oven to take ash form. It is obtained roughly 200 kg per ton of rice and has been taken advantage of in cement replacement material to form sustainable concrete for years [17]. With this aim, Zareei and Ahmadi [17] studied to benefit from rice husk ash as cement substitute material in proportions of 5%, 10%, 15%, 20% and 25%. Authors reported from test results that 15% replacement of RHA with cement increased the compressive strength of concrete by 20%. Patil and Paliwal [18] conducted research performed on the usability of RHA as cement substitute material at different percent as 0%, 5%, 10%, 15% and 20% by weight. From test results, it was noticed that the compressive and splitting tensile strength was improved with RHA by 15.34% and 24% with 15% replacement ratio compared to control concrete results respectively.

Corn Cob Ash (CCA)

The corncob is the remainder of the corn ear after peeling the corn kernels and makes up about 75-85% of the corncob's weight. Corn cob ash (CCA) is an agricultural by-product and can be used by recycling it in concrete production as cement supplementary material [19]. Tiza [20] made a study covering the investigations on the usability of corn cob ash (CCA) as a partial cement substitute material in the production of concrete. In this scope, CCA was obtained and replaced with cement in various ratios of 5%, 10%, 15%, 20%, and 25%. The compressive strength of concrete obtained from cube specimens at the end of the 28 days of water curing decreased by 5.05%, 13.49%, 23.03%, 33.12%, and 42.82% for 5%, 10%, 15%, 20%, and 25% replacement ratios respectively. The decrease in flexural tensile strength also at the end of the 28-day water curing was 7.51%, 20.48%, 27.52%, 39.20% and 46.99% with replacement ratios of 5%, 10%, 15%, 20% and 25% respectively. Adesanya and Raheem [22] tested the effect of cement replacement with CCA in proportions of 0%, 2%, 4%, 6%, 8%, 10%, 15%, 20% and 25% by weight. They concluded that the optimum content for strength improvement comes into view as 8%.

Conclusion

This paper reviewed previous studies that investigated the effects of ESP, CWP, RHA, and CCA replacement with cement on the strength performance of concrete and it was aimed with this present study to arise an awareness for both researchers and concrete sector representatives to produce green concrete. The accumulation of these waste materials in landfills causes toxic gases and is a threat to the environment and public health. Hence, the utilization of these wastes as cement replacement material is a beneficial way to reduce environmental pollution and protect living health. Also, ensuring the minimize of cement usage by 10% in concrete production with this way is an effective way to reduce the greenhouse gas release into the ecosystem, which cement production is a big threat in the aspect of triggering global warming.

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Carbon monoxide forecasting with air quality parameters and fuzzy logic for Konya: A case study of Meram

Esra Aslı Çubukçu*[1] , Vahdettin Demir [1] , Mehmet Faik Sevimli [1]

[1]KTO Karatay University, Civil Engineering Department, Türkiye
cubukcuasli@gmail.com, vahdettin.demir@karatay.edu.tr, mehmet.faik.sevimli@karatay.edu.tr

Keywords
Air quality
Forecast
Fuzzy Logic
Konya
Carbon Monoxide

Abstract
The industrial revolution ushered in a period of fast technological advancement, which resulted in a surge in global consumerism. The phrase "air quality" has come to be associated with global climatic and environmental issues, particularly with industrialization around the world. Human activities have a higher impact on air pollution than natural events such as fires and volcanic eruptions. Air pollution has a variety of effects on natural and human life, including acid rain, respiratory disorders, and a decrease or rise in the number of living species in the environment. It is directly related to human health, particularly in cities that we might characterize as metropolises due to various industrial waste and gases. As a result, forecasting possible severe air pollution is critical for humans and the living ecosystem. The CO ($\mu g/m^3$) parameter of the Meram district in Konya province was evaluated using fuzzy logic methods in this study. PM_{10}, SO_2, NO_2, NO_X, and periodicity are input factors in the models that determine CO. CO is gas that is extremely damaging to human health. When the comparison criteria are analyzed, the FCM algorithm with five input models produces the best results.

1. Introduction

For many years, it has been well acknowledged that the quality of the air we breathe has a direct impact on our health. When the composition of the air changes in a way that disrupts human health or environmental balances, or when substances that shouldn't be in the air mix, it's termed air pollution. Nitrogen (N_2) makes up 78.084 percent of the air, whereas Oxygen (O_2) makes up 20.946 percent, Argon (Ar) makes up 0.934 percent, and carbon dioxide makes up 0.035 percent (CO_2). Neon (Ne), Methane (CH_4), Helium (He), Hydrogen (H_2), and Krypton (Kr) make up the remaining 0.001%. (Kr). With the increase in population, the growth of cities, and the development of industry, air pollution's effects are expanding at a faster rate and with a changing content. While air pollutants generated from a local source have local impacts, increased energy consumption, fossil fuel combustion, and the usage of motor vehicles all contribute to degradation of air quality in metropolitan areas. Regional transportation, acidification, increasing greenhouse gas emissions, and tropospheric ozone production all reflect the repercussions of air pollution that have already reached global proportions. While pollutants from traffic, transportation, industry, and heating (all of which are human) are the most common, the effects of meteorology, topography, and chemical transformation processes on air pollution and climate are now better understood. The impacts of air pollutants on the environment and human health are well understood to be dependent on time, space, duration of effect, concentration, and other factors. Because of heart and lung ailments, air pollution raises death rates. Furthermore, it has a harmful impact on children's lung development and raises the prevalence of chronic airway disorders such as asthma and chronic obstructive pulmonary disease (COPD) in polluted locations [1]. The Covid-19 illness epidemic overtook the globe in 2020. During the pandemic, it became even more apparent that the impact of air pollution on humans is rather significant. Covid-19 air pollution has been linked to an increased risk of getting the virus in numerous research investigations. Long-term air pollution also exposes millions of people to diseases of the respiratory and cardiovascular systems, such as diabetes, chronic diseases, and cancer. As a result, persons who are exposed to pollution are more vulnerable to viruses like Covid-19 [2]. Air pollution forecasting is vital to create individuals who are prepared and responsive to future extreme events[3, 4].

When some studies in the literature in recent years are examined; Unal et al. (2019) in their study, they used machine learning to forecast Ankara's air pollution. The findings were compared using RMSE, MAE, and R^2 [5]. Tunç and Toros (2020) in their study investigated into the impact of the Covid-19 epidemic on air pollution in Adana. While there was a minor drop in the concentration of environmental pollution both throughout the epidemic and compared to previous years, the results show that there was a slight increase in the concentration of environmental pollution during the pandemic. They discovered that the pandemic control measures had no substantial impact on the province of Adana's overall air quality [6]. Kara et al. (2020) evaluated NO, NO_2, NOx levels in Turkey by dividing them into Black Sea region, Marmara region, Aegean region, Mediterranean region, Central Anatolia region, and Eastern regions in their study done in 2020. Looking at the findings, it was discovered that the amount of nitrogen dioxide and its variations (NOx's) in Turkey has been decreasing over time [7]. Bayati et al. (2021) aimed to contribute to the improvement of air quality by monitoring the behavior of air pollutants over Van province through statistical analysis of the data; They discovered that the wind plays an important role in the horizontal transfer of contaminants in the atmosphere after analyzing the findings. They discovered that when the wind is calm, air pollution stays put, and precipitation aids in the collapse of contaminants in the atmosphere, making precipitation a cleaner of the atmosphere [8].

In this study the amount of CO ($\mu g/m^3$) in the air in Meram district was investigated using daily data from the Meram air quality station in Konya. In the modeling, three distinct Adaptive Neuro Fuzzy Inference System (ANFIS) were applied. There are used ANFIS-FCM, ANFIS-GP, and ANFIS-SC three methodologies. PM_{10}, SO_2, NO_2, NO_X, and periodicity (monthly) are the primary pollution constituents used as input parameters. CO is the output parameter. CO is a colorless, odorless gas that is produced when carbon in fuels is not entirely combusted, and it is extremely detrimental to human health. Internal combustion engines are the primary source (85-95 percent). CO emissions are mostly caused by industry, wood combustion, and forest fires. All measurements are in $\mu g/m^3$ unit.

2. Material and Method

2.1. Material

Air quality data were obtained from the air quality monitoring station in the Meram district of Konya, Turkey (https://sim.csb.gov.tr/STN/STN_Report/StationDataDownloadNew). 80% of the data was used in the training phase and 20% in the testing phase. The most important factor in choosing this period is the continuity of the data. The descriptive statistical information of the data used is given in Table 1.

Table 1. Statistical information of the data.

Statistic	PM_{10} ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	CO ($\mu g/m^3$)
Average	28.46	12.47	38.75	60.55	908.20
Standard Eror	1.35	0.62	0.69	1.96	39.91
Median	20.46	7.62	37.07	50.42	601.30
Standard Deviation	24.76	11.40	12.64	35.93	729.53
Kurtosis	5.14	1.64	-0.22	4.97	5.05
Skewness	2.18	1.43	0.42	1.96	2.26
Maximum	3.29	1.26	12.22	15.00	205.80
Minimum	161.01	63.69	82.42	269.29	4201.67

2.2. Method

Fuzzy logic is built on the concept of subsets. An object is either a member of the set or it is not, according to the traditional approach. Fuzzy logic is a type of set theory that is based on classic logic. As a learning tool, clustering can be used to find data points in multivariate datasets. Clusters are separated into meaningful groupings. There are numerous different approaches to data clustering in diverse applications. When dealing with large datasets, however, the approach has significant limitations and may not perform as well as planned. On the other hand, other clustering algorithms have recently been created. One of the most widely used methods is fuzzy c-means clustering. For ANFIS- FCM; the data point is randomly initialized. Centers are selected using various clustering approaches. Minimizes errors by dividing the dataset. This algorithm continues iteratively until the convergence condition is met [9–11]. When employing the Grid Partition (GP) fuzzy inference system, the grid partitioning method is largely responsible for the model's learning. The Grid Partition approach separates the data set into rectangular sub-areas called grids based on the number and types of membership functions to be used. In the subspace, each input is partitioned into membership functions of the same shape. Based on input-output training, the system develops fuzzy rules that optimize data for quick learning and computation [12–14]. Sub Clustering approach (SC) is utilized when there is no clear understanding of the number of centers for data dispersion. This is one of the fuzzy clustering techniques. The number of possible cluster centers is completely determined by the number of data, not the dimensionality or distribution of the data. The data point with the

closest neighbors is chosen as the cluster center. Other data points are positioned in the same way, with each point acting as a potential cluster center depending on its unique characteristics. This tactic is effective, especially because it is not dependent on other methods [13, 15].

3. Application

The comparative criteria were Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and Coefficient of Determination. In Equations 1-3, related equations are given.

$$MAE = \frac{1}{N}\sum_{i=1}^{N}|CO_e - CO_o| \qquad RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(CO_e - CO_o)^2} \qquad R^2 = \left(\frac{N*(\sum CO_o * CO_e) - (\sum CO_o)*(\sum CO_e)}{\sqrt{\left(N*\sum CO_o^2\right)-\left(\sum CO_e\right)^2 * \left(N*\sum CO_e^2\right)-\left(\sum CO_e\right)^2}}\right)^2$$

In the equations, "CO_e" and "CO_o" show the estimated and observed elevation values and "N" represents the number of data. Training and testing results are given in Table 2. The best results are colored red.

Table 2. Training and Testing Results

CRITERIA	METHODS	INPUTS				
		1 INPUT	2 INPUT	3 INPUT	4 INPUT	5 INPUT
MAE (Training)	FCM	183.713	125.212	121.650	113.853	114.124
	GP	383.773	407.148	374.075	398.713	63.205
	SC	179.128	119.973	126.523	79.622	120.082
RMSE (Training)	FCM	279.031	194.999	164.609	155.335	155.711
	GP	396.863	422.243	389.746	425.603	86.800
	SC	278.442	171.398	173.697	95.357	175.443
R^2 (Training)	FCM	0.877	0.940	0.957	0.962	0.962
	GP	0.892	0.214	0.356	0.004	0.768
	SC	0.877	0.954	0.952	0.854	0.951
MAE (Testing)	FCM	163.063	126.490	111.654	95.924	96.797
	GP	346.892	373.904	354.540	360.583	115.475
	SC	166.020	142.345	117.143	79.622	92.156
RMSE (Testing)	FCM	210.655	181.527	153.372	114.078	115.972
	GP	351.676	379.318	361.483	373.846	141.143
	SC	220.188	179.682	162.196	95.357	113.310
R^2 (Testing)	FCM	0.129	0.482	0.492	0.810	0.824
	GP	0.748	0.142	0.030	0.006	0.386
	SC	0.108	0.354	0.479	0.854	0.826

In Table 2, ANFIS-SC 4 (MAE=79.621, RMSE=95.356, R^2=0.853) input in the training phase and ANFIS-FCM 5 input (MAE=96.797, RMSE=115.972, R^2=0.824) result in the testing phase gave the best model.

4. Results

The amount of CO ($\mu g/m^3$) in the air was forecasted for Meram in this investigation. It was forecasted using daily data from the Meram air quality station in Konya's central district. The parameters in the model are primary air polluting gases.

In the modeling, three distinct Fuzzy logic algorithms used. These algorithms were FCM, GP, and SC. FCM 4 and 5 input models, as well as SC 5 input models, gives the best outcomes.

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Investigation of precipitation and temperature changes in Turkey in the last climate period

Taha Demirgül*1 , Cavit Berkay Yılmaz 2 , Büşra Nur Zıpır 3 , Fatma Sena Horzum4 , Muhammet Fatih Pehriz5 , Vahdettin Demir6 , Mehmet Faik Sevimli7

1KTO Karatay University, Faculty of Engineering and Natural Sciences, Civil Engineering Department, Konya, Turkey, demirgultaha@gmail.com; cavitberkayyilmaz@gmail.com; busranurzpr@gmail.com; senahorzum987@gmail.com; m.f.pehriz@gmail.com; vahdettin.demir@karatay.edu.tr; mehmet.faik.sevimli@karatay.edu.tr

Abstract
Time-dependent changes in temperature and precipitation parameters can cause natural events such as drought and flood to turn into natural disasters, which can adversely affect living life and the economy. The aim of this study is to examine the changes in precipitation and temperature of Turkey between the last climate period (1991-2020) and the previous climate period (1981-2010). The precipitation and temperature data used in the study are long-term average data obtained from monthly average data. In the study, the changes in temperature and precipitation were examined in 81 province stations. In addition, interpolation maps were created for the variation of temperatures and precipitation according to location. When the old (574 mm) and new (573.4 mm) precipitation normals are examined throughout the country, it has been determined that there is a decrease of 0.6 mm. On a provincial basis, the highest decrease (586.4 mm-511.1 m) was determined in Erzurum with 75.3 mm (12.84%). The highest increase (1407.5 mm-1602.2 mm) was found in Rize with an increase of 194.7 mm (13.83%). It is observed that the annual average temperature normals tend to increase in all regions of our country. The highest temperature increase (3.6°C-4.3°C) was seen in Ardahan with an increase of 0.7 °C (19.44%). The only province with a decrease in temperature compared to the old normal (9.6°C-9.4°C) is Bitlis with a decrease of 0.2 °C (2.08%).

Introduction

Time-dependent changes in temperature and precipitation parameters cause irreversible deterioration in the hydrological balance with events such as drought and flood. These effects harm nature and the economy with the irregularities they create in terms of amount, intensity and time distribution on precipitation and temperature parameters in Turkey, which experiences many climates at the same time due to its geographical location. It is of great importance to examine the limited water resources management policies to be implemented in the future and to make future analyzes on these parameters.

There are many studies on precipitation and temperature parameters in Turkey. Büyükyıldız (2004), in her study on the precipitation data of the Sakarya Basin, reported that the 44 trends he determined were in the negative direction at a rate of 80% [1]. Partal (2003), in his study on precipitation data in Turkey, determined that there is a negative trend in the whole country [2]. Özfidaner (2007), in his study on precipitation data in Turkey, reported that there is a negative trend in winter and a positive trend in other seasons [3]. Ölgen (2010), concluded that annual precipitation variability in Turkey decreases regularly from south to north [4]. Demir (2018), in his study in the Black Sea region, determined a positive trend in the East and Central Black Sea region, and a negative trend in the West Black Sea region [5]. Yılmaz vd. (2021), determined a positive trend as a result of his study by examining the 57-year temperature and precipitation data of the Eastern Black Sea region [6].

Material and Method

Located between 26°-45° east meridians and 36°-42° north parallels [7], Turkey is among the countries in the risk group in terms of the possible effects of global climate change. As a result of the effects of climate change, drought in some regions and floods in others is very likely.

Material

Long-term monthly average temperature and precipitation data were obtained from the report of the General Directorate of Meteorology on "Temperature and Precipitation Normals for the period of 1991-2020" and dated 25.11.2021. The table containing the statistical information of the old and new normals all the provinces is given below (Table 1).

Table 1. Descriptive Statistical Information on Old and New Precipitation and Temperature Normals

	Old precipitation normals (1981-2010)		New precipitation normals (1991-2020)	
	Precipitation (mm)	Temperature (°C)	Precipitation (mm)	Temperature (°C)
Mean	618.97	13.09	619.08	13.55
Maximum	1407.5	19.5	1602.2	20.2
Minimum	352.3	3.6	349.2	4.3

In Table 1. the average of the precipitation normals for the provinces increased from 618.97 mm to 619.08 mm. Temperature normals increased from 13.09°C to 13.55°C.

Inverse Distance Weighting (IDW) Method

The Inverse Distance Weighting (IDW) is an interpolation method used to create data from the data that cannot be sampled by the exemplary points, wherein the creation of these data depends on the interpositional distance and formula applied by considering relations with various points [8].

$$f(x, y) = \sum_{i=1}^{n} w_i f_i \qquad (1) \qquad\qquad w_i = \frac{h_i^{-p}}{\sum_{j=1}^{n} h_i^{-p}} \qquad (2)$$

In Equations 1 and 2;
p; is taken as a power parameter and denoted by exponent,
h_i; represents the spatial distance between the sample points and the interpolation points,
w_i; represents the weights and the sum of their values must Equation 1,
f_i; represents the known height value [9-10].

Application

Determination of precipitation and temperature normals and analysis of changes are of great importance for Turkey, which is highly sensitive to the danger of drought [11]. These analyzes play a key role in the studies to be carried out in terms of water management. In this study, the data of precipitation and temperature normals of 81 provinces were visualized using the IDW interpolation method.

IDW interpolation maps of old and new precipitation and temperature normals are shown in Figures 1, 2, 3 and 4.
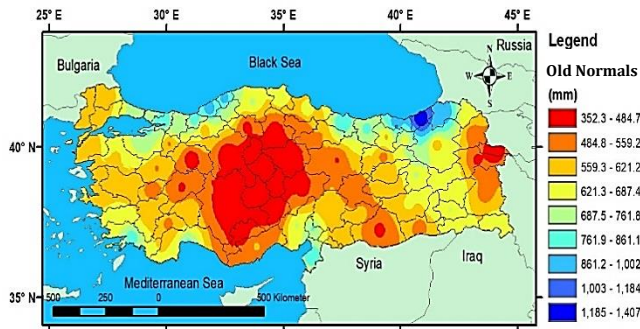

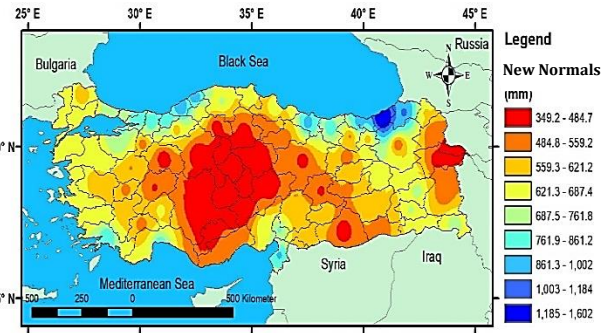**Figure 1.** Old (1981-2010) Precipitation Normals

Figure 2. New (1991-2020) Precipitation Normals

When Fig. 1 and Fig. 2 are examined, it is seen that the highest precipitation normal and the highest increase were in Rize with a difference of 194.7 mm and a percentage of 13.83% new normal- old normal/old normal for example ((1602.2mm-1407.5mm)/1407.5mm). On a provincial basis, the highest decrease was seen in Erzurum with a difference of 75.3 mm and a percentage of 12.84%.
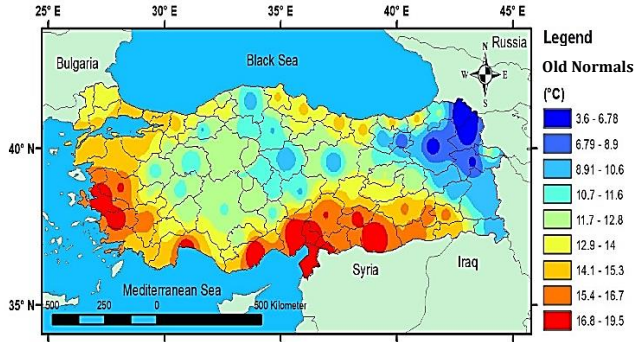
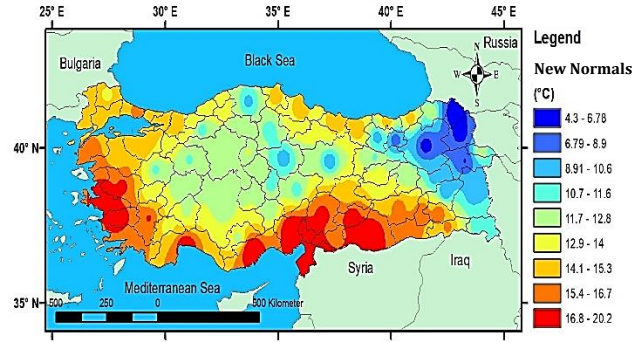

Figure 3. Old (1981-2010) Temperature Normals

Figure 4. New (1991-2020) Temperature Normals

When Fig. 3 and Fig. 4 are examined, it is seen that there is an increase in temperature in all provinces except Bitlis. The highest increase on a provincial basis was seen in Ardahan with a difference of 0.7 °C and an increase of 19.44% ((4.3°C-3,6°C)/3.6°C). The only province with a temperature decrease was Bitlis with a difference of 0.2 °C and a decrease of 2.08%.

Conclusion and Discussion

The changes in precipitation and temperature of Turkey between the new climatic period (1991-2020) and the old climatic period (1981-2010) were analyzed by mapping with the IDW interpolation method. As a result of the examination, it was determined that the precipitation normal throughout the country decreased (from 574 mm to 573.4 mm) by 0.6 mm (0.1%).

It was observed that annual temperature normals tend to increase (from 13.09°C to 13.55°C) by 0.46°C equal (3.51%) change in all regions of our country.

In the literature, it is stated that a 30-year period is sufficient to comment on the climate situation by examining the precipitation and temperature parameters of a region [12]. However, examining longer periods allows us to make clearer comments.

In this study, Turkey's climate interpretation was made by examining 30 years of precipitation and temperature data of the General Directorate of Meteorology for Turkey.

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Prevention of torsional irregularity in steel structures via brace members

Sadrettin Sancıoğlu*1 , **Havva Betül Vural** 1 , **Sena Selen** 1 , **Serdar Çarbaş** 2 , **Abdulkerim İlgün** 1

1KTO Karatay University, Civil Engineering Department, Turkey, sadrettin.sancioglu@karatay.edu.tr; havvabetul42@gmail.com; senaselen12@gmail.com; kerim.ilgun@karatay.edu.tr
2Karamanoğlu Mehmetbey University, Civil Engineering Department, Karaman, Turkey, scarbas@kmu.edu.tr

Keywords
Steel
Brace
SCBF
SMF
Code

Abstract
Steel structures can be designed using moment-resisting frame systems or braced frame systems. Torsional irregularities can occur in non-symmetrical structures designed with moment-resisting steel frame systems. These torsional irregularities can be eliminated by adding braces to moment-resisting steel frame systems. In this study, X-type braces were added to the moment-resisting steel frame system with A1 torsional irregularity and torsional irregularity was prevented.

Introduction

The use of steel in high-rise buildings and industrial structures has been increasing recently with the development of construction technology. Especially, having a high modulus of elasticity makes it superior to other structural materials. Steel structures show ductile behaviour under horizontal loads such as winds and earthquakes. In addition, they have high energy absorption capacity [1], [2]. Therefore, steel structures are mostly preferred especially in earthquake zones.

Moreover, steel structures can be designed as special moment-resisting framed systems (SMF), special concentrically braced framed systems (SCBF), and eccentrically braced framed systems (EBF) [3]. Steel braced frame systems are increased in horizontal load carrying capacity, however restrict the lateral displacement considerably. The cross-section, direction, geometry and location of the used brace member enormously affect the behavior of the structure [4].

In non-symmetrical structure designed as SMF can be occured torsional irregularity. In the design of the steel structures in our country, the torsional irregularity of the non-symmetrical structures must be checked according to the Turkish Building Earthquake Code-2018 (TBEC-2018). This irregularity can be avoided by adding concentrically and eccentrically steel braces to the structure designed as SMF. Besides, torsional irregularity can be occured not only in non-symmetrical structures designed as SMF, but also symmetrical structures because of the strength differences and location of the using braces [5].

In this study, a five-storey non-symmetrical steel structure with A1 type torsional irregularity according to TBEC-2018 was examined. The principle aim of the study is to prevent torsional irregularity by adding X-type concentrically steel braces to this structure.

Material and Method

In this study, five-storey non-symmetrical steel frame structure with 6 m span was examined. Each floor height of the structure was equal and 4.5 m. The structure coordinates was 37.97986°-32.593169° and soil class is ZD. Structural analysis was performed via SAP2000 in order to acquire structural weight and horizontal displacements. According to structural analyses results, cross-section of the beams and columns was determined. Then, concentrically steel braces were added to the structure and the analysis were repeated in order to indicate the effect of steel braces. The structure was designed as to be utilized be used as a industrial building. The view of the examined structure are shown in Figure 1.
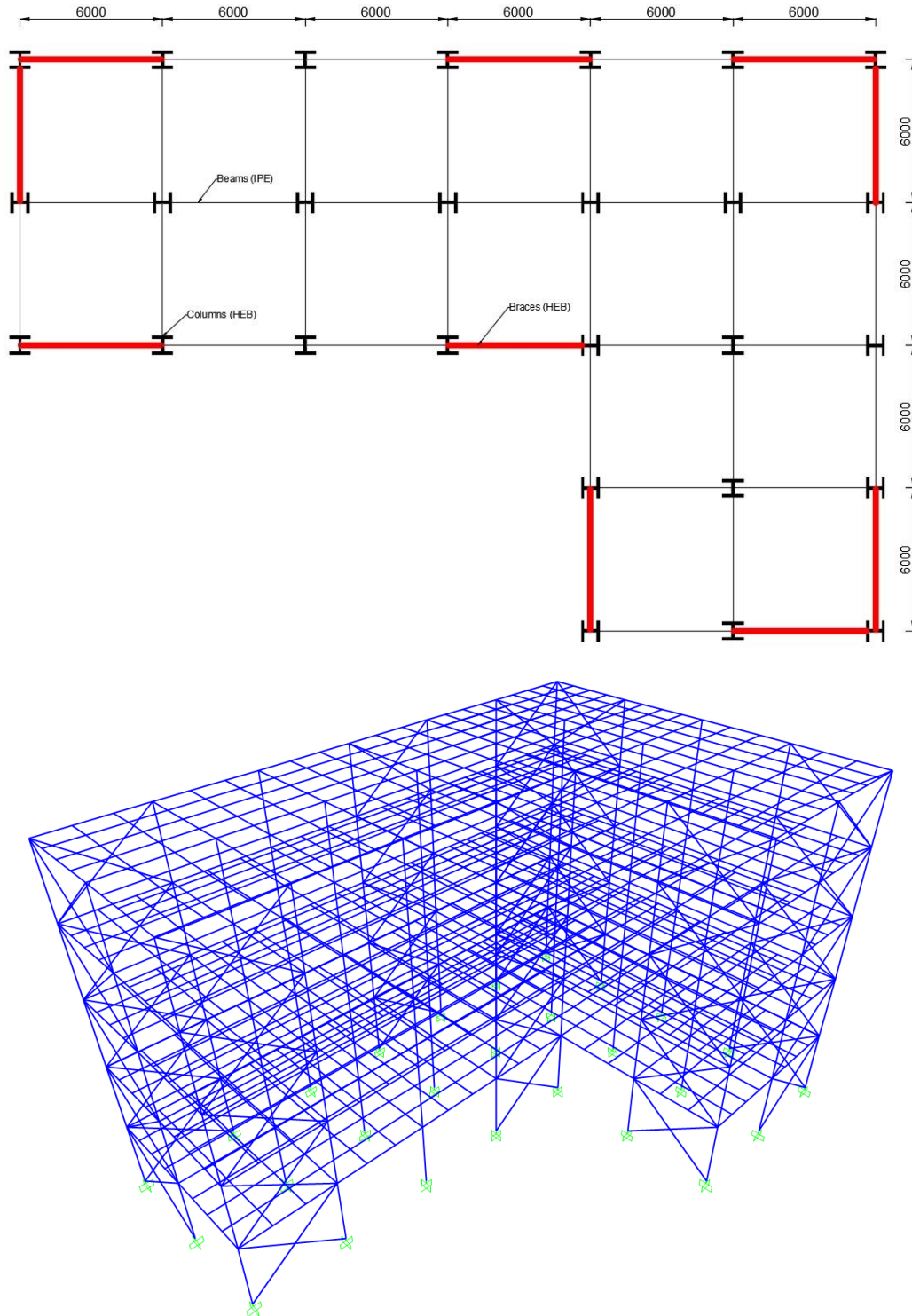

Figure 1. Examined Structure (3D and x-y views)

In the structural analyses, the snow and wind load values were implemented from the Turkish Standards (TS). The calculation details of snow load was taken from Effects on Structures-Part 1-3 (TS EN 1991-1-3) and the wind

load was taken from Effects on Structures-Part 1-4 (TS EN 1991- 1-4). Vertical loads (dead load, roof live load, live load, snow load) acted on the structure were defined in the direction of gravity in SAP2000 modelling. The vertical load values calculated are given in Table 1. Wind loads were affected on both in SAP2000. The terrain category, orographic coefficient, turbulence coefficient, structural coefficient and air density values for the mentioned coordinates through the rigid diaphragms were specified for calculation of the wind loads.

Table 1. Vertical load values

Roof Slab (kN/m²)	
G (dead load)	4
Qr (roof live load)	2
S (snow load)	1,155
Slab (kN/m²)	
G (dead load)	10
Q (live load)	5

Horizontal and vertical earthquake effects were also considered in the structural analysis. The earthquake parameters for the mentioned coordinates were taken from Turkey Earthquake Hazard Maps Interactive Web Application. The information taken was given in Table 2 for Earthquake Ground Motion Levels 2 and 3 (EGML-2, EGML-3).

Table 2. Earthquake parameters

Earthquake Ground Motion Levels	Soil Class	S_s	S_1	PGA [g]	PGV [cm/sn]	T_A (sn)	T_B (sn)	T_L (sn)	S_{DS}	S_{D1}
EGML-2	ZD	0,294	0,070	0,127	6,444	0,073	0,365	6	0,460	0,168
EGML-3	ZD	0,095	0,026	0,042	2,392	0,082	0,411	6	0,152	0,062

The vertical earthquake effect was calculated with the Equation 1 given below in accordance with TBEC-2018 4.4.3.2 and the dead load was added as G.

$$E_d^{(Z)} \approx (2/3)S_{DS}\, G \tag{1}$$

The load combinations used in the structural analyses were determined according to Design, Calculation and Constructional Principles of Steel Structures-2018 (DCCPSS-2018) Section 5.3.1 Load and Resistance Factor Design (LRFD) and TBEC-2018 Section 4.4.4. Wind (W) loads were taken into account on both x- and y- directions, while earthquake loads (E) were taken into account on the x- y- and z- directions. In addition, according to TBEC-2018 4.4.4.2 (a), factorized 1.2G is used instead of G in TBEC-2018 Equation 4.11. The load combinations (C) to be used in the examined structure were listed below.

C1	: 1.4G	C9	: 1.2G+1.6Qr +0.8Wy	C17	: 1.2G+1.0Q+0.2S+1.0Ey
C2	: 1.2G+1.6Qr	C10	: 1.2G+1.6S+0.8Wx	C18	: 0.9G+1.6Wx
C3	: 1.2G+1.6S	C11	: 1.2G+1.6S+0.8Wy	C19	: 0.9G+1.6Wy
C4	: 1.2G+1.6Q+0.5Qr	C12	: 1.2G+1.0Q+0.5Qr+1.6Wx	C20	: 0.9G+1.0Ex
C5	: 1.2G+1.6Q+0.5S	C13	: 1.2G+1.0Q+0.5Qr+1.6Wy	C21	: 0.9G+1.0Ey
C6	: 1.2G+1.6Qr+1.0Q	C14	: 1.2G+1.0Q+0.5S+1.6Wx	C22	: 1.2G+1.0Q+0.2S+1.0Ex+0.3Ey
C7	: 1.2G+1.6S+1.0Q	C15	: 1.2G+1.0Q+0.5S+1.6Wy	C23	: 1.2G+1.0Q+0.2S+0.3Ex+1.0Ey
C8	: 1.2G+1.6Qr +0.8Wx	C16	: 1.2G+1.0Q+0.2S+1.0Ex		

The steel class of the columns, beams, secondary-beams and braces used in the structures had been considered as S275. The cross-sections of columns and braces were selected among HEB profiles and the cross-sections of beams and secondary-beams were selected among IPE profiles. According to TBEC-2018 Table 4.1 C11, the structural system behaviour coefficient R=8 and the overstrength coefficient D=3 were selected for the SMF. Additionally, according to Table 4.1 C15, R=6 and D=2.5 were selected for the SCBF.

Results

At the end of the conducted structural analyses, according to DCCPSS-2018 and TBEC-2018, the minimum cross-sections of the structure were determined. The effective relative storey displacement in both directions (x-, y-) of the two structural models were checked according to TBEC-2018 Equation 4.34b and with recpect to the most dominant load combinations. Additionally, the torsional irregularities were investigated and they were checked according to TBEC-2018 Section 3.6 (load combinations C22-C23). The final results obtained from SAP2000 analyses were given in Table 3-4-5-6.

Table 3. Relative storey displacement (x- direction)

Frame	Floor	Height (mm)	$u_i^{(x)}$ (mm)	$\Delta_i^{(x)}$ (mm)	$\delta_i^{(x)} = \frac{R}{I}\Delta_i^{(x)}$ (mm)	$\lambda_i^{(x)} \frac{\delta_i^{(x)}}{h_i}$	$\lambda_i \leq 0{,}008$
SMF	1	4500	6,18	6,18	49,46	0,0040	✓
	2	4500	27,94	21,76	174,08	0,0142	X
	3	4500	64,43	36,49	291,94	0,0239	X
	4	4500	109,33	44,89	359,13	0,0294	X
	5	4500	158,47	49,15	393,17	0,0322	X
SCBF	1	4500	0,96	0,96	7,65	0,0006	✓
	2	4500	2,68	1,73	13,81	0,0011	✓
	3	4500	4,89	2,21	17,64	0,0014	✓
	4	4500	7,44	2,56	20,45	0,0017	✓
	5	4500	9,97	2,53	20,21	0,0017	✓

Table 4. Relative storey displacement (y- direction)

Frame	Floor	Height (mm)	$u_i^{(x)}$ (mm)	$\Delta_i^{(x)}$ (mm)	$\delta_i^{(x)} = \frac{R}{I}\Delta_i^{(x)}$ (mm)	$\lambda_i^{(x)} \frac{\delta_i^{(x)}}{h_i}$	$\lambda_i \leq 0{,}008$
SMF	1	4500	42,41	42,41	339,306	0,0278	X
	2	4500	174,59	132,18	1057,45	0,0867	X
	3	4500	380,24	205,65	1645,18	0,1349	X
	4	4500	624,68	244,44	1955,48	0,1603	X
	5	4500	887,52	262,84	2102,74	0,1724	X
SCBF	1	4500	3,44	3,44	27,49	0,0023	✓
	2	4500	8,59	5,15	41,19	0,0034	✓
	3	4500	14,44	5,85	46,83	0,0038	✓
	4	4500	20,61	6,18	49,40	0,0041	✓
	5	4500	26,28	5,66	45,29	0,0037	✓

Table 5. Torsional irregularities (x- direction)

Frame	Floor	Height (mm)	$(\Delta_i^{(x)})_{max}$ (mm)	$(\Delta_i^{(x)})_{min}$ (mm)	$(\Delta_i^{(x)})_{ort}$ (mm)	$\eta b_i^{(x)} = (\Delta_i^{(x)})_{max}/(\Delta_i^{(x)})_{ort}$	$\eta b_i^{(x)} > 1,2$
SMF	5	4500	18,6	3,30	10,95	1,70	X
	4	4500	13,4	3,20	8,30	1,61	X
	3	4500	8,50	2,80	5,65	1,50	X
	2	4500	4,20	1,20	2,70	1,56	X
	1	4500	1,10	0,70	0,90	1,22	X
SCBF	5	4500	1,30	1,00	5,65	0,23	✓
	4	4500	9,50	7,40	8,45	1,12	✓
	3	4500	6,10	4,90	5,50	1,11	✓
	2	4500	3,30	2,70	3,00	1,10	✓
	1	4500	1,10	1,00	1,05	1,05	✓

Table 6. Torsional irregularities (y- direction)

Frame	Floor	Height (mm)	$(\Delta_i^{(y)})_{max}$ (mm)	$(\Delta_i^{(y)})_{min}$ (mm)	$(\Delta_i^{(y)})_{ort}$ (mm)	$\eta b_i^{(y)} = (\Delta_i^{(y)})_{max}/(\Delta_i^{(y)})_{ort}$	$\eta b_i^{(y)} > 1,2$
SMF	5	4500	52,70	11,40	32,05	1,64	X
	4	4500	36,30	9,10	22,70	1,60	X
	3	4500	21,50	6,60	14,05	1,53	X
	2	4500	9,50	3,80	6,65	1,43	X
	1	4500	2,20	1,10	1,65	1,33	X
SCBF	5	4500	12,10	11,60	11,85	1,02	✓
	4	4500	9,20	8,70	8,95	1,03	✓
	3	4500	6,20	5,70	5,95	1,04	✓
	2	4500	3,50	3,10	3,30	1,06	✓
	1	4500	1,30	1,10	1,20	1,08	✓

From these obtained results, the structure designed as SMF does not satisfy the relative storey displacement condition in both directions. Besides, while the horizontal displacement of the structure designed as SMF was approximately 158 mm in the x-direction, it decreased approximately 10 mm in the structure model designed as SCBF with SCBF. Likewise, it decreased from about 887 mm to about 26 mm in the y-direction. The structures designed as SMF and SCBF were examined in terms of the A1 torsional irregularities. It was shown that the structure designed as SMF did not provide the condition of torsional irregularities, while the structure designed as SCBF satisfied it. Accordingly, the torsional irregularities can be eliminated by adding braces to the non-symmetrical structures designed as SMF.

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Accuracy prediction of identification in remote customer acquisition in banking with machine learning

Hazim Iscan[1] , Seyma Nur Alkan*[2]

[1]Konya Technical University, Faculty of Engineering and Natural Sci, Computer Engineering, Türkiye, hiscan@ktun.edu.tr
[2]Konya Technical University, Graduate Education Institute, Computer Engineering, Türkiye, alkanseymanur@gmail.com

Keywords
Machine learning
Natural language processing
Word2Vec
Word embedding

Abstract
In banking, thanks to remote identity detection, the customer representative and the real person will not need to be physically in the same environment, and new customers will be reached quickly and effectively. In this study, a data set consisting of randomly generated contact information for remote identity detection methods that can be used in customer identity verification is trained using Natural Language Processing Techniques and an estimate is made as to whether the person is real or not. One of the methods used in this study is "Word Embedding". Word Embedding is a method for closely representing words with similar meanings. The generated data set is modeled with Word2Vec, a word vector algorithm. The clustering of the word vectors obtained by Word2Vec techniques, in terms of their formal properties as well as the semantic relations of the words they belong to, has been examined. Two different Word2Vec methods such as CBoW and Skip-Gram were used to create the model. According to the results of the application, a success rate of 89% was achieved in the estimation of the correct data.

Introduction

The Banking Regulation and Supervision Agency of Turkey, BRSA, published the "Regulation on Remote Identification Methods used by Banks and Establishment of Contractual Relationship in Electronic Environment" about remote authentication methods that will be used by banks to remotely gain new customers and verify customer identity on 01 April 2021.

When the global approaches in distance identity detection processes are examined, it is observed that digital methods predominantly come to the fore. The increase in digitalization and the use of artificial intelligence technologies have increased the studies on this subject. Bektaş et al. using the distinguishing features of the characters, tried to identify the characters with the best accuracy rate of a document in picture format with the help of classification methods. By comparing the performance results and duration of the classification methods, they determined the best method among them [2]. Llados et al. describe the ICAR system, an application for automatic reading of identity cards and passports. The type and content of the document are recognized by a number of complementary statistical and structural OCR techniques. Although the system was originally designed for Spanish documents, it allows the integration of new formats through a supervised learning procedure [3]. Dwi et al. compared the size of original, medium and small images in color and grayscale images using Optical Character Recognition (OCR) technology for ID card reading. As a result of the comparison, they found the accuracy rate of grayscale data to be 88.58% and color data to be 86.32% [4].

Material and Method

Natural Language Processing

NLP, or Natural Language Processing, aims to understand or reproduce the canonical structure of natural languages by analyzing them. The convenience that this analysis will bring to people can be summarized with many topics such as automatic translation of written documents, question-answer machines, automatic speech and command comprehension, speech synthesis, speech generation, automatic text summarization, and information provision. The widespread use of computer technology has enabled specialist software produced from these titles to enter every area of our daily life [5].

Gensim Python Library

Gensim is an open source python library for natural language processing and was developed by Czech natural language processing researcher Radim Řehůřek. Gensim library enables to parse words by training Word2Vec models on a special corpus, with CBOW or Skip-Gram algorithms. [6,7].

Word2Vec

Word2vec is a two-layer neural network that processes text by "vectoring". Its input is a text string and its output is a set of vectors. The word vectors method is proposed to represent the words as vectors in an n-dimensional space and to determine the semantic similarity between them by calculating the distances between the words in this way. Word2Vec is a neural network based approach for embedding words. Trained with a large text set, this model generates a unique vector for each word in high-dimensional space. The characteristic of these unique vectors created is that words with similar meanings in the dataset form vectors close to each other. It has two methods, CBoW and Skip-gram [7,8].

CBoW uses a context surrounding the word to predict a word, while Skip-gram tries to guess the word by surrounding words with a fixed window size. Skip-Gram can produce better results for sparse words. CBoW and Skip-Gram methods are shown in Fig. 1 [9].

As a result of the Word2Vec operation, a dictionary is obtained in which each word has a vector. Since the classification of person information is done in this study, the aim is to extract the vectors of each attribute using this data. In order to achieve this, firstly, each word in the data set is matched with its vectors and a matrix of size k x w is obtained. Here k represents the number of words in the document and w represents the vector size.

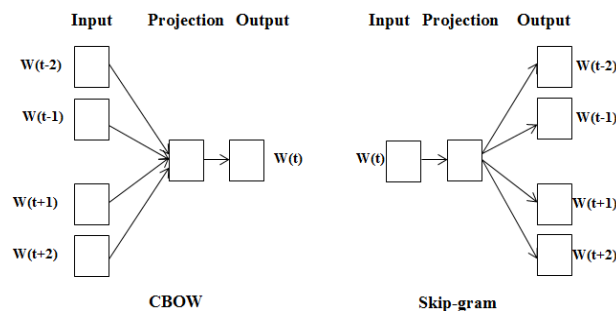**Figure 1.** Word2Vec (CBow and Skip-gram) [8]

Skip-gram

In the skip-gram, the input is the target word, while the outputs are the words around the target word. It is aimed to represent the inputs and outputs in the most appropriate way semantically, by comparing them probabilistically with each other.

CBoW (Continuous Bag of Words)

CBoW (Continuous Bag of Words) is a very similar approach to Skip-Gram. The only difference is that the inputs and outputs are swapped. The idea is that when the words around a word are given to the system, it wants to know which word is most likely to appear in those words.

Application

This study was carried out using the Python programming language and machine learning libraries prepared in that language. The dataset was randomly generated for this study. It is not related to real persons or institutions.

An example of the dataset is shown in Table 1. Personal information is classified as 'P' and 'C' in the 'Card Or Person' attribute. 'P' is the information from the form that the person has filled in, and 'C' is the information from the person's Identity Card. The information received from the Identity Card is correct information. There are various errors in the information entered by the person.

Table 1. Example dataset

Id	Name	Surname	Bdate	Bplace	Gender	Nationality	Mname	Fname	Card or Person
10008039292	MAHİR	ÖZEN	11/4/1979	TURHAL	M	TR	ALTIN	MUSTAFA	C
10012256906	AYŞE	YILMAZ	3/1/1945	KATRANCI	F	TR	ZEYNEP	ALİ	C
10102781370	HÜSEYİN	AKŞAHAN	4/23/1978	SÖKE	M	TR	PAKİZE	FAİK	C
10148539270	BERK	ÇİLBIYIK	8/12/1959	İSTANBUL	M	TR	MARYAM	SAZAR,K	C
10008039292	MAHİR	ÖZEN	11/4/1979	TURAL	M	TR	ALTIN	MUSTAFA	P
10012256906	AYŞE	YILMAZ	3/1/1945	KATRANCI	F	TR	ZEYNEP	ALİ	P
10103781370	HÜSEYİN	AKŞAHAN	4/23/1978	SÖKE	M	TR	PAKİZE	FAİK	P
10148539270	BERÇ	ÇİLBIYIK	8/12/1959	İSTANBUL	M	TR	MARYAM	SAZARİK	P

As data preprocessing, the text attributes to be used in the model are converted to lowercase with the lower() method. With the preprocessed data set, two different models were created using CBoW and Skip-Gram methods. After the models were created, the similarity between the two models was calculated with the Word2vec model.similarity( ) function.

Results

According to the results of the application, it is not sufficient to select the model only according to the accuracy values. According to the results of the analysis, CBoW and Skip-Gram algorithm; found the correct data 89% correct and the incorrect data -09% incorrect, and made a correct prediction.

CBoW models generally work better on smaller datasets, while Skip-gram models work better on larger datasets. CBoW requires less computing power, while Skip-Gram requires more computing power. Skip-gram gives better results while CBoW is not good at understanding two or more meaningful words.

Conclusion

For the same data set, the classification process was carried out successfully by evaluating the CBoW and Skip-Gram algorithms separately. Although the classification success rates of the methods differ, it has been seen that each algorithm is sufficient in classification.

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Impact of hybrid OTDM/WDM implementation on VLC performance

Alper Aytekin*1 , **Vasfiye Mençik** 2 , **Cafer Budak** 3

1 Department of Electric-Electronic Engineering, Batman University, Batman, Türkiye, alper.aytekin@batman.edu.tr
2 Department of Electric-Electronic Engineering, Batman University, Batman, Türkiye, vasfiye.mencik@batman.edu.tr
3 Department of Biomedical Engineering, Dicle University, Diyarbakır, Türkiye, cafer.budak@dicle.edu.tr

Keywords
VLC
WDM
OTDM

Abstract
Parallel to the development of technology, the interest in different protocols in communication systems is increasing. In this context, visible light communication (VLC) systems that promise high data rate, unused spectrum and high data security attract attention and are promising for the future. The main problem to be overcome in visible light communication systems is known as the necessity of increasing the channel capacity in order to spectrally overlap the Light emitting diodes (LEDs) used as transmitters and to serve many users. Wavelength Division Multiplexing (WDM) and Optical Time Division Multiplexing (OTDM) techniques can be suggested as solutions to VLC problems. In this study, the advantages of WDM and OTDM techniques were investigated and a reference hybrid OTDM/WDM VLC system was designed. The performance of the system designed using the OptySystem 14.0 simulation software was analyzed over the Eye diagram, Q factor and Bit Error Rate (BER) values.

Introduction

With the technological developments, the interest in communication systems has increased in the last century. Today, wireless communication systems serve in a wide area, from the transmission of single-bit messages to multimedia sharing, which requires high bandwidth. With the developing technology, different communication protocols have been developed for reasons such as restrictions in the frequency spectrum, insufficient data rate, and inability to provide data security. Visible light communication systems are promising for the future with their high data rate, low loss and wide usage area in the frequency spectrum. VLC systems aim to transmit a message signal to the receiver over free space by modulating it on a carrier at visible light wavelengths (400-700 nm) [1]. In VLC systems, which are technically similar to optical communication systems, it is aimed to get rid of the disadvantages of wired communication and to realize wireless communication by using free space instead of fiber channels [2].

In VLC systems, LED is used as the transmitter and photodetectors are used in the receiver unit. The basic expectation from communication systems is to provide high speed and quality service to multiple users without any interference or deterioration. At this point, it is inevitable to use multiplexing technologies. Multiplexing technologies such as WDM, Code Division Multiple Access (CDMA) and Non-Orthogonal Multiple Access (NOMA) are widely used to increase the data rate and capacity of the VLC system [3]. On the other hand, the number of channels should be increased in line with the goal of increasing the number of users, which leads to an increase in the effect of channel crosstalk. To solve this problem, the use of a secondary multiplexing technique may be beneficial. Hybrid Optical Time Division Multiplexing (OTDM) over WDM system will be a potential solution and a possible alternative for future VLC systems.

There are various studies on multiplexing techniques that can be used for VLC systems in the literature. Saeed et al [4] designed a system using RayLab simulation software to optimize wavelength allocation in multi-user WDM VLC systems. Chen et al. [5] examined the use of MIMO-NOMA in visible light communication systems in their study.

In this study, the advantages of OTDM multiplexing technique integration were investigated in order to increase the scope and efficiency of a WDM-VLC system with RGB LED transmitter with different wavelengths (Red-Green-Blue), then a Hybrid WDM/OTDM visible light communication system was designed using OptiSystem 14.0 simulation software. and system efficiency were analyzed using Q factor, eye diagram and BER. Section-2 includes Materials and Methods, Section-3 includes results.

Material and Method

Mathematical Model

WDM, which works on a similar basis with frequency division multiplexing (FDM) and is frequently used to provide multi-user support in optical communication systems, is a technique that allows to transmit a series of optical signals over a single channel by using carrier signals of different wavelengths [6].

OTDM, which is another technique used to provide multiplexing in communication systems, is a technique that uses different carriers over a single channel by providing the transmission of signals sent from the transmitter unit and coming from multiple users in different time slots [7]. The mathematical expression [8] for the signal obtained at the multiplexer output in the Hybrid WDM/OTDM system is given Eq. (1). Multi-user support, which is one of the main problems in VCL systems, signals from each group of users spread over time are multiplexed according to wavelengths in the WDM mux unit and sent to space. In this way, the number of users and service quality are increased by providing double-layer multiplexing.

$$s_j = \sum_{n=1}^{n=i} \sum_{k=-\infty}^{\infty} P(t - (n-1)\,\text{Ts} - kT)\cos\left(\frac{2\pi c}{\lambda_j}t\right) \tag{1}$$

where P(t) denotes an RZ-OOK pulse of duration Ts, the kT data bit of the nth user transmitting at wavelength λj, and Ts the time slot corresponding to the nth user.

Simulation Study

The ability to serve multiple users, which is one of the main purposes of communication systems, is also a challenge for VLC. In this regard, it is necessary to increase the system efficiency by using different multiplexing techniques in VLC systems. For this purpose, in the system in Figure 1, designed using Optysytem 14.0 simulation software, a two-step multiplexing is carried out by using RGB LEDs with different wavelengths and by spreading the wavelengths with the WDM technique before the signals leaving the transmitter by spreading time with the TDMA technique. targeted.
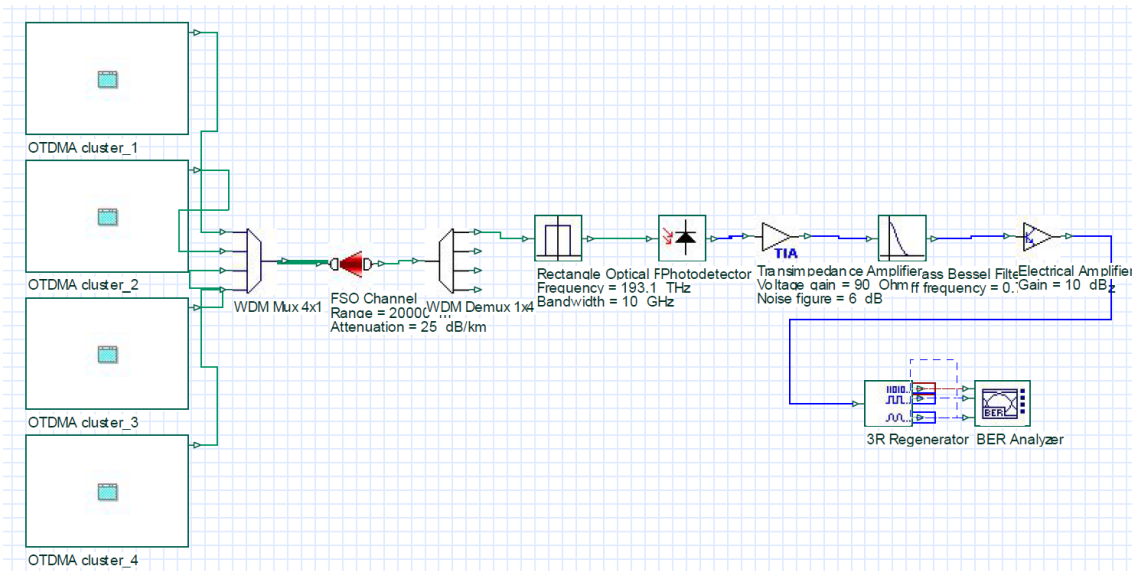

Figure 1. Hybrid OTDM/VLC System

Four different user sets are designed, each of which uses LEDs of different colors and therefore of different wavelengths as transmitters, and the contents of which are shown in Figure 2 (a). Signals with OTDMA technique applied in user clusters are spread over wavelengths via WDM Mux. Thus, it is aimed to provide multiple data transmission from a single channel by paving the way for data transmission at every point of time and at every wavelength of the relevant spectrum region. The signal obtained at the WDM multiplexer output is given to the

Free Space Optic (FSO) channel with a length of 2000m and an attenuation of 25 dB/km. The signal reaching the receiver unit is reduced to previous wavelengths by the WDM Demultiplexer and digitized with the help of the photodedector. Afterwards, the signal, which undergoes the necessary filtering and amplification processes, is made ready for use by the end user.
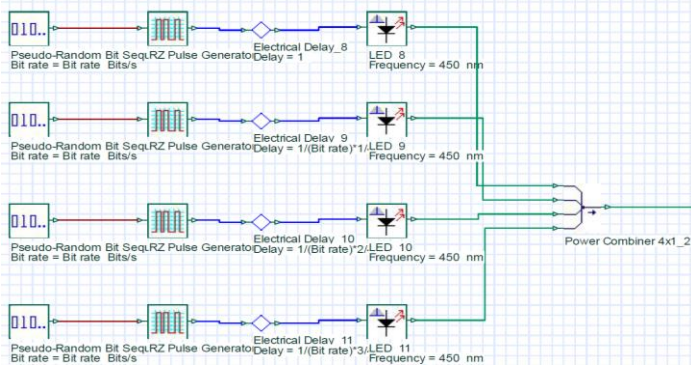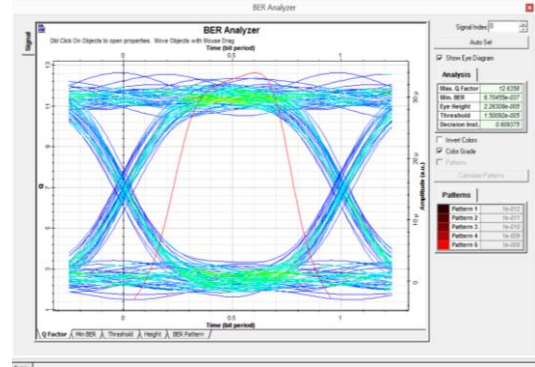

Figure 2. (a) OTDM Clusters   (b) Eye Diagram

OTDMA technique is realized by adding a time delay based on Bit Rate for each user in user clusters, each of which uses LEDs of different wavelengths as transmitters. The Eye diagram obtained as a result of the simulation study and containing the value of the Q factor is given in Figure 2 (b). The most important performance evaluation parameters in optical and visible light communication systems are the Q factor, the BER value and the symmetry of the Eye diagram. Looking at Figure 2 (b), it is seen that a relatively symmetric eye diagram and a smooth Q factor curve are formed.

Conclusion

With the development of technology, societies have become completely data-oriented, triggering the development of high-speed, multi-user and high-security communication systems. In this regard, VLC systems, which have attracted attention with their successful applications in recent years, are promising for the future. In this study, an innovative dual-stage architecture is proposed for multi-user support, which is one of the main problems of VLC systems. In this context, two-stage multiplexing was performed by spreading over the wavelength with the WDM technique, before the signals spread over time with the OTDM technique in the transmitter unit were transmitted to the FSO channel. The system output was observed with the BER Analyzer in the reference Hybrid OTDM/WDM VLC system designed using the OptiSystem 14.0 simulation software. Max. Q factor value and Min BER value are given in Table 1.

Table 1. Simulation Results

Max. Q factor	12,6358
Min. BER	6.7×10^{-37}
Eye Diagram	Symetric

While the Q factor of 12.6358 was obtained in the designed system, the Min BER value was determined as 6.7×10^{-37}. It has been concluded that the system, whose eye diagram symmetry is close to ideal, can produce a solution to the multi-user support problem in VLC technology.

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Effect of energy storage on power system stability

Ayşe Acar*1 , Asım Kaygusuz 1

1Inonu University, Electrical Electronics Engineering, Türkiye, ayseyold@gmail.com; asim.kaygusuz@inonu.edu.tr

Keywords
Energy Storage
Power System Stability
Renewable Energy
Distributed Production
Smart Grid

Abstract
Nowadays, the difference between the amount of energy produced and the amount of energy needed is growing. However, the resources of traditional energy production methods are gradually decreasing and cause environmental pollution. Limited resources lead us to renewable energy sources. On the other hand, production with renewable energy sources brings with it the changing global climate problem. The efficient, functional and continuous use of this energy is as important as the production of energy. However, systems based on renewable energy sources such as solar and wind cannot respond quickly and reliably to fluctuating demand as they have different generation profiles seasonally and during the day. This indicates that energy storage is an important issue. It is academically important to analyze the changes in the stability of power systems by integrating storage systems into power systems. In this study, it is aimed to minimize the production-consumption imbalance by integrating energy storage systems into smart grids and the response of system stability is analyzed. In practice, development studies were carried out on the basis of the MATLAB contents applied by Hadi Saadat. For this analysis, hypothetical generation and consumption systems have been created using the IEEE 14 bus power system.

Introduction

A large part of the world's energy needs is met through centralized production systems that utilize the potential energy of water as well as fossil and nuclear fuels. Due to environmental concerns, the negative effects of dangerous gases formed during the energy production of traditional power plants on the atmosphere and global warming raise a question mark.(Kemal, 2016) Renewable energy sources are seen as a solution against adverse situations that may occur.

Renewable energy systems, especially solar and wind systems, are very important for our future, as they provide environmentally friendly and sustainable production. However, sources such as sun and wind have a production profile that is not constant during the day.

Considering that energy storage systems store energy when production is high and return it to the system, when necessary, energy storage systems are seen as a solution to balance unstable energy production and to ensure energy continuity.

Material and Method

In this study, IEEE 14 bus power system was preferred. Analyzes were made using the Matlab program. Newton-Raphson renewal method was used for stability analysis. While creating the scenarios, the load flow densities of the system were taken into account and solar generation unit, wind generation unit and energy storage system were added to the system. By creating faults in the system, the rotor angle, frequency and voltage stability of the system were examined.

In terms of high efficiency, the charging and discharging time of the battery was chosen as 3 hours.(Yilmaz vd., 2021)

Introducing the scenarios used in stability analysis

- **Scenario 1**

IEEE 14 bus system; It consists of 5 machines, 11 loads, 3 transformers and 15 transmission lines. In the current system, the bus with the highest load density is the 2nd bus. Therefore, the energy storage system is integrated into the 2nd bus and faults are created close to the 2nd bus.
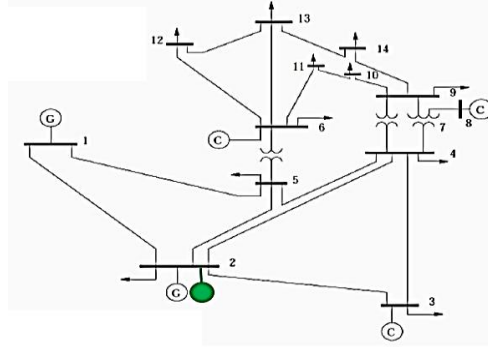

Figure 1. IEEE 14 bus system with added storage system (green circle)

The stability of the system in its current state is analyzed and the stability in the state after the energy storage system is added to the 2nd bus. The system is shown in ''Fig 1''.

- **Scenario 2**

By adding a wind generation unit to the 5th and 2nd buss and a solar generation unit to the 4th bus, it has been accepted as the current situation. In the current situation, stability has been analyzed by adding an energy storage system to the 4th bus. The test system is shown in ''Fig 2''.
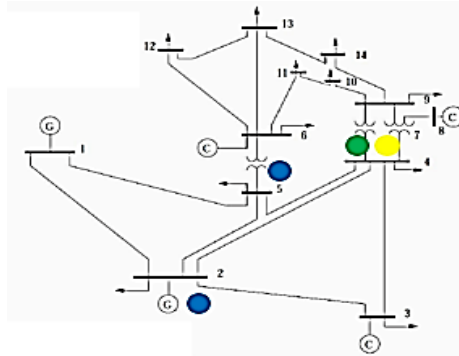

Figure 2. IEEE 14 bus system with added storage system (green circle), solar generation unit (yellow circle), wind generation unit (blue circle)

Results

The analyzes were made by taking into account the hourly consumption-production values of Turkey. The stability of the system was investigated with 0.05 seconds iteration. Since there is production at 07.00, 13.00 and 19.00, the energy storage system acts like a load, that is, it is charging. Since consumption is intense at 12:00, 15:00 and 20:00, the energy storage system acts like a generator, that is, it is discharged through the system.

Table 1. System instability times

Hour/Scenario	Scenario 1	Scenario 2
07.00	0.10	0.10
12.00	0.10	0.15
13.00	0.10	0.10
15.00	0.10	0.15
19.00	0.10	0.10
20.00	0.10	0.15

When the data in ''Table 1'' is examined, the energy storage system alone does not show a different result in case of failure in Scenario 1. However, when the energy storage system is used together with solar and wind generation units (Scenario 2), it is observed that the stability of the system is longer when the storage system gives energy to the system.

Discussion

In this study, it is aimed to see the changes in system stability with the integration of energy storage systems in power systems based on renewable energy sources. Since the energy obtained from smart grid integration renewable resources changes seasonally, annually, daily or even hourly, the importance of energy storage systems emerges to ensure the continuity of this energy.

However, it will be an academically important study to examine the effect of energy storage systems on system stability in their work with the existing power system, solar and wind generation units.

Conclusion

According to the results of the analysis, it is seen that the energy storage system has a positive effect on the stability of the system in case of a possible failure, while providing energy to the system, that is, in case of discharge. It has been observed that while storing energy from the system, that is, in the charging state, it behaves like a load and does not have a serious deterioration effect on the stability of the system.

It is predicted that the use of IEEE's 9, 30 and 39 bus power systems as a test system will also have positive effects on the literature.

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Blockchain and Web-Based electric vehicle charging station application design

Abdulkadir Yelman[*1] , **Asım Kaygusuz** [1] , **Mehmet Fatih Ozdemir** [2]

[1]*Inonu University, Electrical and Electronic Engineering, Türkiye, abdulkadiryelman@gmail.com*; *asim.kaygusuz@inonu.edu.tr*
[2]*Inonu University, Computer Engineering, Türkiye, mfatih.ozdemir@inonu.edu.tr*

Keywords
Electric Vehicles
Blockchain Technology
Charging Stations
Renewable Energy
Energy Efficiency

Abstract
The rapid development of electric vehicle technology in the last 10 years and the expectation of widespread use of vehicles, along with the fact that vehicles can be charged quickly, safely and at an affordable price, and to obtain information about the battery life of vehicles. Renewable energy powered charging stations participating in smart grids prevent grid fluctuations and provide a more stable grid. Blockchain technology, which is one of the most popular technologies of today, allows vehicles to keep this desired data, as well as to charge them quickly, safely and at an affordable price. In this study, an application that can be made by combining blockchain technology with electric charging stations producing with renewable energy is mentioned. The application saves the previous charging data of the vehicles in blocks with blockchain technology and this data cannot be changed. It can be seen transparently by everyone. In addition, with the web-based application that is aimed to be developed, it is aimed that charging stations will be able to instantly sell the energy they obtain from renewable energies without storing them, and that electric vehicle users will be able to obtain electrical energy at affordable prices. The charging data of the vehicles are kept in blocks, and fast, safe and affordable charging is provided thanks to the web-based application. It allows the energy produced to be used efficiently. At the same time, the charging history of electric vehicles can provide information about battery life.

Introduction

A.   Electric Vehicles

Since the invention of the wheel, humanity has devised means to transport people and goods from one place to another. After primitive designs, internal combustion engines and later electric motors were developed. After the development of these engines, fossil fuels or electrical energy were used for their movement. By the 1800s, electric vehicles began to become popular for reasons such as short range. It was used until the 1960s, but remained off the roads until 1980. After the oil crisis in the 1970s, electric vehicles came to the fore again. [1] Increasing ranges are no longer a problem with the development of battery technologies. In the last 10 years, the world agenda has focused on how to charge electric vehicles and the creation of charging infrastructures.

B.   Electric Vehicle Charging Stations

Electric vehicles meet the energy they need through charging stations. Electric vehicles meet the energy they need through charging stations. Providing the energy needed by electric cars from renewable energy sources has often been the first target. For this purpose, various systems are designed and electric cars can be charged only with the help of photovoltaic panels or only wind turbines. It is common practice to install a charging station by placing photovoltaic panels on roofs [2].
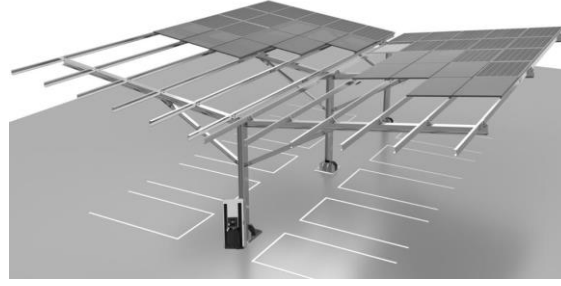
Figure 1. Solar charging station design

C. Smart Grids

Smart grids are a technological evolution of the 20th century electrical grid and are more efficient and controllable than traditional grids. Two-way flow in smart grids [3]. Excess energy can be sold to the grid. Energy tracking becomes easier.

D. Blockchain Technology

The concepts of bitcoin and blockchain were first coined in 2008 by an author named Satoshi Nakamoto, who explained how cryptology and an open distributed ledger could be combined in a digital currency application [4]. Blockchain advocates decentralized and self-management, planning and commerce rather than a centralized management approach. Due to the nature of blockchain technology, it keeps the data it records transparently and is publicly available. It is also secure and all blocks added to the blockchain are kept in a specific hash algorithm and cannot be changed. Because data resides in every block. If changed, the chain will break and the data will no longer be correct. Per-to-per energy trade is also possible through smart grids. Using this technology, a renewable energy-based charging station can sell or buy energy from the vehicle without the need for distribution companies. Even vehicles can sell energy among themselves [3]. In addition, by keeping the data in the blockchain, it is now possible to learn when, how much and at which charging station the vehicles are charged. This helps to see the history of vehicles transparently.
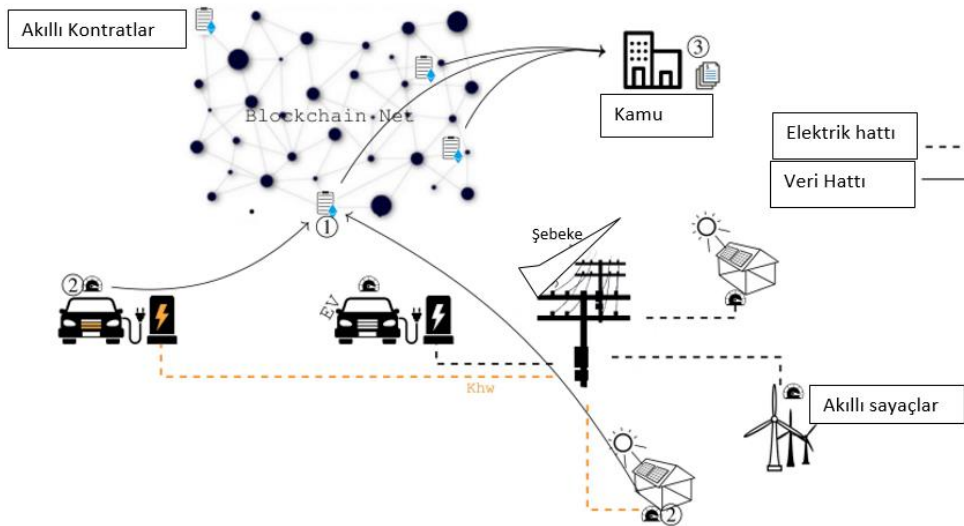

Figure 2. Blockchain-based energy trading [5]

Material and Method

Electric vehicles need charging stations to know that they meet their energy needs at an affordable price. In this study, a web-based software is proposed. A charging station that produces with a renewable energy source wants to instantly sell the energy it produces without storing it. The charging station determines the available socket types and production status. Vehicles that have previously registered to the system with license plates and allow data access are determined. It sends notifications to vehicles with a charge status of less than 30%, located within 3 km of the charging station, based on the type of charging socket the vehicle has. In this notification seen in the in-car entertainment system, it is stated that the socket of the charging station suitable for the vehicle is

empty and can provide charging at a lower price than the normal selling price. The vehicle driver reads the warning and makes a decision. If a positive decision is made, the corresponding socket of the charging station is reserved and the route is established. A 10-minute reservation request arrives at the charging station and the socket to which the notification is sent is reserved. When the vehicle reaches the charging station, the QR code created for the vehicle is scanned to the charging station. Charging starts. At the end of the pricing, the payment is made with the appropriate payment method and the pricing ends. In addition, the data obtained from here is recorded in the blockchain. By defining the hash function on the license plate of each vehicle, it is possible to determine how long the vehicle was charged at which charging station, how many cycles it made, how long it was charged in which charging state, etc. data is recorded in blocks. Since this data is non-changeable, it provides transparent and accurate information during the sale of the vehicle or in case of reviewing its history. The application can be written in the web environment using the python language. The algorithm created is shown in flowchart 1.
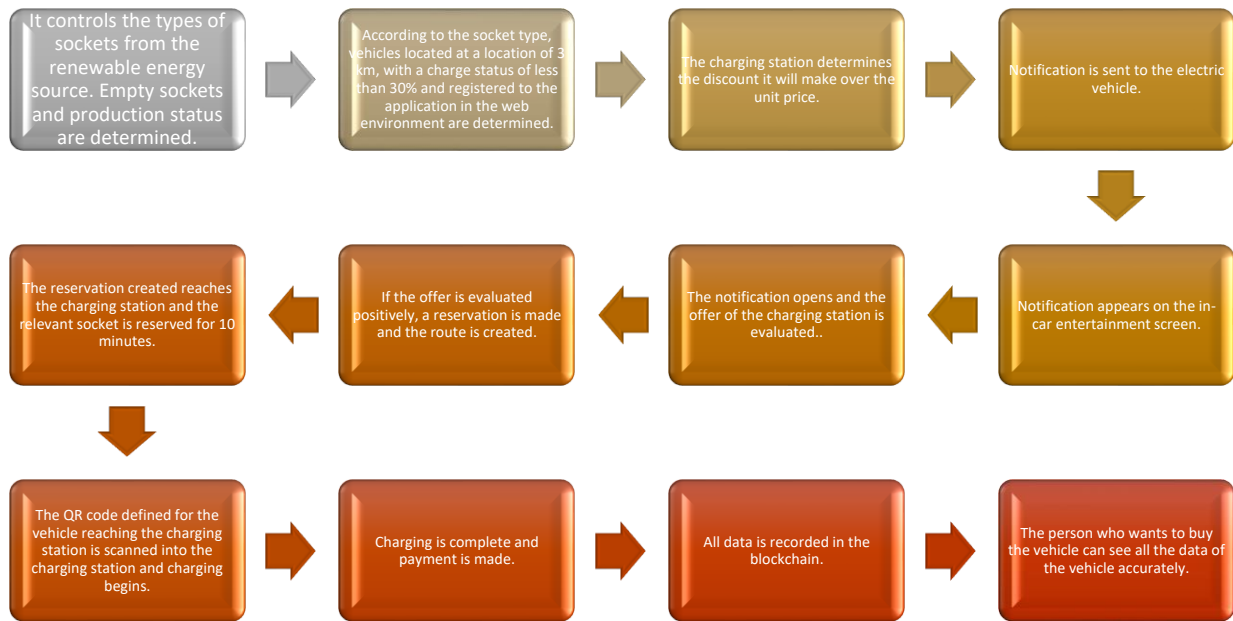
Flow Chart 1. Implementation Algorithm

Results

As a result of this study, it can be ensured that charging stations producing electrical energy from renewable energy sources can instantly sell the energy they produce. This can contribute to increased energy efficiency. Vehicle users, on the other hand, are offered the opportunity to charge their vehicles quickly, reliably and at affordable prices. With Blockchain technology, it is possible for people who will buy new vehicles to access real information without consulting anyone. As a result of such a study, reliable information can be obtained as well as providing energy efficiency.

Discussion

In order to achieve energy efficiency, consuming the produced energy immediately can be considered as the cheapest method. The common phenomenon of electric vehicle users is fast, reliable and affordable charging of the vehicle. In addition, people who will buy new electric vehicles can see accurate and reliable information about the vehicles they choose from the data recorded on the blockchain instead of learning from a center.

Conclusion

It can be facilitated to transfer instant generation from renewable energy sourced charging stations to electric vehicles without storage, to charge the electric vehicle more economically, and to access the previous data of the vehicle in a transparent manner with blockchain technology.

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24V Input 12V AND 36V Output Buck-Boost Converter Design

Muslime Altun*1 , **Mehmet Rida Tur** 2 **Fevzi Çakmak**3

1 Batman University, Energy Coordination Center, Batman, Türkiye, muslime.altun@batman.edu.tr
3 Batman University, Department of Electrical & Energy Engineering, Batman, Türkiye, mrida.tur@batman.edu.tr
3 Mardin Artuklu University, Midyat Vocational School, Mardin, Türkiye, fcakmak72@hotmail.com

Keywords
Buck-boost converter
Voltage deviation
Pulse Width Modulation

Abstract
In this modern era of electronic technologies, all the appliances require a separate power supply. To overcome this drawback, the concept of a single converter with multiple power supply has been proposed. Furthermore, the proposed research work clarifies about multipurpose charger, which alters and uses a boost topology to supply different outputs as required for different applications. Proposed method consists of multiple PWM duty cycles to produce multiple regulated power supply voltages, and so it is also referred as multi power boost converter. It uses one converter for obtaining various outputs. For example, mobile, laptop, electric vehicle, or any other electronic appliances can be charged using multi power boost converter.

Introduction

Nowadays, most of DC power supply uses are needed in electronic devices. This utilization is required in order to be able to convert DC voltages from certain voltage to desired voltage. Buck-boost converter is a type of switching converter that is able to produce voltage levels greater or smaller than the input voltage. Voltage regulation is carried out by adjusting the duty cycle of Pulse Width Modulation (PWM) [1]. Buck-boost converters are widely used in alternative and renewable energy power plants, portable devices and industrial installations [2].

1. Buck-Boost Transducer Design, Modeling and Control

Switched power supplies are widely used today, especially in electric vehicles, renewable energy systems, computers, televisions, mobile phones and many electrical household appliances. The advantage of switch-mode power supplies over other conventional power supplies is that they are quite light, smaller and therefore take up less space. [3]

 Dc-dc converters are structures that are used to transform the unregulated or the regulated voltage at the output of a rectifier, battery or solar cell. Buck-boost converter can generally be in two different structures as isolated and non-isolated. However, non-insulated structure is more widely used. [4,5] The output voltage value of the buck-boost converter can be greater or less than the input voltage value depending on the value of the duty period. In addition, the polarity of the output voltage is opposite to the polarity of the input voltage. [6]

1.1. Buck-Boost Converter

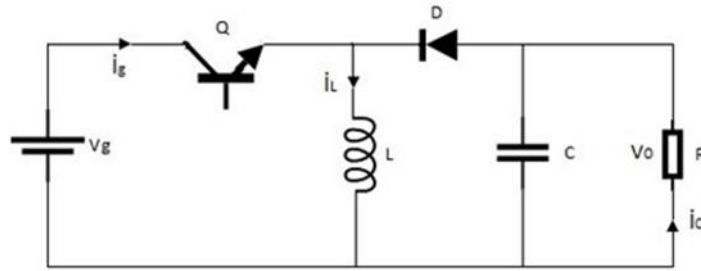The circuit diagram of the buck-boost converter is shown in Figure 1.

Figure 1. Buck-boost converter circuit

To analyze the buck-boost circuit, it is necessary to consider two cases where switch Q is on (Qon) and switch Q is on cut (Qoff).

If the duty period of the switch is d;

$$d = \frac{t_{on}}{t_{on} - t_{off}} - \frac{t_{on}}{T_s} \tag{1}$$

Here t_{on} and t_{off} are the on and off times of the switch, respectively. T_s is the switching period.
The output voltage of the converter under ideal conditions;

$$V_o = \frac{d}{1-d} * V_g \tag{2}$$

changes to. Here, the duty period d varies in the range of 0-1. Different output voltage values can be obtained for different d values. Output voltage; If d<0.5 it becomes buck (reducer), if d>0.5 it becomes boost. The current is also intermittent, as the output of the Buck-Boost converter is a bit too fluctuating.

$$\frac{d\dot{I}_L}{d_t} = \frac{V_g}{L}.d + \frac{V_C}{L}.(1-d) \tag{3}$$

$$\frac{dV_C}{d_t} = -(1-d)\frac{I_L}{C} - \frac{V_C}{RC} \tag{4}$$

1.2. Proteus Model of Buck-Boost Converter

Equations in equality (3) and (4) are modeled as in Figure 2 using the Proteus program.
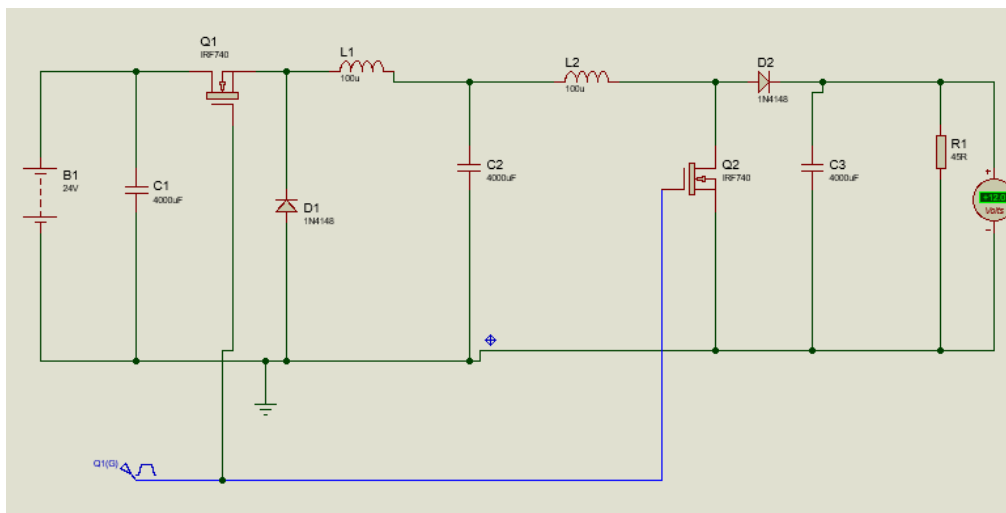

Figure 2. Proteus Model of buck-boost converter

In Figure 2, if the desired output voltage is entered into the model as Vo value, the duty period that will provide this output is calculated and applied as an input to the model.

The model in Figure 2 was operated for different reference output voltage (Vo) values by taking Vg=24 V, C=100 μF, L=4000 μH, R=45 ohm and switching frequency fs=75 kHz, and the following results were obtained. The created model calculates the duty period value of the converter according to the entered reference voltage.

In order to calculate the desired reference output voltage as Vo=36.8 V, when the signal width is entered as PW=66, the duty period, output voltage and inductance current of the buck-boost converter are as seen in Figure 3. In this case, the model calculated the duty period as d=0.454.
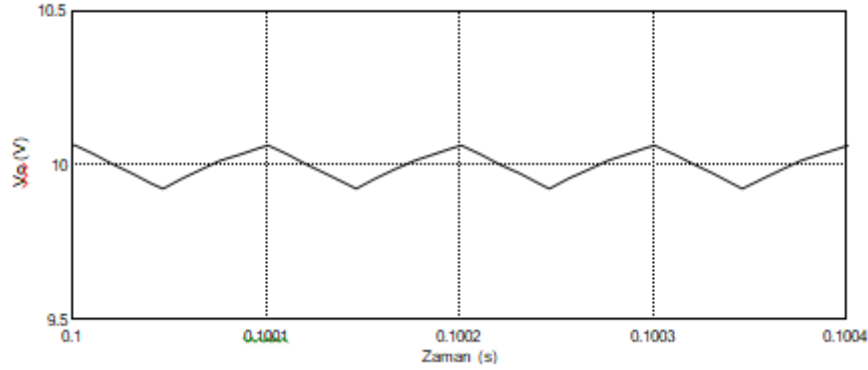

Figure 3. Variation of output voltage with time for Pw=66 in buck-boost converter

When the signal width is entered as PW=37 to calculate the desired reference output voltage as Vo=12 V, the duty period, output voltage and inductance current of the buck-boost converter are as seen in Figure 4. In this case, the model calculated the duty period as d=0.625.
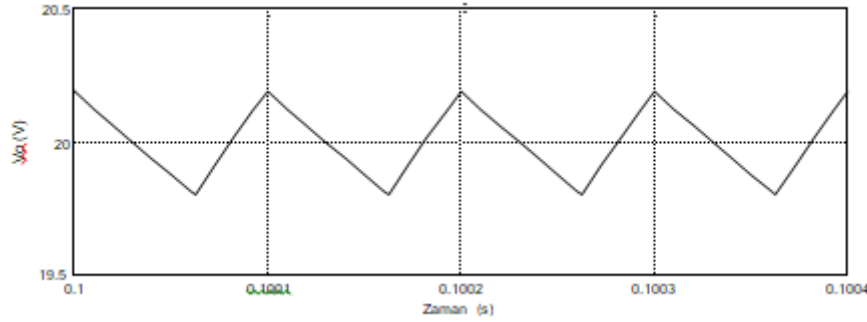

Figure 4. Variation of output voltage with time for Pw=37 in buck-boost converter

Conclusion

In this study, the design, modeling and control of da-da Buck-Boost transducer are examined. The Proteus model of the controlled da-da Buck-Boost converter, which provides the desired output voltage according to different reference voltages, has been realized and the results regarding this situation are presented in detail.

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Measurements and modelling of PM$_{2.5}$ level in summertime period in Novada main shopping centre Konya, Turkey

Sukru Dursun *[1] , **Mina Naseer Qasım** [2]

[1]Konya Technical University, Environmental Engineering Department, Türkiye, sdursun@ktun.edu.tr; mineenviro@gmail.com

Keywords
Air quality
Indoors
Measuring
Modelling
Particulate matters
PM$_{2.5}$
Shopping centers

Abstract
The people are spending most more the daily time in closed environments in their life. The living atmospheric air quality is important because of this long contact time. Air pollution is the presence of particles in the atmosphere because of the interaction of dust, gas, smoke, water vapor, odor and many chemicals in amounts that can harm living things and other things. This pollution, which is an environmental health problem affecting all countries of the world in recent years, causes the death of 3 million people every year in the world. In another definition, air pollution occurs because of fossil fuel burning, that is, anthropogenic activities such as natural gas, coal, and oil, to power industrial processes and motor vehicles. Industrialized countries expect a modern living place in modern life and living spaces. Their vehicle demands bring along motor vehicles and industrialization close to city centers and this effects a damage the human and environmental health. Konya city center is one of the most crowded plan sections of Turkey, and to finish our preparations together with central planning and industrial planning. People also prefer to spend their spare time doing great shopping that Novada Shopping Centre is one of them. It turns out that the forecasts of this weather arise if it is for the air pollution of the air from the people who come from shoppers and visitors. The basic organization for a good material for obtained air quality preparations. Improvement planning in the current situation achieves the goal of the air quality specialist so that the results obtained can be achieved.

Introduction

Looking at the main causes of air pollution, the increasing population, urbanization, and the need for energy from industrialization have led to an increase in the need for fossil fuels [1]. As a result of the excessive use of fossil fuels, changes occur in the structure of the atmosphere day by day. People are constantly breathing the air around them all the time. Gases and particles in the air are exhaled together with the inhaled air. These pollutants damage people's heart, lungs, and other organs. When we look at the death cases caused by air pollution in the past, approximately 20 people died in Pennsylvania in 1948, while this event killed 63, 3000 people in Belgium in 1930 and in London in 1952 due to air pollution. Although different pollutants are released into the atmosphere because of natural physical events (volcanoes, fires), anthropogenic (human) activities have been determined as the primary source of air pollution in the environment.

The energy saving policies of recent times in countries and the construction of insulated buildings with insufficient ventilation, minimum indoor air circulation, no windows that can be opened to the outside, and air conditioners have had a significant impact on the air quality of these indoor environments. It is a known fact that human performance is affected by indoor air quality. For human comfort and productivity, the indoor environment must be at 19-20°C and the humidity of the air he breathes must be 30-50% [2]. To achieve this aim, PM$_{2.5}$ particulate matter measurements were made in the Novada shopping center in Konya city, which is called one of the most industrial cities. Modelling was done by mapping the obtained data. The results obtained were interpreted according to all levels and then compared with each other.

Material and Method

Study area

The variation of the levels of air pollutant concentrations between regions in big cities is shaped depending on the characteristics of the regions [3]. In this study, which was started based on the shopping centers in the Selçuklu district of Konya, were selected for measurements. The first of these places, which were chosen by paying attention to the fact that they are closed environments, is the Novada shopping center located in the new development area of the bay was chosen as the second place for data collection.

Novada outlet shopping and living center located near the bus station area, which is known as the new development area of the city, opened for use in 2015. This shopping center, with a total area of 33000 m², has 2 outdoor and one indoor parking lots, 51 stores, 12 restaurants and 3 playgrounds. Consisting of 4 floors, this building looks like the letter L when viewed from the satellite image, and 3 of the 4 entrance doors are located on the front of the building facing the main street. Sampling points were determined for the measurements to be made in the Novada.

For this reason, it is directly exposed to air pollution caused by traffic. The other entrance door is used as a parking garage entrance on the -1 floor and there is no direct exposure to outdoor air pollution. There are cash machines, travel agency and tailor shops on this floor. The first measurement point was chosen right in front of the entrance door.

The ground floor (0 in order) has two entrance doors at the same level on the north and south facades. On this floor, there are mostly household goods, electronic goods stores, cosmetics, a small number of cafes and clothing stores. The possible source of pollution was mostly thought of as the exhaust fumes carried in from the open parking lot located at the front of the shopping mall and where both doors open directly there. The first floor consists entirely of clothing stores, and the possible source of pollutants is considered as fabric types and store perfumes. The fourth entrance door is located at the back of this floor. There is a ventilation system on the ceiling and the floor in the entire building is covered with ceramic porcelain.

Modelling and graphics program Surfer-16

This software, produced by Golden software company, consists of a 3D graphics system. It is used for gridding scattered data recorded in different environments, creating contour maps, and obtaining 3D images (Polat, 2002). Since 1984, more than 100,000 scientists and engineers worldwide have benefited from Surfer. The program's exceptional shaping capabilities make it the preferred software for working with X,Y,Z data. It shows high performance to visualize X,Y,Z data with stunning clarity and accuracy [4]. This program, which transforms the collected data into information, visualizes the data in high quality while preserving its accuracy and precision. Along with Surfer's extensive modeling tools, interpolation and grating parameters can be adjusted, define errors and breaks, or perform grid calculations such as volumes, transformations, smoothing or filtering [5].

It consists of map types such as contour, calculation, 3D surfaces, color relief *etc.*, and provides tools to visualize and model all types of data. The type of map obtained in this study is contour map. After making all the statistical calculations by turning the 3D data loaded on the worksheet into a grid, the map is created by selecting the desired map type. To make the map more meaningful and readable, the map can be personalized with various customization options, thanks to the window in the lower left corner of the screen. These options include sections, magnifiers, scale bars and edits such as multi-axis, linear or logarithmic color scales, combining multiple maps, text, line, fill, and symbol properties [6].

Results and Discussion

In the research carried out to determine the particulate matter concentrations, the pollutant sources in the external environment were examined. By comparison, there is little information on indoor particulate matter pollution, its concentrations, sources, and exposure levels to people who spend most of their time in various indoor environments [7]. In this study, which was started to determine the effect of seasonal changes on particulate matter, summer, autumn, and winter seasons were selected to take measurements. In summer and autumn seasons, measurements were made for one week at Novada shopping center, and during the summer season, weekday and weekend measurements were made in both locations. The total measurement period was completed as 4 days in the sampling period.

In seasons when the measurements were made, the daily measurement program lasted for 10 hours depending on the working hours of the places, and the measurements were repeated 6 times a day at 2-hour intervals. After taking the coordinates of the measurement points, the data collected at the end of each season are listed in the Excel program in a way that daily, weekly, and hourly averages will be taken. Besides the X and Y coordinates, the Z coordinate represented the measured $PM_{2.5}$ values. A worksheet was created by transferring X Y coordinates and measurement values to the SURFER 16 program. All statistical calculations were made by making the prepared data into a grid. Then, contour map was selected from the map options to show the contour lines, and the

customization window was used to clearly show the high and low concentrations and the distribution lines on the map.

Table 1. Seasonal weekday and weekend averages of particulate matter $PM_{2.5}$ in Novada shopping center

Sampling period	Weekday average $PM_{2.5}$ µg/m³	Weekend average $PM_{2.5}$ µg/m³
Summer	336.97	322.55

Conclusions and Recommendations

Lower concentrations were obtained in all three seasons in Novada shopping center. Measurements were made on the minus one level, entrance, first and second floors of the shopping mall. The highest concentrations were seen in this mall minus one and the first floor. Opening the only door on this floor where there is no ventilation to the parking garage caused the emissions from the vehicles to spread indoors. The fact that the measurements made in the summer season coincide with the month of Ramadan caused the results to be lower than the weekend values compared to the weekdays. In the autumn and winter measurements, the situation differed, and the weekend averages were generally higher than the weekday results. The fact that the concentrations found in Novada AVM are lower than that of Rainbow is due to the presence of a clean air plant operating here. These power plants, operating on the entrance, first and second floors, changed the indoor air of the building and helped to breathe quality air. In addition, cleaning activities continue throughout the day. High concentrations are mostly in the food layer; It has been found in areas where restaurants and playgrounds are located. This building, which was put into use in 2015, has less pollution reflected in the environment due to the building material and the age of the building.

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The effects of the climate crisis and adaptation policies: The Green Consensus

Aziz Cumhur Kocalar *1

1Niğde Ömer Halisdemir University, Urban and Regional Planning Department, Türkiye, azizcumhurkocalar@gmail.com

Keywords
European Green Consensus
Climate crisis effects
International trade
Economic planning
Public administration
Public politics

Abstract
The study examines the prominent issues about Turkey's signing of the Paris Agreement and the process of harmonization with the EU Green Consensus. The study evaluates the findings on the Green Consensus Era and makes predictions about the near future on issues related to international trade. Research is important in terms of illuminating the critical points of the related process. The method of the research is based on interdisciplinary findings and observations. The European Union put into effect the European Green Consensus (EGC) in 2019. In 2021, Turkey published the Green Reconciliation Action Plan. In the same year, Turkey also signed the Paris Agreement. Therefore, Turkey should speed up its preparations for this process involving EGC. It is known that especially digital transformation will play a dominant role with the solutions it will provide in this process. For this purpose, it was deemed necessary for Turkey to start making new moves in economic planning, public administration, and politics.

Introduction

The study examines the prominent issues about Turkey's signing of the Paris Agreement and the process of harmonization with the EU Green Consensus. The study evaluates the findings on the Green Consensus Era and makes predictions about the near future on issues related to international trade. Research is important in terms of illuminating the critical points of the related process. The method of the research is based on interdisciplinary findings and observations.

Material and Method

The most important data on the process are international and national documents on historical agreements. The first data on the process is based on historical documents. The Paris Agreement was signed 2015 and the effective date on 5 October 2016 [1].

The European Union put into effect the European Green Consensus (EGC) in 2019 [2]. In 2021, Turkey published the Green Reconciliation Action Plan [3]. In the same year, Turkey also signed the Paris Agreement in the parliament [4]. Therefore, Turkey should speed up its preparations for this process involving EGC.

Turkey's accession to the party countries in the Past Historical Process from the Paris Agreement to the European Green Deal is given in Figure below (Figure 1).

It is known that especially digital transformation will play a dominant role with the solutions it will provide in this process. For this purpose, it was deemed necessary for Turkey to start making new moves in policies.
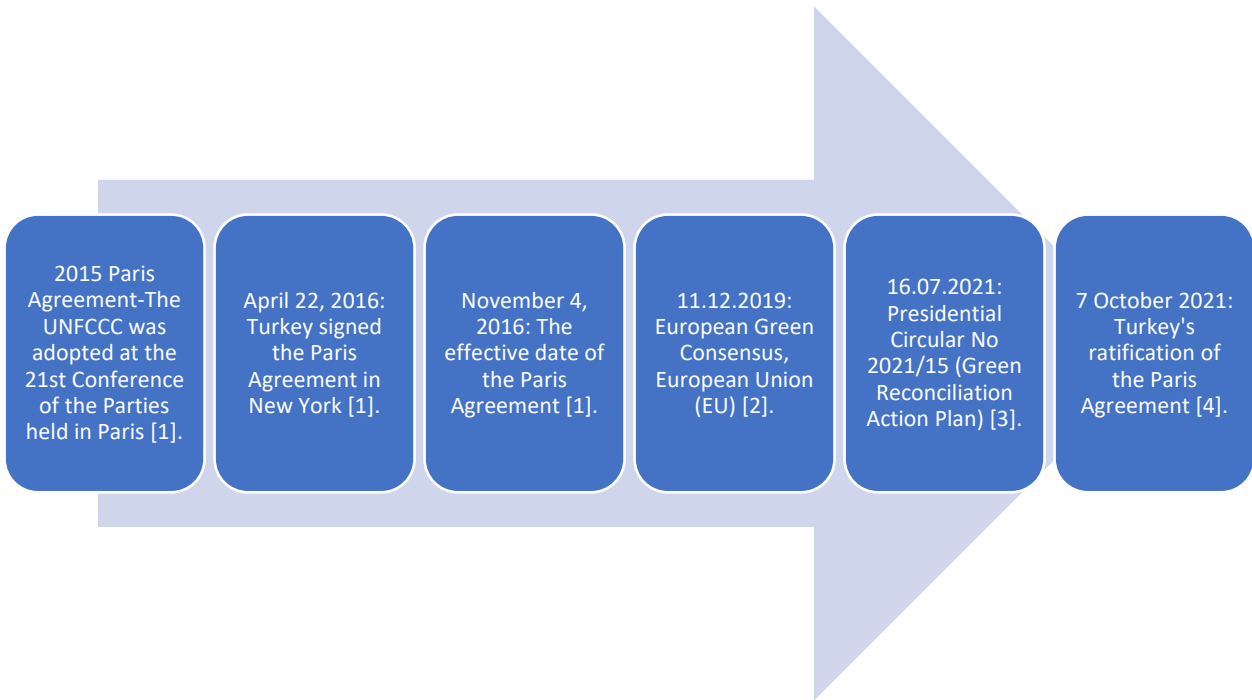
Figure 1. Turkey's accession to the party countries in the Past Historical Process from the Paris Agreement to the European Green Deal

Results

Concrete and relational data have not yet been fully revealed. As can be observed in the field examples in industrialized metropolitan cities in Turkey, the general situation is rather depressing. The situation in cities that have industrialized rapidly and unevenly in recent years is thought-provoking. The measurement processes are also rapidly converging in accordance with the EGC criteria that the countries supplying abroad from Turkey comply with.

By 2023, carbon footprint calculations will begin to be considered in practice. Many activities, from wastewater to renewable energy, will evaluate in this context. For this purpose, models based on documents should be put forward. It will become important that the paid tax items become visible. For this purpose, the Ministry of Commerce prepared an action plan, and the plan was published as a Presidential Circular.

Institutions and their related tasks that are now stakeholders in the process need to become clear quickly. Thus, the relevant activities will be carried out within more precise areas of responsibility.

Discussion

A smart transformation process has been entered with EGC. Digital transformation approaches are expected to evolve properly within this perspective. In the 2000s, the first footprints of this transformation in corporate structures showed itself sufficiently with the change in the names given to company departments.

For examples: "Human Resources Department" has started to be used instead of "Personnel Department" in institutions. Organizational models were rapidly renewed in this way.

Conclusion

In the recent commercial processes that have developed in the world and in Turkey, only certain occupational groups are no longer sufficient. In parallel with the processes in future commercial activities, the increase in the capacities of all action categories has become quite remarkable. This situation gradually increases the complexity of commercial processes and keeps the coordination between stakeholders much more intense.

Today, the coordination of all corporate processes must be ensured by the developments in information and communication technologies. The difficulties that arise because of the increasing competition in international trade can be overcome with effective and timely plans by going through the ways presented in the study.

For this purpose, it was deemed necessary for Turkey to start making new moves in economic planning, public administration, and politics. Technical details are the subject of new and more detailed studies.

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Investigation of Base Flow Reserve in Konya Closed Basin

Fatma Sena Horzum *1 , **Vahdettin Demir** 1 , **Mehmet Faik Sevimli**1

1KTO Karatay University, Civil Engineering Department, Turkey, senahorzum987@gmail.com; vahdettin.demir@karatay.edu.tr; mehmet.faik.sevimli@karatay.edu.tr

Keywords
Base Flow
Water Resources
Konya Closed Basin
Flow Continuity Curves
Interpolation Maps

Abstract
Management and protection of water resources, planning and implementation of water budget are of great importance for the development of countries. Calculate on of the water levels and flow values in the rivers is of great importance in the management and planning of water resources. The aim of this study is to investigate the base flow reserve of the Konya Closed Basin by using the stream flow values and to increase the use of water resources to a satisfactory level. Base flow values were obtained based on the stream flow data of the stations in the Konya Closed Basin in 1987 and 2015. Interpolation maps were produced using base flow values and IDW method. According to the created interpolation maps, the base flows of the Konya Closed Basin changed between 0.087-46.54 m^3/s for 1987 and between 0.180-70.14 m^3/s for 2015. Despite some stations shutting down in a period of about 30 years, the base flow values are variable levels in this region.

Introduction

Base flows play an important role in the protection and appropriate management of water resources. In this study, it is aimed to increase the water resources of Konya Closed Basin (KCB) to a more prosperous level thanks to the knowledge of the base flow.

When the studies in the literature are examined, the base flow estimations are obtained with the help of ARMA models in rivers [1]. Base flows were also estimated by variable slope methods [2]. Graphical methods and withdrawal analyze are among the estimation methods [3-4].

In this study, the base flow values of the KCB were obtained for 1987 and 2015 by using the flow continuity curve (existing 95% of the time) and IDW (Inverse Distance Weight) methods.

Material and Method

In the study, stream flow data of 1987 and 2015 of KCB were used. The flow data were obtained from the official website of the General Directorate of State Hydraulic Works [5]. The KCB is the largest closed basin of Turkey, covering an average of 62.000 km^2 in the inner part of the Anatolian peninsula and including the provinces of Konya, Karaman, Niğde and Aksaray [6]. KCB is located 36°51' and 39°29' north latitude, and 31°36' and 34°52' east longitude [7]. The studied study area is shown in Figure 1.

Method

Flow continuity curve (flow-rate -confidence interval relationship) and IDW methods were used in the study.

Figure 1. Study area [8]

Flow Continuity Curve

Flow-continuity curves were used to calculate the base flow in this investigation. A flow rate values curve is a graph that depicts the amount of flow in a given time unit changing over time [9]. The flow-confidence relationship is used to create the flow-continuity curve of monthly average flows [10-11].

IDW (Reverse Distance Weight)

The Inverse Distance Weighting (IDW) is an interpolation method used to create data from the data that cannot be sampled by the exemplary points, wherein the creation of these data depends on the interposition distance and formula applied by considering relations with various points [12].

$$f(x, y) = \sum_{i=1}^{n} w_i f_i \tag{1}$$

$$w_i = \frac{h_i^{-p}}{\sum_{j=1}^{n} h_i^{-p}} \tag{2}$$

In Equations 1 and 2;
p; is taken as a power parameter and denoted by exponent,
h_i; represents the spatial distance between the sample points and the interpolation points,
w_i; represents the weights and the sum of their values must Equation 1,
f_i; represents the known height value [13-14].

Application

Knowing the base flow values has an important place in controlling water resources. From the base flow data obtained, the base flow reserves of the KCB can be investigated. In this study, the stream flow values of the KCB in 1987 and 2015 were examined and the base flow values approximately 30-year period were found. Flow data of 51 stations in the KCB in 1987 and 2015 were taken into account. Interpolation maps were created with the IDW method in accordance with the base flow values of these stations.

The interpolation map for 1987 is shown in Figure 2 and the interpolation map for 2015 is shown in Figure 3.
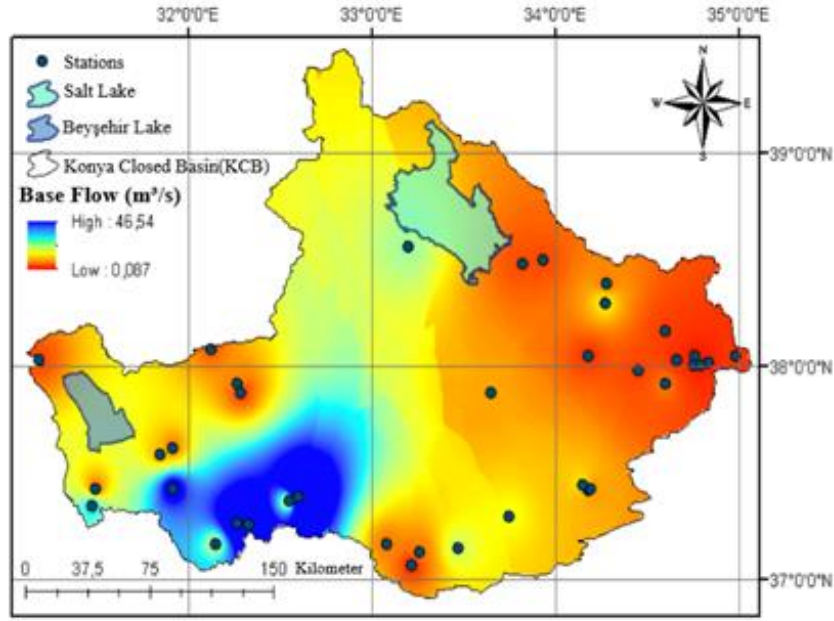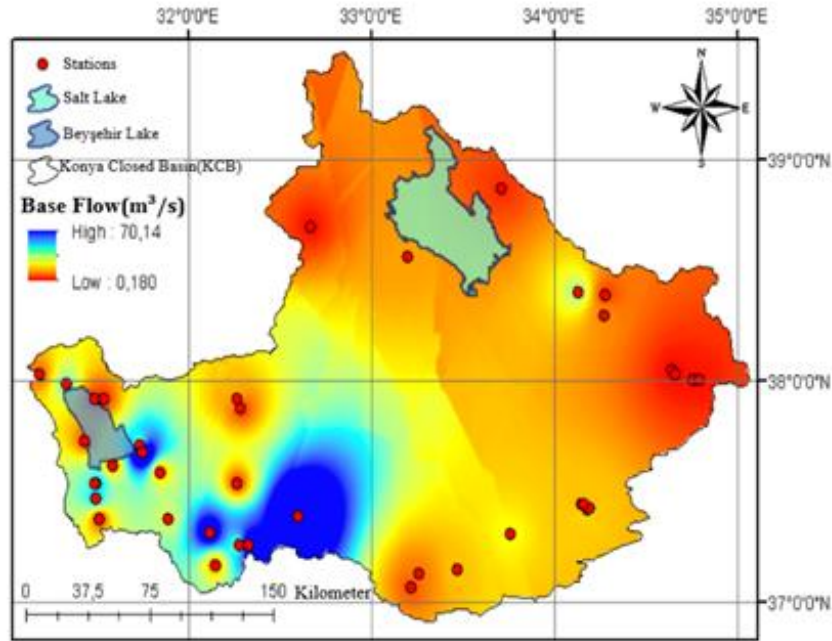
Figure 2. Interpolation map for 1987

Figure 3. Interpolation map for 2015

In Figure 2 and Figure 3, the base flows of the KCB vary between 0.087-46.54 m³/s for 1987 and between 0.180-70.14 m³/s for 2015.

Results

In this study, base flow values were obtained by using the average stream flow rates values (m³/s) of 51 stations in the KCB for the years 1987 and 2015 and by using the flow continuity curve method. The variation of the base flows obtained for these two years was examined. Using the IDW method, interpolation maps of the years 1987 and 2015 were created from these values. When the maps are examined, while the base flow values in the South-West section of the study area were the highest, the base flow values in the East region were the lowest, according to the station base flow values in 1987. In 2015, high base flow is observed in the South-West region of the study area, as in 1987. It is seen that the base flow values are low in the North and North-West regions of the study area.

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While some of the stations used in this study were available in both 1987 and 2015, some of the other stations were only available in 1987 and some were only available in 2015. For this reason, all existing and accessible stations were used to represent the basin in the study. In the next study, the base flows for all stations will be obtained and compared using different interpolation methods.

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Energy efficiency in ports with a green port perspective: A conceptual framework

Elif Demir*1 , Tanzer Satır 1 , Neslihan Doğan-Sağlamtimur 2 , Ufuk Yakup Çalışkan 3

1İstanbul Technical University, Department of Maritime Transportation and Management Engineering, Türkiye, demir18@itu.edu.tr, tsatir@itu.edu.tr
2Nigde Omer Halisdemir University, Department of Environmental Engineering, Türkiye, nds@ohu.edu.tr
3Bartın University, Division of Transportation Services, Türkiye, ucaliskan@bartin.edu.tr

Keywords
Green port
Energy efficiency
Sustainable energy
Maritime transportation

Abstract
The importance of ports has continued to increase day by day, because trade can be done faster and efficiently. The fact that the ports are located at such an important point and the increasing transaction volume, and the development of environmentally sensitive systems bring along an inevitable process of change. At this point, with increasing awareness, the concept of green port has been developed. Green port aims (i) to minimize the negative effects on the environment and ecosystem while the ports continue their activities, (ii) to use energy resources efficiently and effectively while meeting energy needs and having the least impact on the ecosystem. The equipment that maintains port operations, port equipment and ships berthing in the port are energy-consuming elements. The aim of this study is to analyze the energy efficiency in ports with a green port perspective by using the literature review method. In this context, the energy efficiency practices of two of the leading ports in Europe were examined. As a result, because of the qualitative analysis, it has been determined that the studies of the ports for energy efficiency have reached an important point and an approach compatible with the green port principles has been exhibited.

Introduction

With the consequences of climate change and increasing awareness, the concepts of decarbonization and energy efficiency, which have become more popular in recent years, make green transformation a necessity in ports. To express the concept of "green port" in the literature, green transformation in ports is addressed. It is a policy to include environmentally friendly methods in the port's activities and operations, thus increasing efficiency and minimizing the negative effects on the environment and ecosystem [1]. The term green harbor was first announced at the United Nations (UN) climate conference in 2009, in other words, at the Copenhagen summit (COP15). At the conference, the importance and necessity of reducing emissions originating from ports and ships was emphasized [2]. In this context, it is seen that energy efficiency and green port principles and policies in ports are directly related. In short, it is possible to say what are the criteria that a port with a green port perspective should consider, as waste management, sustainability, water, air and energy management and sustainable port activities [3]. In the maritime sector, it is stated that the emission generation amount of ports is approximately 3%. Although it can be considered low for the port sector in maritime, it is seen that it is significant when the greenhouse gas (GHG) emission rates are taken into account [4]. If we need to list the motivation and importance of decarbonization studies in ports as following [5]: (i) Compliance with international regulations of International Maritime Organization (IMO) and decarbonisation regulations, (ii) ensuring green port practices and contributing to sustainability in ports, (iii) within the scope of harmonization with the UN sustainable development goals, target 13, climate change mitigation and target 7, implementation of renewable energy use targets, (iv) contributing to the expansion of the corporate social responsibility vision of the ports and achieving cooperation and harmony

with the stakeholders, (v) reducing greenhouse gas emissions from port operations, (vi) contribution to the corporate image of ports with the green port concept and reduction in energy costs.

Decarbonization and Energy Efficiency Applications in Ports

Alternative fuels and their use

It is possible to obtain the energy needs of the equipment used to maintain the activities in the ports from different fuel sources such as liquefied natural gas (LNG), hydrogen, biomethanol and biofuel obtained by recycling wastes and biomass, which are expressed as alternative energy sources. Considering the use of LNG in ports, it is used in port internal operations and activities as well as being used to power the ships in the port [6]. With the use of LNG, a significant decrease in NO_x and SO_2 emissions, and a 25% reduction in CO_2 emissions can be achieved [7]. Hydrogen is not a natural energy source, and other energy sources are needed to ensure its production. At this point, it is important to reach hydrogen energy by choosing and using renewable energy sources [8]. If it is produced through renewable energy sources, it is possible to reduce the amount of greenhouse gas emissions by preferring hydrogen energy in ports. Although the use of biomass and biofuels in ports is very new, special equipment and hardware are required for generation and use these kinds of energy. High investment costs and requiring complex production tools are seen as another difficulty [6].

Renewable energy resources and their use in ports

Renewable energy sources in ports are the general expression of preferred energy production sources due to their positive contribution for reducing greenhouse gas emissions. It is possible to express renewable energy sources as wind, solar, wave and geothermal energy [9]. Solar energy is expressed as the radiant energy emerging from fusion process in the solar core. It is a clean and renewable energy source that can meet the amount of energy needed by the world with approximately $3.9x1026$ W of power emitted by the sun. Photovoltaic (PV) solar modules have technology used to convert solar energy to electrical energy [10]. Solar energy is proposed as an energy system used in ports to reduce carbon emissions [11]. Radiation originating from the sun heats the earth at different rates. Due to warming difference, changes occur in the temperature, humidity balance and pressure of the air. All these changes cause air movements and these air movements create winds. Wind energy is the name given to the use of these changes in air movements as energy. Approximately 2% of the solar energy reaching the earth's surface is converted into wind energy. The high initial investment cost for using wind energy as an energy source and the low-capacity factor and the variability of energy production can be expressed as disadvantages. Despite to all these disadvantages, the advantages of wind energy are [12]: (i) Being an environmentally friendly and renewable energy source, (ii) no possibility of extinction or increase in price over time, (iii) low maintenance costs of the system, (iv) its technology is relatively simple to implement and operate, (v) the establishment of the facility in the short term. The oceans, which cover 71% of the world, provide opportunities for wave energy. Wave energy is recognized as one of the most promising methods among renewable energy sources. It is estimated that wave energy produces a maximum of 2000 TWh and at least 1 TWh annually [13]. Geothermal resources have thermal energy stored in trapped steam and water from the Earth's interior [14]. In geothermal energy, the power of heat is used to generate electricity. Antwerp and Hamburg Ports, which are European Union (EU) ports, generate energy from geothermal sources located close to the surface [4]. As GHG emissions cause concerns on a global scale, the interest in renewable energy sources for energy production and transportation sectors is increasing day by day. Promoting and using renewable energy are key factors in tackling climate change [15].

Alternative power systems used in ports

Although the sources of pollution in the ports are very diverse, the ships in the port are responsible for a large part of the air emissions of the ports. The new system that can be used instead of the fuel generators used by the ships for their energy needs during berthing and waiting at the port is expressed as "cold ironing". It is expressed as the transportation of energy to the ships through the systems installed in the port, instead of meeting the energy needs from the auxiliary engines of the ships waiting at the pier [16]. Cold ironing can be expressed in different ways as land power supply, shore-to-ship power supply and shore-to-shore power supply. Currently, it is seen as the most effective way to reduce emissions from ships waiting in ports. The cold ironing power system basically consists of three parts. These are port power system, port-ship power system and ship power system [17].

It is possible to say that the shore power supply system allows feasibility to be made in the short term and all the necessary components have been available for many years. The biggest obstacle to the usability of the system is incompatibility between port and ship connection points. While it does not pose a problem for ships that follow the same route all the time, it is not suitable for ships operating between ports on different routes. This lack of standardization has been overcome with the standards developed by Institute of Electrical and Electronics

Engineers (IEEE). In addition, the low cost of adapting the system to newly built ships can be considered as an advantage. However, the high initial investment cost of the system in ports is seen as a disadvantage [18].

Use of Renewable Energy in European Ports

Within the scope of the study, two ports operating in Europe were examined. These ports are the Port of Rotterdam located in the Netherlands and the Port of Antwerp operating in Belgium.

Port of Rotterdam

The Port of Rotterdam is the largest port in Europe with a size of 105 square kilometers and 40 kilometers [19]. Due to its hinterland network connected to the Central European region, the Port of Rotterdam hosting approximately 30 thousand ships/year is the busiest port in Europe [20]. It has been observed that the use of wind energy is used quite actively. The Port of Rotterdam can generate wind energy with a power capacity of approximately 200 MW. Increasing the capacity by 150 MW is among the plans of this port. Another renewable energy usage area of the port is biomass. It is planned to provide hydrogen energy with biofuels, which is an important step in reducing emissions. The most important renewable energy work of the port is the generation of hydrogen energy, which is expressed as "green hydrogen", from renewable environmentally friendly energy sources. With this vision, the port continues its projects to realize its 2025 targets. It has also been seen that the port has been very successful in energy production using solar energy [21].

Port of Antwerp

The Port of Antwerp is the second largest port in Europe. It is seen that emissions will be reduced until 2050 and aimed to continue its activities as a more sustainable port. Energy transition studies with a greener port perspective gain importance and actions are taken in this direction. By using solar energy as an energy source in the port, it produces heat, which is expressed as green heat, and uses it for heat processes. Another renewable energy source used by this port is biomass energy. In addition, more than 200 MW of energy can be produced annually with wind energy at the port. Port continues its new projects with its partnerships. One of the most important of these, the 'power-to-methanol' project, aims to reduce its CO_2 emissions by at least 8000 tons. In addition to all these works, the port's work on generating energy with hydrogen continues [22].

Conclusion

With climate change and increasing awareness, it is seen that the use of renewable energy in ports and the transition to alternative fuels are started to be realized by the ports. It is found that the ports are given importance in the transition from carbon-intensive sources to renewable sources, because of their targets of being more sustainable and efficiency in terms of cost. As seen in the ports of Rotterdam and Antwerp, which are the two ports given as examples in this study, it was seen that the use of solar energy is heavily utilized in the transition to renewable resources in the ports. In addition, it is seen that investments are made to meet the energy needs by using wind energy. The replacement of port equipment with electrical energy-operated equipment provides a significant reduction in emissions originating from the port. In this context, all steps taken by ports to reduce fossil fuel emissions are considered important.

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Software used to extract discontinuity sets from point clouds

Aydın Alptekin[*1] , **Murat Yakar**[2]

[1]Mersin University, Geological Engineering Department, Türkiye, aydinalptekin@mersin.edu.tr
[2]Mersin University, Geomatics Engineering Department, Türkiye, myakar@mersin.edu.tr

Abstract
Slope failure has always been a problem for geotechnical engineers. Rockfall is a widely seen natural disaster in mountainous terrain. Rock slope stability is mainly controlled by fractures. Accurate modelling the rockfall event is crucial to lessen the damage came from the rocks. Traditional compass method is time-consuming and dangerous at steep slopes. Remote sensing techniques such as photogrammetry and laser scanner are new techniques to obtain geotechnical data. Geospatial information of the object can be obtained easily. This data contains 3D coordinates with color and intensity information. In this study, we have revealed the software that can automatically detect and extract geotechnical data from point clouds. Discontinuities in the rock mass can be easily obtained with high accuracy and precision with these software packages.

Introduction

Mass movements contribute to reshape the geomorphology of the Earth surface. They damage the forest area, farm area, transportation corridors, houses and people life. In order to prevent harmful effects of mass movements, engineering geologists need to model the terrain with high accuracy and resolution.

Steep slopes are prone to failure with a small change on forces acting on them. Therefore, these areas need to be analyzed carefully. Detached rock fragments may fall extremely fast. Potential energy will transform into kinetic energy during falling.

Traditional geomechanical surveys are often carried out on limited sectors of the rock mass. Therefore, they do not provide enough data for a complete reconstruction of the rock mass [1]. Most of the steep slopes are inaccessible. Traditional geological surveys are not possible in steep terrain or heavily fractured rock masses [2]. Recent advances in remote sensing technologies allow automatically detect the discontinuity sets (DS) and minimize survey time in dangerous environments.

In order to examine the rockfall event, factors, models, software and DEMs are critical in rockfall modelling as they are related with each other [3]. Topographic maps were popular sources from time immemorial to produce Digital Elevation Maps (DEM). However, they have low accuracy and are not actual. Nowadays, remote sensing techniques are used to generate DEM.

Unmanned aerial vehicle (UAV) and Light Detection and Ranging (LiDAR) are very popular remote sensing equipment that have been used in engineering projects since last decade. Data obtained from UAV and LiDAR are 3D coordinates that include intensity and color information of the object. Small details can be monitored in 3D model. Direct access to the rocks does not need in remote sensing techniques. Rock mass characterization can be performed with high-precision.

International Society for Rock Mechanics and Rock Engineering (ISRM) selected the following ten parameters orientation, spacing, persistence, roughness, wall strength, aperture, filling, seepage, number of sets, and block size [1].

This study focused on the collection of scientific papers related with discontinuity set extractor programs. DS is crucial in rock engineering applications [4].

Discontinuity sets

In rock mass classification, two popular methods, Q and RMR classifications, have been used. Discontinuity set properties are important input parameters for these classification systems. Intact rock is rarely seen, most of the rocks contain one or more discontinuity.

Discontinuities are used in rock engineering projects such as rockfall studies, mining and tunneling. Rockfall event is prevalent on rocky terrain and it threatens people life and structures. Discontinuities play a significant role in strength, permeability and stability of rock masses. Therefore, precise measurement of discontinuities (dip and dip direction) is vital in rock engineering applications [4].

In recent years, collection geotechnical data on-site has evolved to collect data using remote sensing [5]. Remote sensing provides several possibilities for landform analyses. Structural and geological features can be extracted from 3D point clouds. High density 3D point cloud export more detailed outcomes for capturing morphology and extracting discontinuity sets.

Kinematic analysis using dip and dip direction information of discontinuities, which were obtained from 3D point clouds, may be performed more beneficial than classical compass methods.

Software packages

Today, there are many software packages that can extract dip and dip direction properties from point clouds (Table 1). These software packages can easily detect DS in rocks using three-dimensional (3D) point clouds obtained from UAV and LiDAR.

Using dip and dip direction, rockfall type (wedge, planar and toppling) can be determined. Therefore, the area that can be affected from rockfall disaster will be identified and the precautions can be taken.

Table 1. Software used to extract discontinuity sets

Software	Reference
Matterocking	[6]
DSE	[7]
ShapeMetrix 3D (3GSM GmbH	[8]
Sirovision (Datamine and CSIRO)	[9]
Split-FX	[10]
Coltop-3D	[11]
Plane Detect	[12]
RockScan	[13]
3DM Analyst	[14]
CloudCompare	[15]
DiAna	[1]

Conclusion

Discontinuities such as joints, bedding planes and fractures play vital role in rock engineering. Geo-structural analysis of rock mass discontinuities is vital to propose a solution. Discontinuity orientation determines the falling type and the consequences of rockfall. Traditional methods require direct access to the rockmass. Remote sensing technology solves the problem of reaching inaccessible areas. Classical compass method requires skilled geoscientist and it has error-prone. The automatic discontinuity extractor software eliminates this need. High density of point clouds can enable the reconstruction of the rocky surface. Characterization of rockfall dynamics can be easily performed via using point clouds.

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