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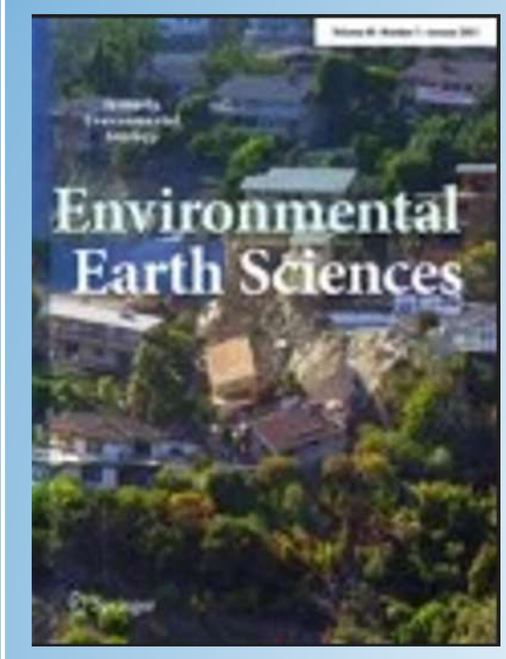

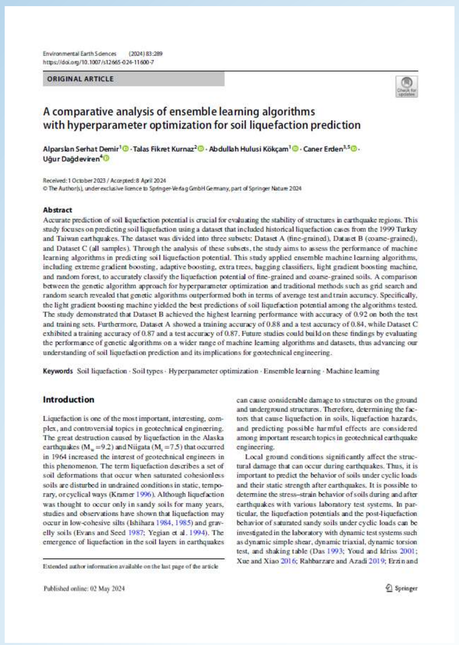
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ORIGINAL ARTICLE

A comparative analysis of ensemble learning algorithms with hyperparameter optimization for soil liquefaction prediction

Alparslan Serhat Demir[1] · Talas Fikret Kurnaz[2] · Abdullah Hulusi Kökçam[1] · Caner Erden[3,4] · Uğur Dağdeviren[4]

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Abstract
Accurate prediction of soil liquefaction potential is crucial for evaluating the stability of structures in earthquake regions. This study focuses on predicting soil liquefaction using a dataset that included historical liquefaction cases from the 1999 Turkey and Taiwan earthquakes. The dataset was divided into three subsets: Dataset A (fine-grained), Dataset B (coarse-grained), and Dataset C (all samples). Through the analysis of these subsets, the study aims to assess the performance of machine learning algorithms in predicting soil liquefaction potential. This study applied ensemble machine learning algorithms, including extreme gradient boosting, adaptive boosting, extra trees, bagging classifiers, light gradient boosting machine, and random forest, to accurately classify the liquefaction potential of fine-grained and coarse-grained soils. A comparison between the genetic algorithm approach for hyperparameter optimization and traditional methods such as grid search and random search revealed that genetic algorithms outperformed both in terms of average test and train accuracy. Specifically, the light gradient boosting machine yielded the best predictions of soil liquefaction potential among the algorithms tested. The study demonstrated that Dataset B achieved the highest learning performance with accuracy of 0.92 on both the test and training sets. Furthermore, Dataset A showed a training accuracy of 0.88 and a test accuracy of 0.84, while Dataset C exhibited a training accuracy of 0.87 and a test accuracy of 0.87. Future studies could build on these findings by evaluating the performance of genetic algorithms on a wider range of machine learning algorithms and datasets, thus advancing our understanding of soil liquefaction prediction and its implications for geotechnical engineering.

Keywords Soil liquefaction · Soil types · Hyperparameter optimization · Ensemble learning · Machine learning

Introduction

Liquefaction is one of the most important, interesting, complex, and controversial topics in geotechnical engineering. The great destruction caused by liquefaction in the Alaska earthquakes (M_w =9.2) and Niigata (M_w =7.5) that occurred in 1964 increased the interest of geotechnical engineers in this phenomenon. The term liquefaction describes a set of soil deformations that occur when saturated cohesionless soils are disturbed in undrained conditions in static, temporary, or cyclical ways (Kramer 1996). Although liquefaction was thought to occur only in sandy soils for many years, studies and observations have shown that liquefaction may occur in low-cohesive silts (Ishihara 1984, 1985) and gravelly soils (Evans and Seed 1987; Yegian et al. 1994). The emergence of liquefaction in the soil layers in earthquakes can cause considerable damage to structures on the ground and underground structures. Therefore, determining the factors that cause liquefaction in soils, liquefaction hazards, and predicting possible harmful effects are considered among important research topics in geotechnical earthquake engineering.

Local ground conditions significantly affect the structural damage that can occur during earthquakes. Thus, it is important to predict the behavior of soils under cyclic loads and their static strength after earthquakes. It is possible to determine the stress–strain behavior of soils during and after earthquakes with various laboratory test systems. In particular, the liquefaction potentials and the post-liquefaction behavior of saturated sandy soils under cyclic loads can be investigated in the laboratory with dynamic test systems such as dynamic simple shear, dynamic triaxial, dynamic torsion test, and shaking table (Das 1993; Youd and Idriss 2001; Xue and Xiao 2016; Rahbarzare and Azadi 2019; Erzin and

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ORIGINAL PAPER

Comparison of machine learning algorithms for slope stability prediction using an automated machine learning approach

Talas Fikret Kurnaz[1] · Caner Erden[2,3] · Uğur Dağdeviren[1] · Alparslan Serhat Demir[4] · Abdullah Hulusi Kökçam[4]

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Abstract
Evaluation of slope failures, which cause significant loss of life and property comparable to natural disasters such as earthquakes, floods and hurricanes, is one of the main areas of interest in geotechnical engineering. Although traditional and modern methods have been developed for slope stability analysis, the importance given to computer-based approaches has increased in recent years. In this study, we investigated the effectiveness of advanced machine learning (ML) algorithms in classification-based slope stability assessment. In this context, examining the impact of input parameters, such as slope height, slope angle, unit volume weight, internal friction angle of the soil, cohesion of the slope material, and water pressure ratio on the slope stability potential and a comparative analysis was performed on the ML algorithms. On the other hand, automated machine learning (AutoML) approaches were used to make rapid and comprehensive comparisons of ensemble, boosting, bagging and traditional ML algorithms to simplifying application development. The weighted ensemble learning algorithm provided by the AutoGluon package outperformed other algorithms in both testing and training accuracy, achieving an impressive rate of 97.5%, according to the obtained results. All algorithms included in the study performed well, with NeuralNetTorch and CatBoost securing the second position with an accuracy rate of 95%. Furthermore, when evaluating the importance of features using the best algorithm, it can be seen that unit volume weight and internal friction angle of soil had the highest weights, 0.225 and 0.200, respectively, indicating their importance in classifying slope stability. In conclusion, our research significantly advanced slope stability assessment, achieving one of the highest accuracy of 0.975 among various classification-based studies.

Keywords Automated machine learning · AutoML · Slope stability · AutoGluon · Classification · Ensemble learning

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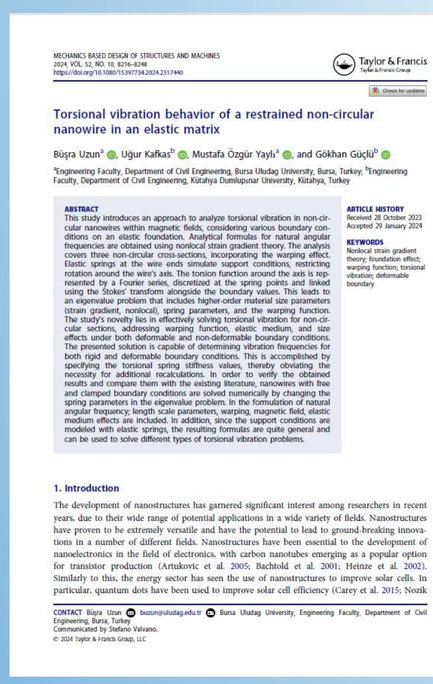
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Torsional vibration behavior of a restrained non-circular nanowire in an elastic matrix

Büşra Uzun[a], Uğur Kafkas[b], Mustafa Özgür Yaylı[a], and Gökhan Güçlü[b]

[a]Engineering Faculty, Department of Civil Engineering, Bursa Uludag University, Bursa, Turkey; [b]Engineering Faculty, Department of Civil Engineering, Kütahya Dumlupınar University, Kütahya, Turkey

ABSTRACT
This study introduces an approach to analyze torsional vibration in non-circular nanowires within magnetic fields, considering various boundary conditions on an elastic foundation. Analytical formulas for natural angular frequencies are obtained using nonlocal strain gradient theory. The analysis covers three non-circular cross-sections, incorporating the warping effect. Elastic springs at the wire ends simulate support conditions, restricting rotation around the wire's axis. The torsion function around the axis is represented by a Fourier series, discretized at the spring points and linked using the Stokes' transform alongside the boundary values. This leads to an eigenvalue problem that includes higher-order material size parameters (strain gradient, nonlocal), spring parameters, and the warping function. The study's novelty lies in effectively solving torsional vibration for non-circular sections, addressing warping function, elastic medium, and size effects under both deformable and non-deformable boundary conditions. The presented solution is capable of determining vibration frequencies for both rigid and deformable boundary conditions. This is accomplished by specifying the torsional spring stiffness values, thereby obviating the necessity for additional recalculations. In order to verify the obtained results and compare them with the existing literature, nanowires with free and clamped boundary conditions are solved numerically by changing the spring parameters in the eigenvalue problem. In the formulation of natural angular frequency; length scale parameters, warping, magnetic field, elastic medium effects are included. In addition, since the support conditions are modeled with elastic springs, the resulting formulas are quite general and can be used to solve different types of torsional vibration problems.

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KEYWORDS
Nonlocal strain gradient theory; foundation effect; warping function; torsional vibration; deformable boundary

1. Introduction

The development of nanostructures has garnered significant interest among researchers in recent years, due to their wide range of potential applications in a wide variety of fields. Nanostructures have proven to be extremely versatile and have the potential to lead to ground-breaking innovations in a number of different fields. Nanostructures have been essential to the development of nanoelectronics in the field of electronics, with carbon nanotubes emerging as a popular option for transistor production (Artukovic et al. 2005; Bachtold et al. 2001; Heinze et al. 2002). Similarly to this, the energy sector has seen the use of nanostructures to improve solar cells. In particular, quantum dots have been used to improve solar cell efficiency (Carey et al. 2015; Nozik

CONTACT Büşra Uzun buzun@uludag.edu.tr Bursa Uludag University, Engineering Faculty, Department of Civil Engineering, Bursa, Turkey
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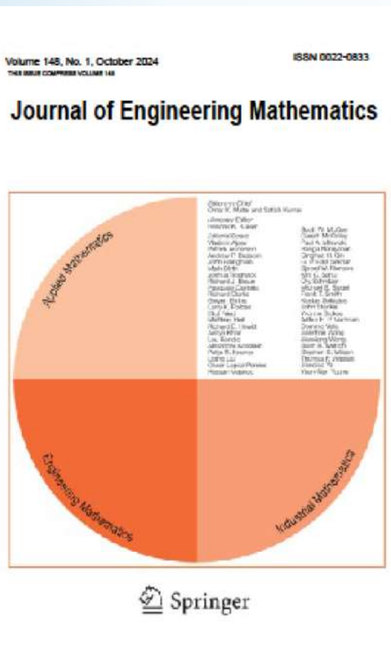
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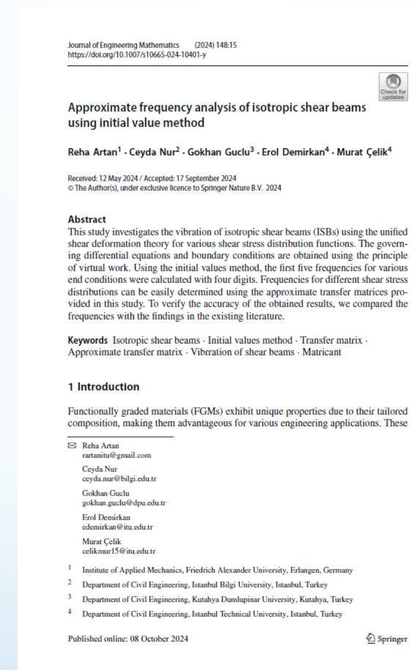
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Approximate frequency analysis of isotropic shear beams using initial value method

Reha Artan[1] · Ceyda Nur[2] · Gokhan Guclu[3] · Erol Demirkan[4] · Murat Çelik[4]

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Abstract
This study investigates the vibration of isotropic shear beams (ISBs) using the unified shear deformation theory for various shear stress distribution functions. The governing differential equations and boundary conditions are obtained using the principle of virtual work. Using the initial values method, the first five frequencies for various end conditions were calculated with four digits. Frequencies for different shear stress distributions can be easily determined using the approximate transfer matrices provided in this study. To verify the accuracy of the obtained results, we compared the frequencies with the findings in the existing literature.

Keywords Isotropic shear beams · Initial values method · Transfer matrix · Approximate transfer matrix · Vibration of shear beams · Matricant

1 Introduction

Functionally graded materials (FGMs) exhibit unique properties due to their tailored composition, making them advantageous for various engineering applications. These

Reha Artan
rartanitu@gmail.com
Ceyda Nur
ceyda.nur@bilgi.edu.tr
Gokhan Guclu
gokhan.guclu@dpu.edu.tr
Erol Demirkan
edemirkan@itu.edu.tr
Murat Çelik
celikmur15@itu.edu.tr
[1] Institute of Applied Mechanics, Friedrich Alexander University, Erlangen, Germany
[2] Department of Civil Engineering, Istanbul Bilgi University, Istanbul, Turkey
[3] Department of Civil Engineering, Kutahya Dumlupinar University, Kutahya, Turkey
[4] Department of Civil Engineering, Istanbul Technical University, Istanbul, Turkey

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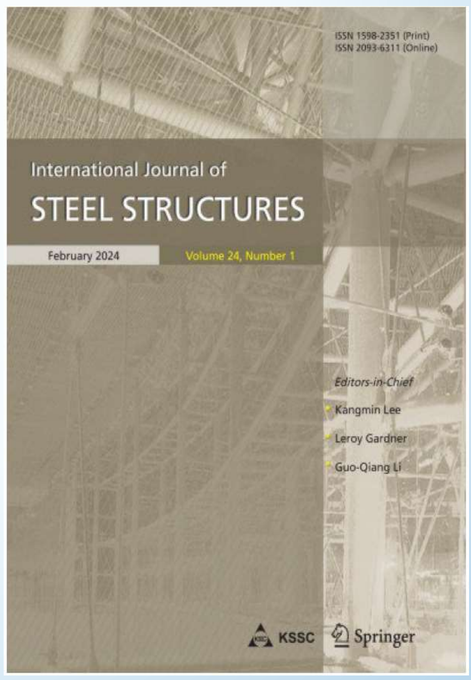

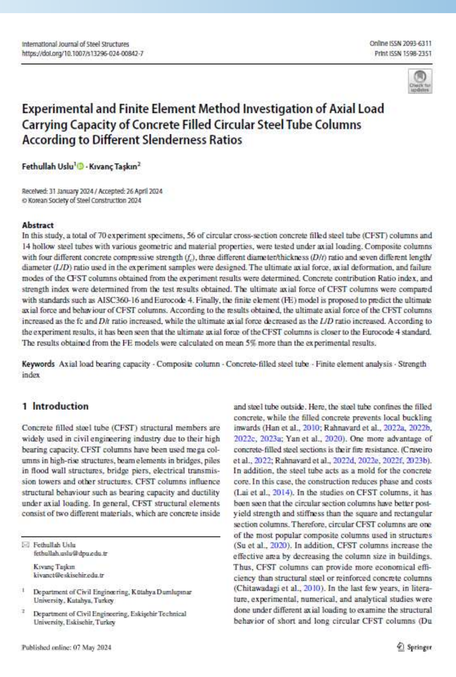
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Experimental and Finite Element Method Investigation of Axial Load Carrying Capacity of Concrete Filled Circular Steel Tube Columns According to Different Slenderness Ratios

Fethullah Uslu[1] · Kıvanç Taşkın[2]

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Abstract
In this study, a total of 70 experiment specimens, 56 of circular cross-section concrete filled steel tube (CFST) columns and 14 hollow steel tubes with various geometric and material properties, were tested under axial loading. Composite columns with four different concrete compressive strength (f_c), three different diameter/thickness (D/t) ratio and seven different length/diameter (L/D) ratio used in the experiment samples were designed. The ultimate axial force, axial deformation, and failure modes of the CFST columns obtained from the experiment results were determined. Concrete contribution Ratio index, and strength index were determined from the test results obtained. The ultimate axial force of CFST columns were compared with standards such as AISC360-16 and Eurocode 4. Finally, the finite element (FE) model is proposed to predict the ultimate axial force and behaviour of CFST columns. According to the results obtained, the ultimate axial force of the CFST columns increased as the fc and D/t ratio increased, while the ultimate axial force decreased as the L/D ratio increased. According to the experiment results, it has been seen that the ultimate axial force of the CFST columns is closer to the Eurocode 4 standard. The results obtained from the FE models were calculated on mean 5% more than the experimental results.

Keywords Axial load bearing capacity · Composite column · Concrete-filled steel tube · Finite element analysis · Strength index

1 Introduction

Concrete filled steel tube (CFST) structural members are widely used in civil engineering industry due to their high bearing capacity. CFST columns have been used mega columns in high-rise structures, beam elements in bridges, piles in flood wall structures, bridge piers, electrical transmission towers and other structures. CFST columns influence structural behaviour such as bearing capacity and ductility under axial loading. In general, CFST structural elements consist of two different materials, which are concrete inside and steel tube outside. Here, the steel tube confines the filled concrete, while the filled concrete prevents local buckling inwards (Han et al., 2010; Rahmavard et al., 2022a, 2022b, 2022c, 2023a; Yan et al., 2020). One more advantage of concrete-filled steel sections is their fire resistance. (Craveiro et al., 2022; Rahmavard et al., 2022d, 2022e, 2022f, 2023b). In addition, the steel tube acts as a mold for the concrete core. In this case, the construction reduces phase and costs (Lai et al., 2014). In the studies on CFST columns, it has been seen that the circular section columns have better post-yield strength and stiffness than the square and rectangular section columns. Therefore, circular CFST columns are one of the most popular composite columns used in structures (Su et al., 2020). In addition, CFST columns increase the effective area by decreasing the column size in buildings. Thus, CFST columns can provide more economical efficiency than structural steel or reinforced concrete columns (Chitawadagi et al., 2010). In the last few years, in literature, experimental, numerical, and analytical studies were done under different axial loading to examine the structural behavior of short and long circular CFST columns (Du

Fethullah Uslu
fethullah.uslu@dpu.edu.tr
Kıvanç Taşkın
kivanctsk@eskisehir.edu.tr
[1] Department of Civil Engineering, Kütahya Dumlupınar University, Kutahya, Turkey
[2] Department of Civil Engineering, Eskişehir Technical University, Eskisehir, Turkey

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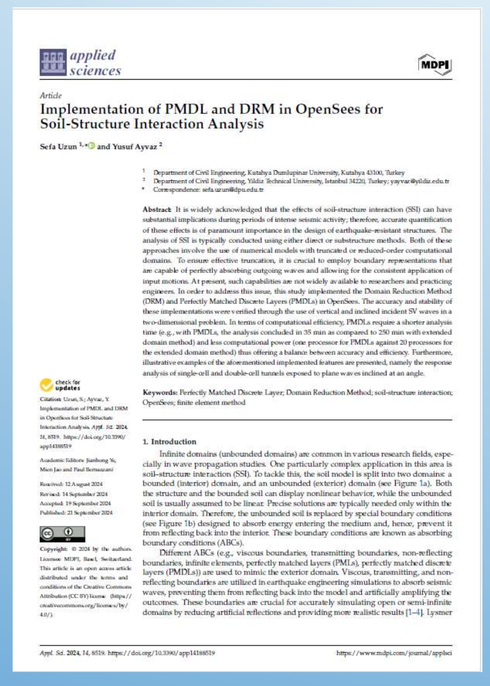
applied sciences


applied sciences

Article

Implementation of PMDL and DRM in OpenSees for Soil-Structure Interaction Analysis

Sefa Uzun [1,*] and Yusuf Ayvaz [2]
[1] Department of Civil Engineering, Kutahya Dumlupinar University, Kutahya 43100, Turkey
[2] Department of Civil Engineering, Yildiz Technical University, Istanbul 34220, Turkey; yayvaz@yildiz.edu.tr
* Correspondence: sefa.uzun@dpu.edu.tr

Abstract It is widely acknowledged that the effects of soil-structure interaction (SSI) can have substantial implications during periods of intense seismic activity; therefore, accurate quantification of these effects is of paramount importance in the design of earthquake-resistant structures. The analysis of SSI is typically conducted using either direct or substructure methods. Both of these approaches involve the use of numerical models with truncated or reduced-order computational domains. To ensure effective truncation, it is crucial to employ boundary representations that are capable of perfectly absorbing outgoing waves and allowing for the consistent application of input motions. At present, such capabilities are not widely available to researchers and practicing engineers. In order to address this issue, this study implemented the Domain Reduction Method (DRM) and Perfectly Matched Discrete Layers (PMDLs) in OpenSees. The accuracy and stability of these implementations were verified through the use of vertical and inclined incident SV waves in a two-dimensional problem. In terms of computational efficiency, PMDLs require a shorter analysis time (e.g., with PMDLs, the analysis concluded in 35 min as compared to 250 min with extended domain method) and less computational power (one processor for PMDLs against 20 processors for the extended domain method) thus offering a balance between accuracy and efficiency. Furthermore, illustrative examples of the aforementioned implemented features are presented, namely the response analysis of single-cell and double-cell tunnels exposed to plane waves inclined at an angle.

Keywords: Perfectly Matched Discrete Layer; Domain Reduction Method; soil-structure interaction; OpenSees; finite element method

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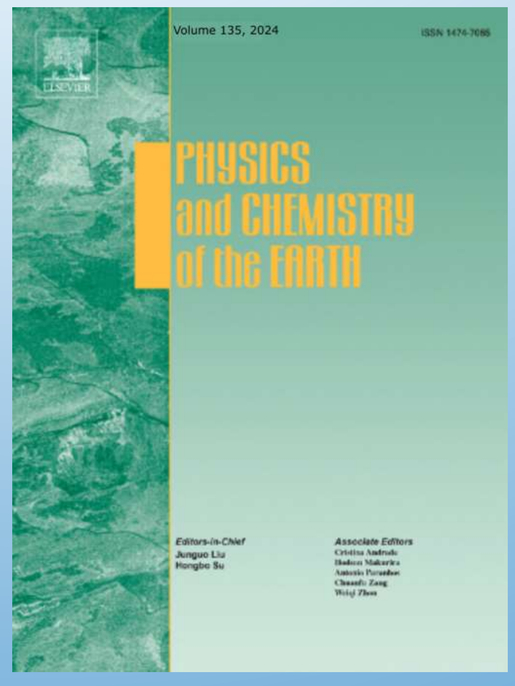
1. Introduction

Infinite domains (unbounded domains) are common in various research fields, especially in wave propagation studies. One particularly complex application in this area is soil–structure interaction (SSI). To tackle this, the soil model is split into two domains: a bounded (interior) domain, and an unbounded (exterior) domain (see Figure 1a). Both the structure and the bounded soil can display nonlinear behavior, while the unbounded soil is usually assumed to be linear. Precise solutions are typically needed only within the interior domain. Therefore, the unbounded soil is replaced by special boundary conditions (see Figure 1b) designed to absorb energy entering the medium and, hence, prevent it from reflecting back into the interior. These boundary conditions are known as absorbing boundary conditions (ABCs).

Different ABCs (e.g., viscous boundaries, transmitting boundaries, non-reflecting boundaries, infinite elements, perfectly matched layers (PMLs), perfectly matched discrete layers (PMDLs)) are used to mimic the exterior domain. Viscous, transmitting, and non-reflecting boundaries are utilized in earthquake engineering simulations to absorb seismic waves, preventing them from reflecting back into the model and artificially amplifying the outcomes. These boundaries are crucial for accurately simulating open or semi-infinite domains by reducing artificial reflections and providing more realistic results [1–4]. Lysmer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A new approach for identification of dispersivity class of soils by combining physical and chemical tests

Sadettin Topçu [a,*], Evren Seyrek [b]
[a] Kütahya Dumlupınar University, Kutahya Voc. School of Technical Sciences Evliya Çelebi Campus, Kütahya, Turkey
[b] Kütahya Dumlupınar University, Department of Civil Engineering Evliya Çelebi Campus, Kütahya, Turkey

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ABSTRACT
The safety and performance of embankment dams after impounding water are highly related to the characteristics of the selected dam material. Impermeability is achieved by using clay soils as the core material in embankment dams. It has been observed that there are many collapsed dams, especially when dispersive soils with very low internal erosion resistance are used in the impermeable zone. For this reason, such soils should be determined at the design stage and not used in the construction of embankment dams. The dispersion mechanism is known to be controlled by clay mineralogy and cations in the pore fluid of soil. The physicochemical behaviour of the clay-water system is crucial to clarify the dispersion mechanism. Physical and chemical tests used for determining the dispersibility potential of soils are extensive and time-consuming methods. As alternative method has been proposed within the scope of this study. Three user-friendly and practical models based on Gene Expression Programming (GEP) were produced using chemical and double hydrometer test results to predict dispersion percentage (D%). In addition, a new classification criteria was proposed to identification of dispersivity class based on pinhole test data. If the dispersion percentage is less than 12% is soil is classified as non-dispersive, the dispersion percentage is between 12% and 30% and greater than 30%, it is defined as intermediate and dispersive, respectively. With this proposed criterion, more consistent and successful results were obtained for the dispersivity class.

1. Introduction

Soils produced by the physical and chemical disintegration of rocks have different physical and mechanical properties. Therefore, it is important that suitable soil types should be selected for different earth structures. Structural behavior of soils may change in the short or long term after contact with water. The engineering properties of clay soils that will be used in the construction of structures such as large embankment dams or tailings dams, which have high-risk potential for downstream life and property can cause great damage especially when they collapse, should be thoroughly investigated. Erosion susceptibility of fine-grained soils used in earth structures (embankment dam, road fill, pavement etc.) where water can come into contact is an important issue that should be determined before design. Particular attention should be paid to not using dispersive soils with very low erosion resistance during these earth structures' design and planning stages. Many dams have been damaged or failure for this reason. Wister and Upper Red Rock Site 20 dams are USA's most significant failure cases (Richards et al., 2015). In the case of using dispersive soil, there are embankment dams in Turkey that collapse due to erosion (Tosun and Kilbıyık, 2006). For this reason, it is of great importance to identify dispersive soils and prevent the problems that may arise at an early stage. Especially in recent years, it has been seen that different materials are used to improve soils with dispersability potential (Savaş, 2016; Vakili et al., 2018; Mohanty et al., 2021; Zhao et al., 2022).

Material transport in dispersive soils occurs by dispersive erosion under the control of the dispersion mechanism (Topçu and Tosun, 2022). The dispersion mechanism is known to be controlled by clay mineralogy and cations in the pore fluid of soil. In dry conditions, cations are tightly bound to negatively charged clay surfaces. Adding water to the medium allows these adsorbed cations to pass into the solution medium. The negatively charged clay surface tries to attract these cations simultaneously. Because of the removal of cations from the clay surface in solution, the spontaneous diffusion of substances occurs from a very dense medium to a less dense medium. With this attracting behavior of the negatively charged surface, a diffuse double layer (DDL)

* Corresponding author.
E-mail addresses: sadettin.topcu@dpu.edu.tr (S. Topçu), evren.seyrek@dpu.edu.tr (E. Seyrek).

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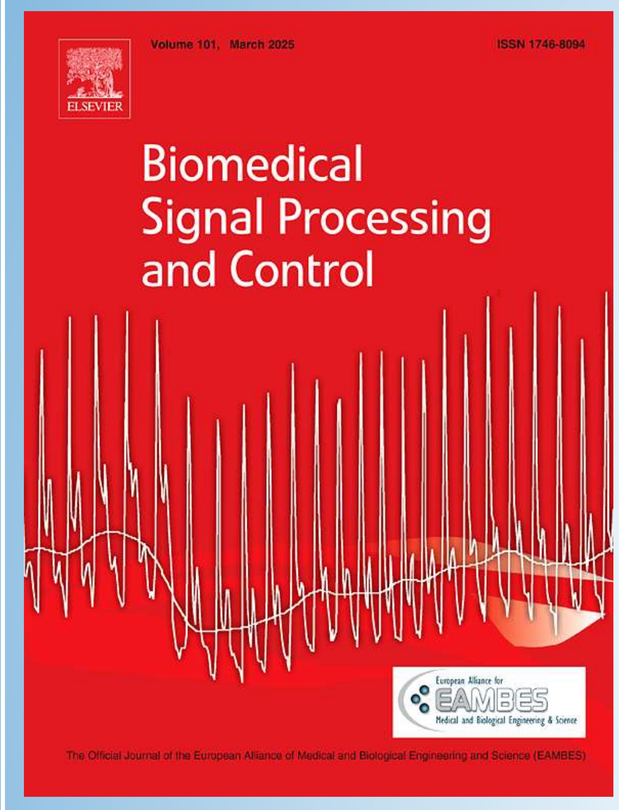

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Multi-objective optimization of ViT architecture for efficient brain tumor classification

Emrullah Şahin [a,*], Durmuş Özdemir [b], Hasan Temurtaş [b]

[a] Software Engineering, Dumlupinar University, Faculty of Engineering, Kutahya 43000, Turkey
[b] Computer Engineering, Dumlupinar University, Faculty of Engineering, Kutahya 43000, Turkey

ARTICLE INFO

Keywords:
Vision transformer
Brain tumor classification
Hyperparameter optimization
Multi-objective optimization

ABSTRACT

This study presents an advanced approach to optimizing the Vision Transformer (ViT) network for brain tumor classification in 2D MRI images, utilizing Bayesian Multi-Objective (BMO) optimization techniques. Rather than merely addressing the limitations of the standard ViT model, our objective was to enhance its overall efficiency and effectiveness. The application of BMO enabled us to fine-tune the architectural parameters of the ViT network, resulting in a model that was not only twice as fast but also four times smaller in size compared to the original. In terms of performance, the optimized ViT model achieved notable improvements, with a 1.48 % increase in validation accuracy, a 3.23 % rise in the F1-score, and a 3.36 % improvement in precision. These substantial enhancements highlight the potential of integrating BMO with visual transformer-based models, suggesting a promising direction for future research in achieving high efficiency and accuracy in complex classification tasks.

1. Introduction

In recent years, Deep Learning-based analysis studies have been increasing, and one of the most important fields of use for these studies is medical data analysis. Medical data analysis plays a crucial role in the healthcare industry by enabling healthcare professionals to evaluate medical images in a computer environment. With this technology, healthcare professionals can perform examinations more accurately and precisely, allowing patients to receive more accurate and better treatment. The analyzed data helps to improve the accuracy, applicability, traceability, and overall time of decisions [1,2,3,4,5].

Within the scope of medical data analysis, one of the problems where deep learning-based studies are concentrated is the diagnosis of brain tumors. Brain tumors are health problems that result from the uncontrolled growth of abnormal cells. Symptoms, growth rate, and treatment vary depending on the type of tumor. It is diagnosed by radiological imaging and biopsy and can be treated with surgery, radiation, and drug therapy options. Deep learning-based brain tumor detection is an alternative to traditional methods and is important for accurate and rapid diagnosis [1,2]. In particular, many studies on brain tumor classification, detection, and localization exist. For example, a study conducted in 2021 to classify brain tumors showed that deep-learning models achieved high accuracy rates and could be used in clinical applications [3]. In another study, brain tumor classification was successfully performed using a combination of SVM [6] and KNN [7] methods with transfer learning. This study significantly surpassed the accuracy of traditional methods [4]. In addition, with the advancements in MRI technologies, it has been observed that deep learning methods have further developed in the classification of brain tumors. Finally, in a study conducted in 2022, a hybrid system was developed using a deep learning model for the automatic classification and detection of brain tumors [8]. These studies demonstrate that deep learning can play an essential role in the early diagnosis of brain tumors.

Many deep learning-based methods in the literature are used for different purposes. One of these methods is the Vision Transformer (ViT) architecture introduced by Google Research [8]. The ViT architecture is a model that uses the transformer module to perform traditional tasks such as image classification. It also requires fewer parameters and computation than traditional CNN architectures while achieving high accuracy rates in large-scale datasets [8]. It can classify images of different sizes with a scalable attention mechanism. However, machine learning and deep learning studies involve many different hyperparameters, and these parameters affect the network's basic structure, features, and performance. The ViT architecture, like other deep

* Corresponding author.
E-mail addresses: emrullah.sahin@dpu.edu.tr (E. Şahin), durmus.ozdemir@dpu.edu.tr (D. Özdemir), hasan.temurtas@dpu.edu.tr (H. Temurtaş).

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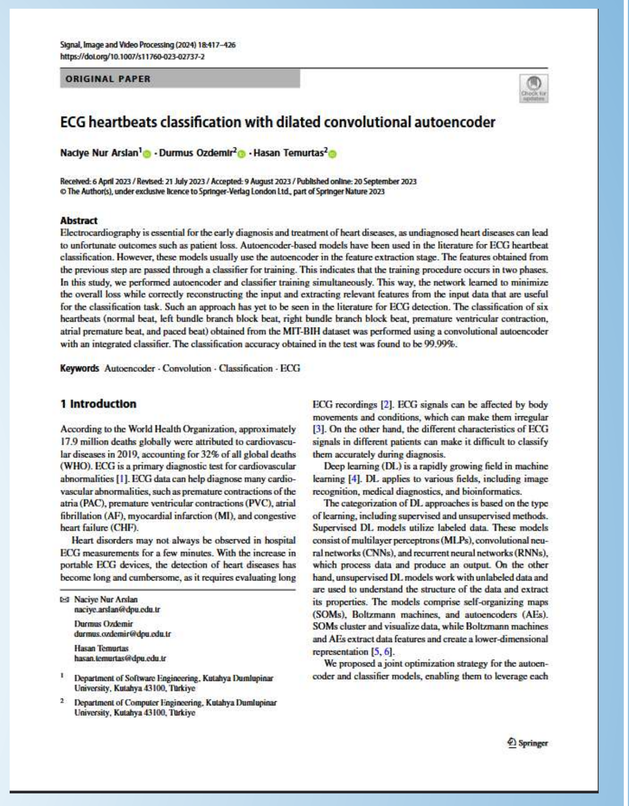

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ORIGINAL PAPER

ECG heartbeats classification with dilated convolutional autoencoder

Naciye Nur Arslan[1] · Durmus Ozdemir[2] · Hasan Temurtas[2]

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Abstract
Electrocardiography is essential for the early diagnosis and treatment of heart diseases, as undiagnosed heart diseases can lead to unfortunate outcomes such as patient loss. Autoencoder-based models have been used in the literature for ECG heartbeat classification. However, these models usually use the autoencoder in the feature extraction stage. The features obtained from the previous step are passed through a classifier for training. This indicates that the training procedure occurs in two phases. In this study, we performed autoencoder and classifier training simultaneously. This way, the network learned to minimize the overall loss while correctly reconstructing the input and extracting relevant features from the input data that are useful for the classification task. Such an approach has yet to be seen in the literature for ECG detection. The classification of six heartbeats (normal beat, left bundle branch block beat, right bundle branch block beat, premature ventricular contraction, atrial premature beat, and paced beat) obtained from the MIT-BIH dataset was performed using a convolutional autoencoder with an integrated classifier. The classification accuracy obtained in the test was found to be 99.99%.

Keywords Autoencoder · Convolution · Classification · ECG

1 Introduction

According to the World Health Organization, approximately 17.9 million deaths globally were attributed to cardiovascular diseases in 2019, accounting for 32% of all global deaths (WHO). ECG is a primary diagnostic test for cardiovascular abnormalities [1]. ECG data can help diagnose many cardiovascular abnormalities, such as premature contractions of the atria (PAC), premature ventricular contractions (PVC), atrial fibrillation (AF), myocardial infarction (MI), and congestive heart failure (CHF).

Heart disorders may not always be observed in hospital ECG measurements for a few minutes. With the increase in portable ECG devices, the detection of heart diseases has become long and cumbersome, as it requires evaluating long ECG recordings [2]. ECG signals can be affected by body movements and conditions, which can make them irregular [3]. On the other hand, the different characteristics of ECG signals in different patients can make it difficult to classify them accurately during diagnosis.

Deep learning (DL) is a rapidly growing field in machine learning [4]. DL applies to various fields, including image recognition, medical diagnostics, and bioinformatics.

The categorization of DL approaches is based on the type of learning, including supervised and unsupervised methods. Supervised DL models utilize labeled data. These models consist of multilayer perceptrons (MLPs), convolutional neural networks (CNNs), and recurrent neural networks (RNNs), which process data and produce an output. On the other hand, unsupervised DL models work with unlabeled data and are used to understand the structure of the data and extract its properties. The models comprise self-organizing maps (SOMs), Boltzmann machines, and autoencoders (AEs). SOMs cluster and visualize data, while Boltzmann machines and AEs extract data features and create a lower-dimensional representation [5, 6].

We proposed a joint optimization strategy for the autoencoder and classifier models, enabling them to leverage each

✉ Naciye Nur Arslan
naciye.arslan@dpu.edu.tr

Durmus Ozdemir
durmus.ozdemir@dpu.edu.tr

Hasan Temurtas
hasan.temurtas@dpu.edu.tr

[1] Department of Software Engineering, Kutahya Dumlupinar University, Kutahya 43100, Türkiye

[2] Department of Computer Engineering, Kutahya Dumlupinar University, Kutahya 43100, Türkiye

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ORIGINAL PAPER

Analysis of CNN models in classifying Alzheimer's stages: comparison and explainability examination of the proposed separable convolution-based neural network and transfer learning models

Naciye Nur Arslan[1] · Durmus Ozdemir[2]

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Abstract
Dementia is a condition that affects brain functions and usually occurs with age, resulting in a decrease in cognitive functions (such as thinking, remembering, and decision-making). The most common type of dementia is Alzheimer's disease. Early diagnosis of Alzheimer's disease is essential to ensure benefit from treatment options, help plan the future, and facilitate the management of symptoms. Significant advances have been made in AI-assisted MRI analysis for early diagnosis of Alzheimer's disease. This study proposed a separable convolution-based neural network called DEMxNET to classify four different Alzheimer's stages. The proposed model was compared with nine different state-of-the-art transfer learning models named VGG16, VGG19, InceptionV3, Xception, DenseNet201, MobileNetV2, ResNetRS101, NASNetMobile, and ConvNeXtBase. The Synthetic Minority Oversampling Technique (SMOTE) was used to solve the class imbalance problem in the dataset. The proposed DEMxNET model achieved the highest performance compared to other models and reached an accuracy rate of 99.79%. In addition to artificial intelligence-supported diagnostic methods, the explainability and understandability of how the diagnosis is made are also essential for patients and healthcare professionals. In this respect, the explainability and the performance of the DEMxNET model were considered. The explainability of the model was ensured using the LIME method.

Keywords Alzheimer · Transfer learning · Deep learning · CNN · LIME · XAI

1 Introduction

Alzheimer's disease is a type of dementia that leads to the formation of amyloid plaques in the brain and the breakdown of neurons. It was described by Alois Alzheimer more than 100 years ago and later termed "Alzheimer's-type dementia" by Emil Kraepelin [1]. Dementia is a syndrome that signifies the loss of the mind, and Alzheimer's disease is the most common form of dementia [2]. While there is no known cure for Alzheimer's, treatments are available to mitigate some symptoms [3]. According to a report by Alzheimer's Disease International, the number of dementia patients, which was around 50 million in 2018, is expected to increase to 82 million by 2030 and 152 million by 2050 if significant progress in treatment is not made. Dementia ranks as the fifth leading cause of death worldwide, with spending on dementia patients nearing 1 trillion dollars annually [4].

The characteristic symptoms of dementia include difficulties in memory, language, problem-solving, and other cognitive skills that affect a person's ability to perform daily activities [3]. Since there is no definitive diagnostic test for the disease, a combination of various tests is assessed to make a diagnosis. Neurologists take a detailed medical history of the patient. Various screening tests, blood tests, and genetic screenings are conducted to measure the patient's neurological functions. Additionally, images obtained through Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Single Photon Emission Computed Tomography (SPECT), and Positron Emission Tomography (PET) techniques are used to gather information related to brain tissue loss [5]. Alzheimer's disease is categorized into stages as follows [6]:

✉ Naciye Nur Arslan
naciye.arslan@dpu.edu.tr

Durmus Ozdemir
durmus.ozdemir@dpu.edu.tr

[1] Department of Software Engineering, Kutahya Dumlupinar University, Kutahya 43100, Turkey

[2] Department of Computer Engineering, Kutahya Dumlupinar University, Kutahya 43100, Turkey

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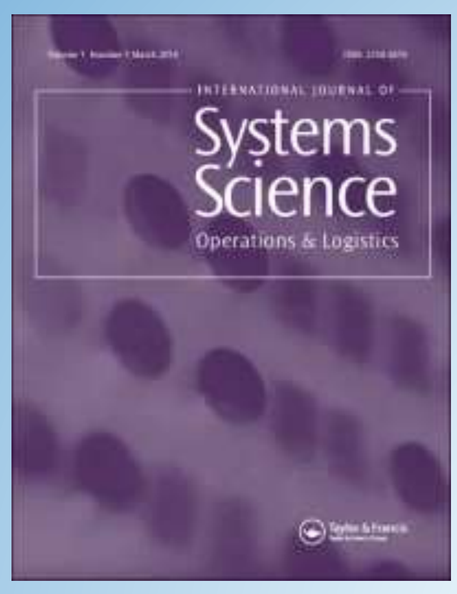

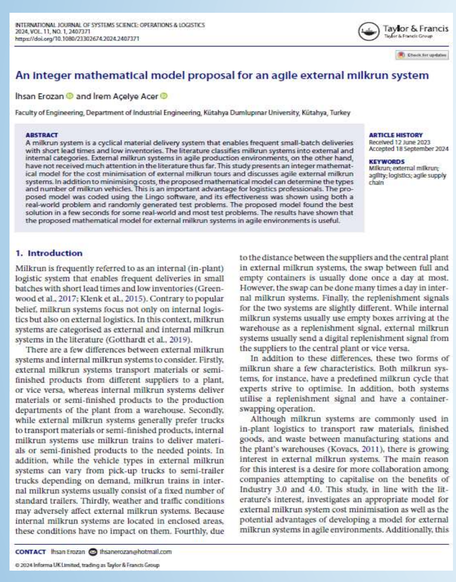
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An Integer mathematical model proposal for an agile external milkrun system

İhsan Erozan and İrem Açelye Acer

Faculty of Engineering, Department of Industrial Engineering, Kütahya Dumlupınar University, Kütahya, Turkey

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KEYWORDS
Milkrun; external milkrun; agility; logistics; agile supply chain

ABSTRACT
A milkrun system is a cyclical material delivery system that enables frequent small-batch deliveries with short lead times and low inventories. The literature classifies milkrun systems into external and internal categories. External milkrun systems in agile production environments, on the other hand, have not received much attention in the literature thus far. This study presents an integer mathematical model for the cost minimisation of external milkrun tours and discusses agile external milkrun systems. In addition to minimising costs, the proposed mathematical model can determine the types and number of milkrun vehicles. This is an important advantage for logistics professionals. The proposed model was coded using the Lingo software, and its effectiveness was shown using both a real-world problem and randomly generated test problems. The proposed model found the best solution in a few seconds for some real-world and most test problems. The results have shown that the proposed mathematical model for external milkrun systems in agile environments is useful.

1. Introduction

Milkrun is frequently referred to as an internal (in-plant) logistic system that enables frequent deliveries in small batches with short lead times and low inventories (Greenwood et al., 2017; Klenk et al., 2015). Contrary to popular belief, milkrun systems focus not only on internal logistics but also on external logistics. In this context, milkrun systems are categorised as external and internal milkrun systems in the literature (Gotthardt et al., 2019).

There are a few differences between external milkrun systems and internal milkrun systems to consider. Firstly, external milkrun systems transport materials or semi-finished products from different suppliers to a plant, or vice versa, whereas internal milkrun systems deliver materials or semi-finished products to the production departments of the plant from a warehouse. Secondly, while external milkrun systems generally prefer trucks to transport materials or semi-finished products, internal milkrun systems use milkrun trains to deliver materials or semi-finished products to the needed points. In addition, while the vehicle types in external milkrun systems can vary from pick-up trucks to semi-trailer trucks depending on demand, milkrun trains in internal milkrun systems usually consist of a fixed number of standard trailers. Thirdly, weather and traffic conditions may adversely affect external milkrun systems. Because internal milkrun systems are located in enclosed areas, these conditions have no impact on them. Fourthly, due to the distance between the suppliers and the central plant in external milkrun systems, the swap between full and empty containers is usually done once a day at most. However, the swap can be done many times a day in internal milkrun systems. Finally, the replenishment signals for the two systems are slightly different. While internal milkrun systems usually use empty boxes arriving at the warehouse as a replenishment signal, external milkrun systems usually send a digital replenishment signal from the suppliers to the central plant or vice versa.

In addition to these differences, these two forms of milkrun share a few characteristics. Both milkrun systems, for instance, have a predefined milkrun cycle that experts strive to optimise. In addition, both systems utilise a replenishment signal and have a container-swapping operation.

Although milkrun systems are commonly used in in-plant logistics to transport raw materials, finished goods, and waste between manufacturing stations and the plant's warehouses (Kovacs, 2011), there is growing interest in external milkrun systems. The main reason for this interest is a desire for more collaboration among companies attempting to capitalise on the benefits of Industry 3.0 and 4.0. This study, in line with the literature's interest, investigates an appropriate model for external milkrun system cost minimisation as well as the potential advantages of developing a model for external milkrun systems in agile environments. Additionally, this

CONTACT İhsan Erozan ihsanerozan@hotmail.com

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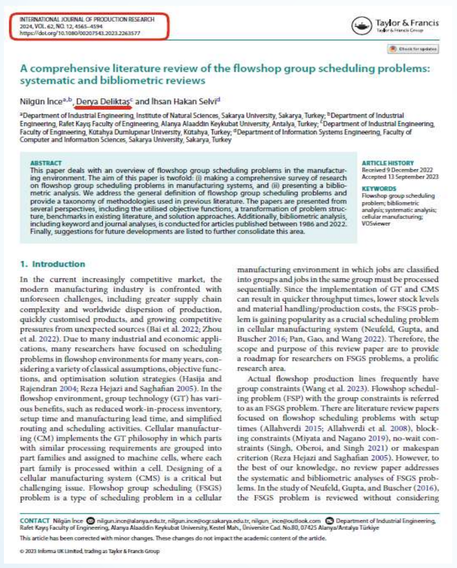
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A comprehensive literature review of the flowshop group scheduling problems: systematic and bibliometric reviews

Nilgün İnce[a,b], Derya Deliktaş[c] and İhsan Hakan Selvi[d]

[a]Department of Industrial Engineering, Institute of Natural Sciences, Sakarya University, Sakarya, Turkey; [b]Department of Industrial Engineering, Rafet Kayış Faculty of Engineering, Alanya Alaaddin Keykubat University, Antalya, Turkey; [c]Department of Industrial Engineering, Faculty of Engineering, Kütahya Dumlupınar University, Kütahya, Turkey; [d]Department of Information Systems Engineering, Faculty of Computer and Information Sciences, Sakarya University, Sakarya, Turkey

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KEYWORDS
Flowshop group scheduling problem; bibliometric analysis; systematic analysis; cellular manufacturing; VOSviewer

ABSTRACT
This paper deals with an overview of flowshop group scheduling problems in the manufacturing environment. The aim of this paper is twofold: (i) making a comprehensive survey of research on flowshop group scheduling problems in manufacturing systems, and (ii) presenting a bibliometric analysis. We address the general definition of flowshop group scheduling problems and provide a taxonomy of methodologies used in previous literature. The papers are presented from several perspectives, including the utilised objective functions, a transformation of problem structure, benchmarks in existing literature, and solution approaches. Additionally, bibliometric analysis, including keyword and journal analyses, is conducted for articles published between 1986 and 2022. Finally, suggestions for future developments are listed to further consolidate this area.

1. Introduction

In the current increasingly competitive market, the modern manufacturing industry is confronted with unforeseen challenges, including greater supply chain complexity and worldwide dispersion of production, quickly customised products, and growing competitive pressures from unexpected sources (Bai et al. 2022; Zhou et al. 2022). Due to many industrial and economic applications, many researchers have focused on scheduling problems in flowshop environments for many years, considering a variety of classical assumptions, objective functions, and optimisation solution strategies (Hasija and Rajendran 2004; Reza Hejazi and Saghafian 2005). In the flowshop environment, group technology (GT) has various benefits, such as reduced work-in-process inventory, setup time and manufacturing lead time, and simplified routing and scheduling activities. Cellular manufacturing (CM) implements the GT philosophy in which parts with similar processing requirements are grouped into part families and assigned to machine cells, where each part family is processed within a cell. Designing of a cellular manufacturing system (CMS) is a critical but challenging issue. Flowshop group scheduling (FSGS) problem is a type of scheduling problem in a cellular manufacturing environment in which jobs are classified into groups and jobs in the same group must be processed sequentially. Since the implementation of GT and CMS can result in quicker throughput times, lower stock levels and material handling/production costs, the FSGS problem is gaining popularity as a crucial scheduling problem in cellular manufacturing system (Neufeld, Gupta, and Buscher 2016; Pan, Gao, and Wang 2022). Therefore, the scope and purpose of this review paper are to provide a roadmap for researchers on FSGS problems, a prolific research area.

Actual flowshop production lines frequently have group constraints (Wang et al. 2023). Flowshop scheduling problem (FSP) with the group constraints is referred to as an FSGS problem. There are literature review papers focused on flowshop scheduling problems with setup times (Allahverdi 2015; Allahverdi et al. 2008), blocking constraints (Miyata and Nagano 2019), no-wait constraints (Singh, Oberoi, and Singh 2021) or makespan criterion (Reza Hejazi and Saghafian 2005). However, to the best of our knowledge, no review paper addresses the systematic and bibliometric analyses of FSGS problems. In the study of Neufeld, Gupta, and Buscher (2016), the FSGS problem is reviewed without considering

CONTACT Nilgün İnce nilgun.ince@alanya.edu.tr, nilgun.ince@ogr.sakarya.edu.tr, nilgun_ince@outlook.com Department of Industrial Engineering, Rafet Kayış Faculty of Engineering, Alanya Alaaddin Keykubat University, Kestel Mah., Üniversite Cad. No.80, 07425 Alanya/Antalya Türkiye

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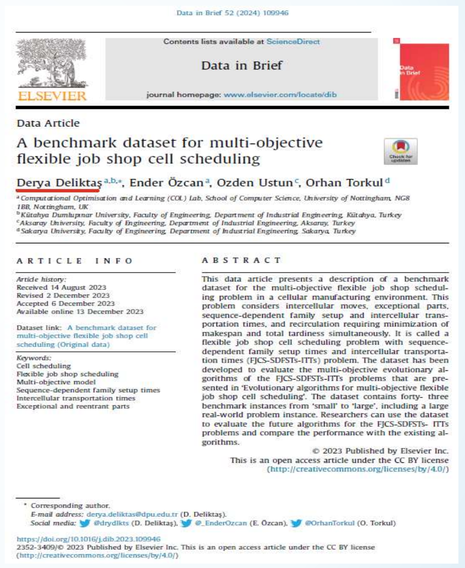
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Data Article

A benchmark dataset for multi-objective flexible job shop cell scheduling

Derya Deliktaş[a,b,*], Ender Özcan[a], Ozden Ustun[c], Orhan Torkul[d]

[a]Computational Optimisation and Learning (COL) Lab, School of Computer Science, University of Nottingham, NG8 1BB, Nottingham, UK
[b]Kütahya Dumlupınar University, Faculty of Engineering, Department of Industrial Engineering, Kütahya, Turkey
[c]Aksaray University, Faculty of Engineering, Department of Industrial Engineering, Aksaray, Turkey
[d]Sakarya University, Faculty of Engineering, Department of Industrial Engineering, Sakarya, Turkey

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Dataset link: A benchmark dataset for multi-objective flexible job shop cell scheduling (Original data)

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Cell scheduling
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Multi-objective model
Sequence-dependent family setup times
Intercellular transportation times
Exceptional and reentrant parts

ABSTRACT

This data article presents a description of a benchmark dataset for the multi-objective flexible job shop scheduling problem in a cellular manufacturing environment. This problem considers intercellular moves, exceptional parts, sequence-dependent family setup and intercellular transportation times, and recirculation requiring minimization of makespan and total tardiness simultaneously. It is called a flexible job shop cell scheduling problem with sequence-dependent family setup times and intercellular transportation times (FJCS-SDFSTS-ITTs) problem. The dataset has been developed to evaluate the multi-objective evolutionary algorithms of the FJCS-SDFSTS-ITTs problems that are presented in 'Evolutionary algorithms for multi-objective flexible job shop cell scheduling'. The dataset contains forty- three benchmark instances from "small" to 'large', including a large real-world problem instance. Researchers can use the dataset to evaluate the future algorithms for the FJCS-SDFSTS- ITTs problems and compare the performance with the existing algorithms.

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* Corresponding author.
E-mail address: derya.deliktas@dpu.edu.tr (D. Deliktaş).
Social media: @drydlkts (D. Deliktaş), @_EnderOzcan (E. Özcan), @OrhanTorkul (O. Torkul)

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MULTI-CHOICE CONIC GOAL PROGRAMMING MODEL-BASED NETWORK DATA ENVELOPMENT ANALYSIS

Derya Deliktaş[1,*], Ozden Ustun[2], Ezgi Aktar Demirtas[3] and Rifat Aykut Arapoglu[4]

Abstract. In multi-stage processes, classical Data Envelopment Analysis (DEA) acts like a black box and measures the efficiency of decision-making units (DMUs) without considering the internal structure of the system. Unlike classical DEA, recent studies have shown that the overall system efficiency scores are more meaningful if researched using the Network DEA (NDEA) methodology. NDEA performs simultaneous efficiency evaluations of sub-processes and the entire system. Recently, the composition method integrated with multi-objective programming (MOP) has been preferred by many authors to alleviate the drawbacks of earlier methods such as decomposition, slack-based measure (SBM) and the system-centric approach. This study proposes a novel approach incorporating Multi-Choice Conic Goal Programming into the NDEA (MCCGP-NDEA). It provides a more accurate representation of the Pareto front by revealing potential Pareto optimal solutions which are overlooked by the composition methods. Due to its ability to modify stage weights based on the decision makers' (DMs) preferences, it is likely to gather more samples from the Pareto surface. Computational results on available benchmark problems confirm that the proposed MCCGP-NDEA is a viable alternative to existing methods.

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1. Introduction

Efficiency measurement is essential for planning the future development of a DMU by evaluating its past status. DEA, following [17] seminal work, has become a widely employed method for evaluating the relative efficiency of DMUs by using multiple inputs/outputs. Banker *et al.* [9] presented a model by mitigating the conditions of the variable returns to scale (VRS). Subsequently, numerous theoretical advancements and practical applications have been reported in many fields (see the reviews of [46, 71, 72]).

DEA simplifies DMU efficiency evaluation by treating it as a single unified entity, overlooking internal structural considerations. This conceptualization treats the system as a *black box*, wherein multiple inputs and outputs are used to produce efficiency scores. Despite a typically positive correlation between input and output variables, it remains crucial to delve into internal workings to uncover the origins of inefficiencies. NDEA serves to evaluate the relative efficiency of a system while considering its internal structure, resulting in more

Keywords. Data envelopment analysis, network DEA, multi-choice conic goal programming, multi-objective programming.

[1] Kütahya Dumlupınar University, Faculty of Engineering, Department of Industrial Engineering, Kütahya, Turkey.
[2] Aksaray University, Faculty of Engineering, Department of Industrial Engineering, Aksaray, Turkey.
[3] Eskişehir Osmangazi University, Faculty of Engineering, Department of Industrial Engineering, Eskişehir, Turkey.
*Corresponding author: derya.deliktas@dpu.edu.tr; derya.deliktas@outlook.com

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Mühendislik Mimarlık Fakültesi Dergisi

Genetic algorithm based on weighted goal programming for doctor rostering problem

Anıl Yalçın, Derya Deliktaş*

Department of Industrial Engineering, Faculty of Engineering, Kütahya Dumlupınar University, 43020, Kütahya, Türkiye

Highlights:
- We propose a genetic algorithm based on a weighted goal programming model for the doctor rostering problem
- The preferences of doctors for shifts and day-offs are taken into account
- The model is successfully applied to a real-life case
- Study

Keywords:
- Doctor Rostering
- Experimental Design
- Genetic Algorithm
- Weighted Goal Programming
- Sensitivity Analysis

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Correspondence:
Author: Derya Deliktaş
e-mail:
derya.deliktas@dpu.edu.tr
phone: +90 274 443 4310

Graphical/Tabular Abstract

In this study, a more efficient, more effective and fairer way of doctor rostering for a real case application in the lateral branch department and the internal diseases department of a training and research hospital was investigated, and was found that use of weighted goal programming based genetic algorithm (WGP-GA) is advantageous due to efficiency, effectiveness, fairness and meeting multiple demands at the same time rather than scheduling manually.

Weeks	Week 1							Week 2							Week 3							Week 4						
Days	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1	M	M	M	M	M	T	T	M	M	N	N	M	T	T	M	M	M	M	M	T	T	M	N	N	M	M	T	T
2	M	M	M	M	N	T	T	M	M	M	M	M	T	T	M	M	N	N	M	T	T	M	M	M	M	M	T	T
3	M	M	M	M	T	T	T	M	M	M	N	T	T	M	M	N	N	M	T	T	M	M	M	M	M	M	T	T
4	M	M	M	M	M	T	T	M	M	N	N	M	T	T	M	M	M	M	M	T	T	M	N	N	M	M	T	T
5	M	M	M	M	M	T	T	N	M	M	M	M	T	T	M	N	N	M	M	T	T	M	M	M	M	M	T	T
6	M	M	M	M	M	T	T	M	M	M	M	M	T	T	N	M	M	M	M	T	T	N	M	M	M	M	T	T
7	M	M	N	N	M	T	T	I	I	I	I	I	T	T	I	I	I	I	I	T	T	M	N	N	M	M	T	T
8	M	M	M	M	N	T	T	M	M	M	M	M	T	T	M	M	M	M	M	T	T	M	M	M	M	M	T	T
9	M	M	M	M	N	T	T	I	I	I	M	M	T	T	M	M	M	N	N	T	T	M	M	M	M	M	T	T
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12	M	M	M	M	M	T	T	M	M	M	M	M	T	T	M	M	M	M	N	T	T	M	M	N	M	M	T	T
13	M	M	M	M	M	T	T	M	N	M	M	M	T	T	M	M	M	M	M	T	T	M	M	N	N	M	T	T

Pyramids

Figure A. The schedule of the professor for main building problem

Purpose:
In the healthcare sector, undisrupted service is essential for hospitals. Therefore, shift work plays a vital role in satisfying constraints such as coverage requirements and government regulations. The doctor rostering problem is classified as an NP-hard problem due to its complexity and scale. In addition to the fairness of assignments, including hospital management policies, and government regulations, many related factors must be taken into account during the scheduling process in this scheduling problem.

Theory and Methods:
This study aims to generate a rostering system that can satisfy the requirements of the hospital, ensure fairness amongst the doctors, and take preferences into account. A genetic algorithm based on a weighted goal programming model was proposed to solve the doctor rostering problem. The proposed model was applied to the internal diseases department and the lateral branches department of a training and research hospital.

Results:
15 different scenarios were constructed, considering different problem scales and different preference patterns of the doctors that may occur in the future. It is approved that the proposed algorithm can be applied to different problem scales and conditions. The parameters of the proposed algorithm were calibrated with an experimental design method.

Conclusion:
In this study, two main contributions were presented. A model with new constraints was introduced for researchers. In addition, a genetic algorithm based on weighted goal programming was proposed to solve the problem and applied to a real-world case study.

A New Model for Assembly Task Recognition: A Case Study of Seru Production System

ORHAN TORKUL, İHSAN HAKAN SELVI, MERVE ŞİŞCİ, AND DENİZ DEMİRCİOĞLU DİREN

ABSTRACT The Seru production system is an innovative assembly system that combines the flexibility of shop floor production and the high efficiency of assembly lines. In addition to its advantages, seru-type production has the disadvantage that all the tasks required for the assembly of a product are completed in a yatai by a cross-trained worker. This results in a higher risk of production errors compared to assembly lines. In order to mitigate these risks, a real-time control system is considered necessary. Recognition of assembly tasks is needed to prevent quality defects in the Seru production system. To meet this need, in this study, a skeleton-based deep learning hybrid Convolutional Neural Network-Bi-directional Gated Recurrent Unit-Convolutional Neural Network (CNN-BiGRU-CNN) assembly task recognition model is developed. In this study, a two-stage data augmentation approach is proposed to improve the performance of the model developed by utilizing the worker skeleton data obtained with Mediapipe Holistic infrastructure from the assembly video collected from the seru production system. The effectiveness of the model was evaluated by comparing it with Convolutional Neural Network (CNN), Long Short Term Memory (LSTM), Gated Recurrent Unit (GRU), Bi-directional Long Short Term Memory (BiLSTM), BiGRU, and hybrid models created by combinations of these models. The proposed data augmentation approach improved the performance of all the models compared in the study. With the proposed hybrid CNN-BiGRU-CNN model, the best performance was achieved with a prediction accuracy of 96%.

INDEX TERMS Assembly action recognition, data augmentation, deep learning, MediaPipe, pose estimation, seru production system.

NOMENCLATURE

CNN	Convolutional Neural Network.	CNN-GRU	Convolutional Neural Network-Gated Recurrent Unit.
LSTM	Long Short Term Memory.	CNN-BiLSTM	Convolutional Neural Network-Bi-directional Long Short Term Memory.
GRU	Gated Recurrent Unit.		
BiLSTM	Bi-directional Long Short Term Memory.	CNN-BiGRU	Convolutional Neural Network-Bi-directional Gated Recurrent Unit.
BiGRU	Bi-directional Gated Recurrent Unit.		
CNN-LSTM	Convolutional Neural Network-Long Short Term Memory.	CNN-BiGRU-CNN	Convolutional Neural Network-Bi-directional Gated Recurrent Unit-Convolutional Neural Network.
		RNN	Recurrent Neural Network.

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Smart seru production system for Industry 4.0: a conceptual model based on deep learning for real-time monitoring and controlling

Orhan Torkul[a], İhsan Hakan Selvi[b] and Merve Şişci[a,c]

[a]Industrial Engineering Department, Sakarya University, Serdivan, Turkey; [b]Information Systems Engineering Department, Sakarya University, Serdivan, Turkey; [c]Industrial Engineering Department, Kütahya Dumlupınar University, Kütahya, Turkey

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KEYWORDS
Seru production system; deep learning; assembly systems; flexible assembly; AI in manufacturing systems; manufacturing management

ABSTRACT
Seru production system is an innovative assembly system and combines the flexibility of job shop production and high efficiency of assembly lines. This production system easily adapts to product replacements, reduces product wastages by eliminating work-in-process inventories and delay time, and provides enterprises with a competitive advantage through reducing the operating costs, required workforce, and space. Besides these advantages, the disadvantage of seru type production is that, in assembly lines, specific tasks are completed in specified stations, whereas in seru production, the tasks required for the assembly of a product are completed in a yatai by a cross-trained worker. This, in turn, results in a higher risk of production errors. Accordingly in this research, a conceptual model is proposed to monitor and control multiple factors of the production process like worker, environment, assembly tools, ergonomics, storage and inventory and issue warning for prevention of process and quality errors in seru production by use of advanced analytics based on deep learning. In addition to providing support to the worker, the proposed Smart Seru Production System Model will assist system participants in obtaining and understanding data about the production processes and reacting quickly based on this information.

1. Introduction

One of the most important ways for companies to gain a competitive advantage over their competitors is to use their resources most effectively and efficiently to obtain high-quality products at the lowest possible cost. To achieve this goal, for many years, enterprises have made use of mass production and assembly lines to efficiently produce high-volume standard products since the product model change is low. However, with the advancement of technology, improvements in high technology products such as smartphones, cameras, and computers have accelerated and changed the structure of customer demand. Increasing the variety of these products leads to reduced batch size and product life. Because of such changes in product mix and demand, many manufacturing companies face fluctuations known as dynamic or uncertain conditions. Many production and assembly challenges have arisen due to the spread of product diversity resulting from product development, increased personalization, and changes in production systems (ElMaraghy and ElMaraghy 2016). Under these circumstances, other conventional production methods, such as assembly lines, cannot meet market requirements (Wang and Tang 2017). In addition to being efficient, production systems must now also have the flexibility and adaptability capability.

In contrast to the conventional assembly line, in the seru production system, one or more small assembly units which are responsible for assembling an entire product are configured. Since the workers and product groups can be dynamically assigned to a seru system to keep up with market demands, a seru system has much higher flexibility than a conventional assembly line system. Also, the efficiency of the assembly line is determined by the least skilled worker. In the seru production system, the restructuring of the worker can significantly reduce the impact of the least skilled worker on productivity. One of the most important reasons why the seru production system is more flexible than the assembly line is that the workers in the seru system are multi-skilled operators that have the ability to handle multiple jobs and process multiple

CONTACT Merve Şişci merveisicisisci@sakarya.edu.tr Industrial Engineering Department, Sakarya University, Esentepe Campus, Serdivan, Sakarya 54187, Turkey

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AN INTEGRATED SIMULATION-DATA ENVELOPMENT ANALYSIS APPROACH FOR IMPACT OF LINE-SERU CONVERSION

Orhan Torkul[1], İhsan Hakan Selvi[2], Merve Şişci[1,3,*] and Mecit Öge[4]

Abstract. This study aims to design an innovative method to evaluate the effects of line-seru conversion in terms of various environmental and economic performance criteria. For this purpose, an integrated approach using simulation and data envelopment analysis (DEA) assisted with various performance criteria is proposed for the first time. The simulation studies involve diverse scenarios for the production of a circuit breaker on assembly lines balanced with RPW and COMSOAL heuristic algorithms, and seru production systems. The simulation results indicate a significant increase in labour effectiveness and station/yatai utilization ratios, complete removal of WIP inventories, which led to a growth in productivity up to 43.29%. The number of workers, carbon-dioxide emission, required workspace, training costs of workers and equipment cost data were incorporated in the results to evaluate the applicability and relative efficiency of the developed scenarios by use of the CCR and BCC models of DEA. The calculated scale efficiency shows that the scenarios for assembly lines balanced with COMSOAL and the seru-based scenarios were both fully effective. The seru production system scenario with 6 yatais was the most effective scenario due to reduced task times after conversion. Also, line-seru conversion proved to be advantageous despite the high training costs.

Mathematics Subject Classification. 90B30, 37M05, 68U20, 91B06.

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1. Introduction

The impact of technological and digital transformations around the world on the field of industry is undeniable. Major transformations ranging from Industry 1.0 to Industry 4.0 have led to significant changes in several fields such as manufacturing, planning, marketing and logistics. Improving of production systems to maximize efficiency has become compulsory for companies in order to effectively respond to customer demands, increase their competitiveness and gain profit. This leads to the requirement for redesigning the production systems. Assembly line systems hold major advantages such as low labour costs, high efficiency and low product costs due to scale economy, as they require technical skills and qualities to a considerably lower extent [37]. Conventional

Keywords. Seru production system, line-seru conversion, simulation, data envelopment analysis, assembly systems.

[1] Industrial Engineering Department, Sakarya University, Sakarya, Turkey.
[2] Information Systems Engineering Department, Sakarya University, Sakarya, Turkey.
[3] Industrial Engineering Department, Kütahya Dumlupınar University, Kütahya, Turkey.
[4] Mechanical Engineering Department, Bartın University, Bartın, Turkey.
*Corresponding author: merveisici@sakarya.edu.tr

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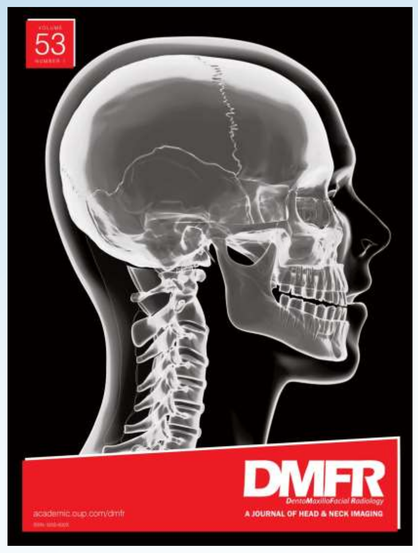

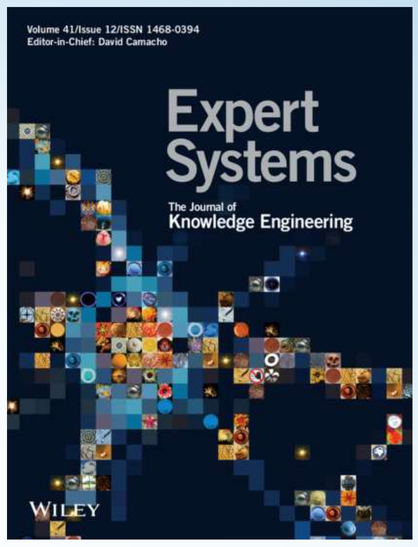

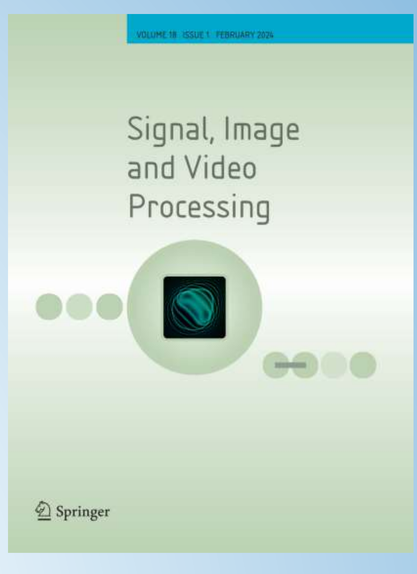


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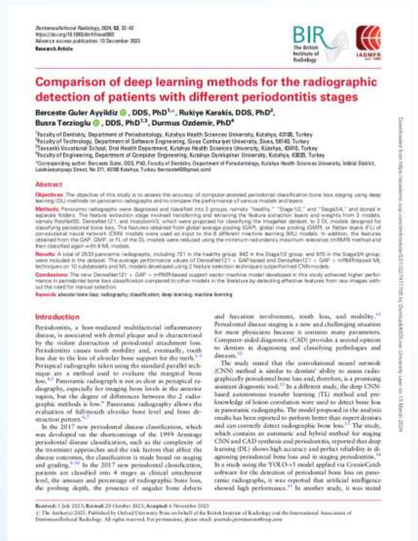
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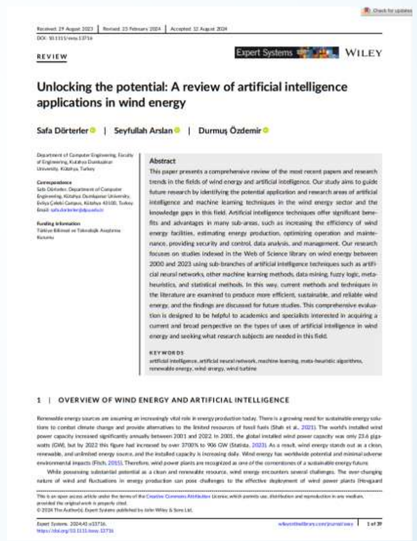
Berceste Guler Ayyildiz, Rukiye Karakis, Buzra Terzioglu, Durmus Ozdemir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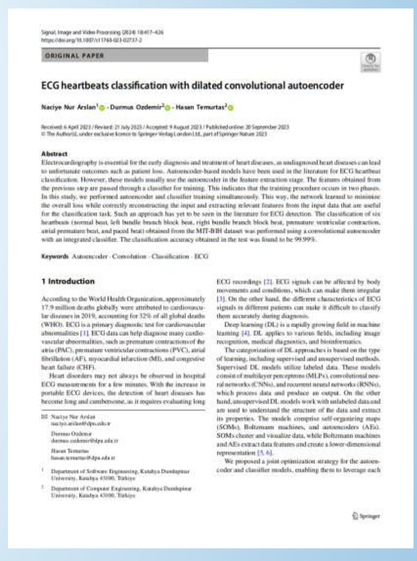
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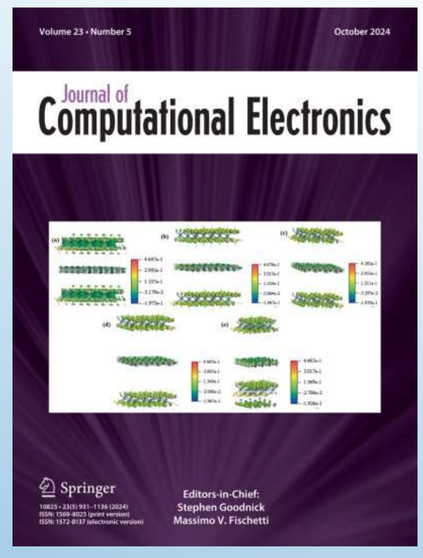

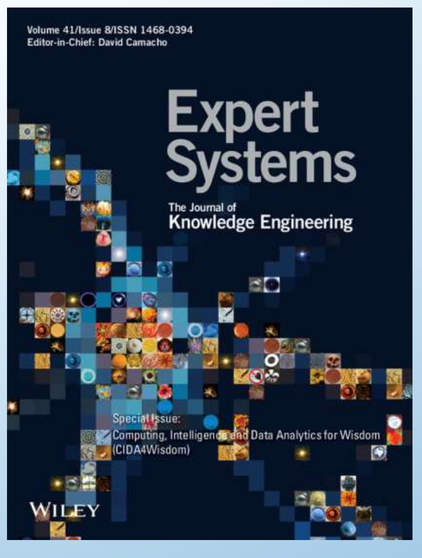

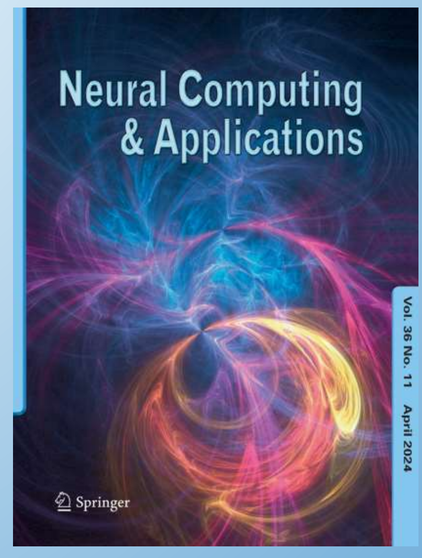

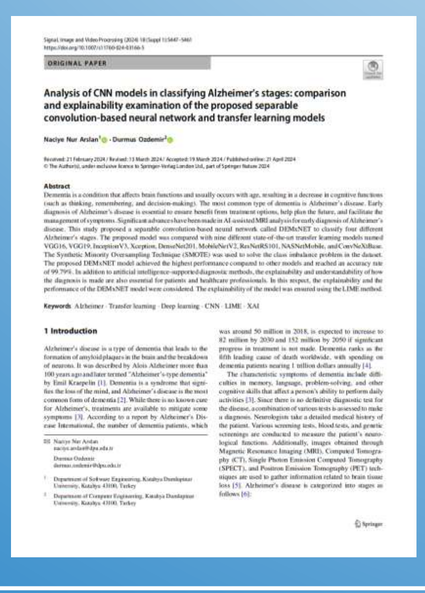
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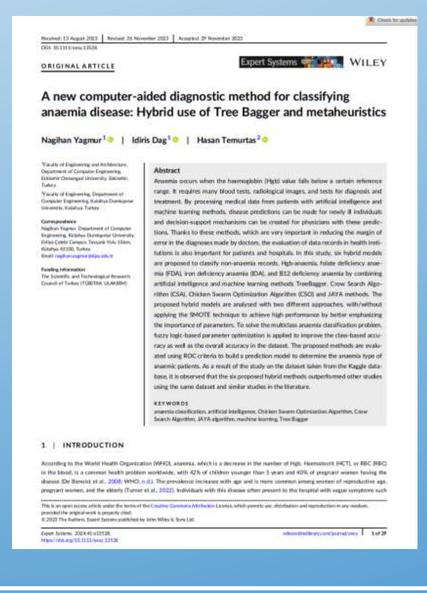
Hasan Temurtas · Gürcan Yavuz · Serdar Özyön · Aybüke Ünlü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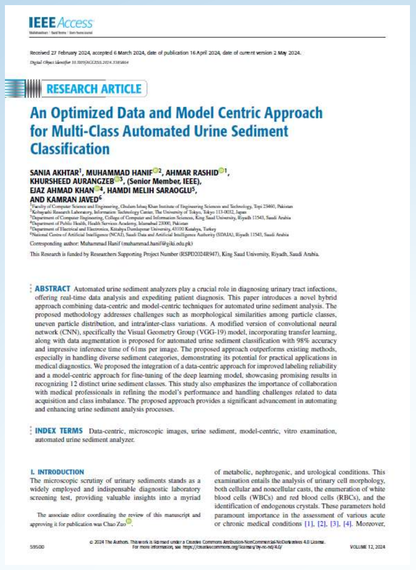

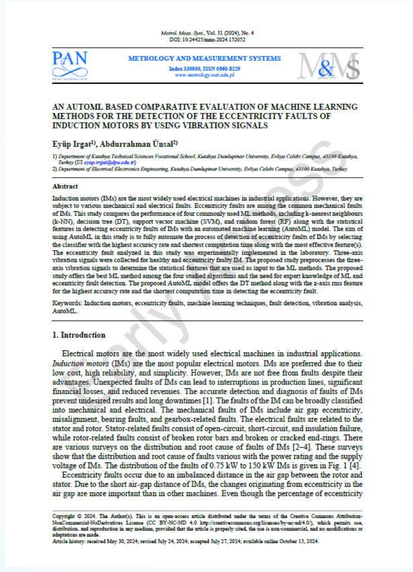

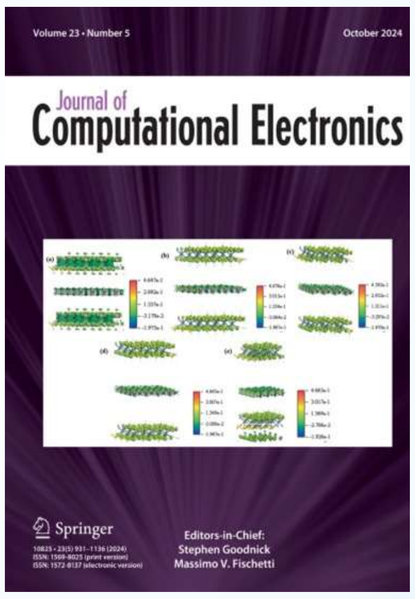

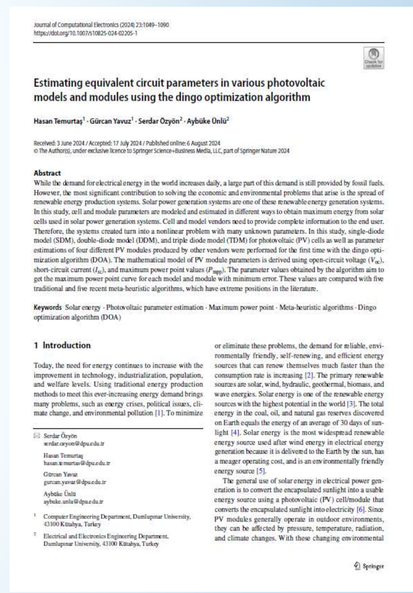

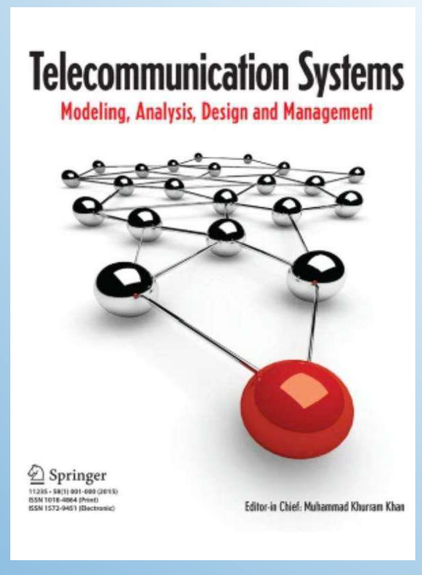

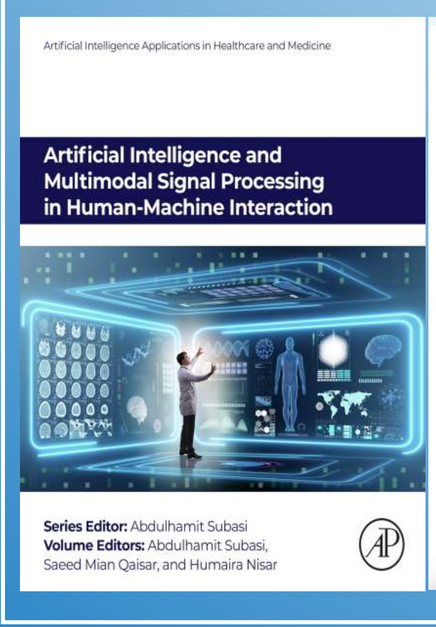

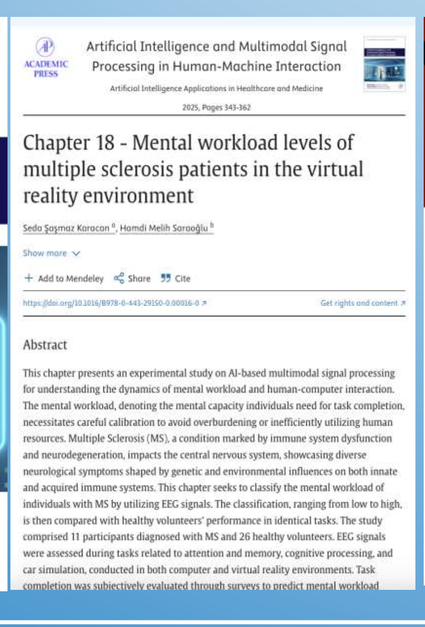

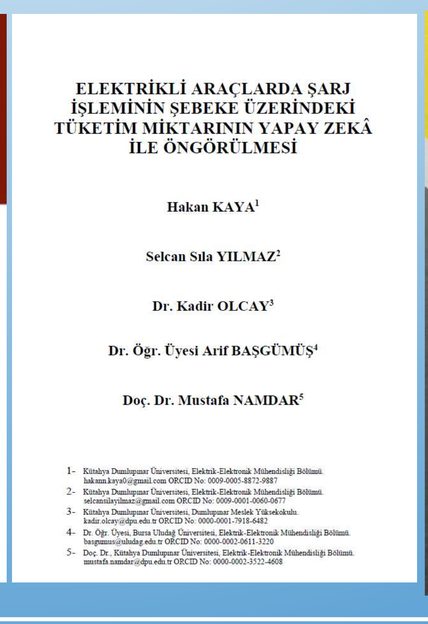

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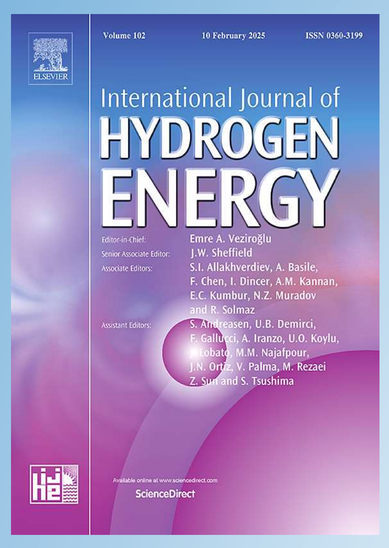

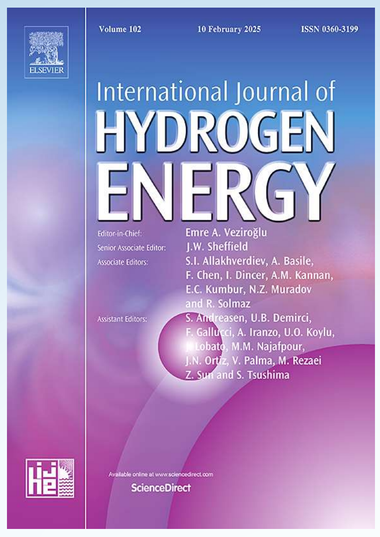

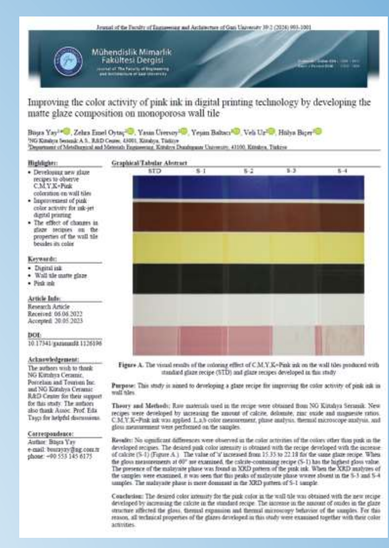

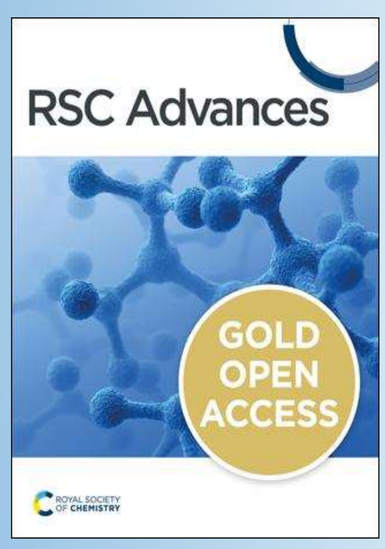

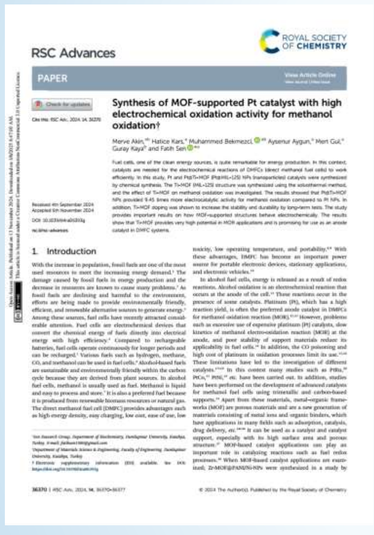

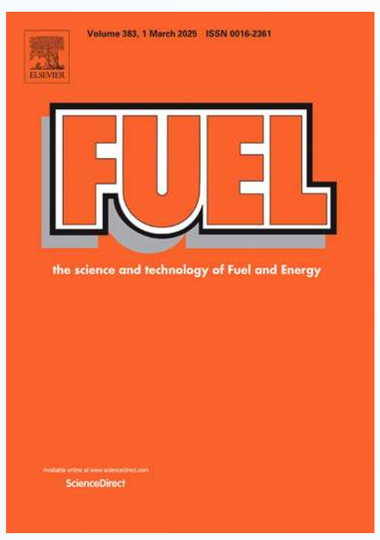

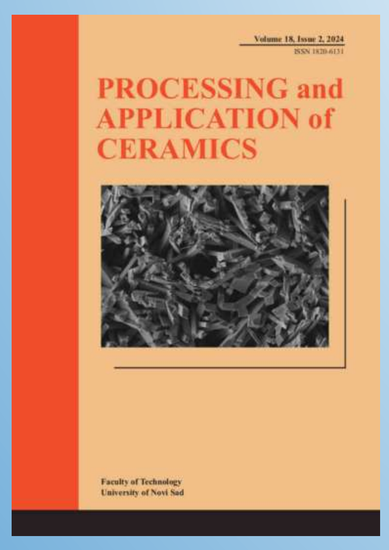

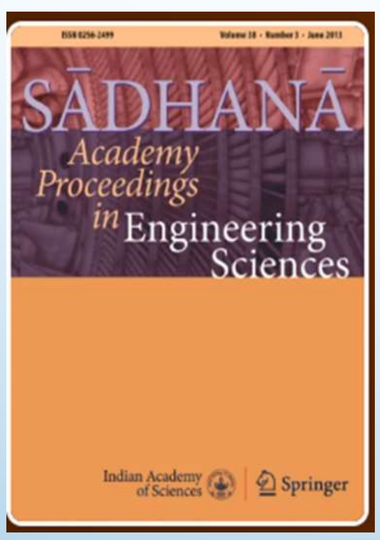

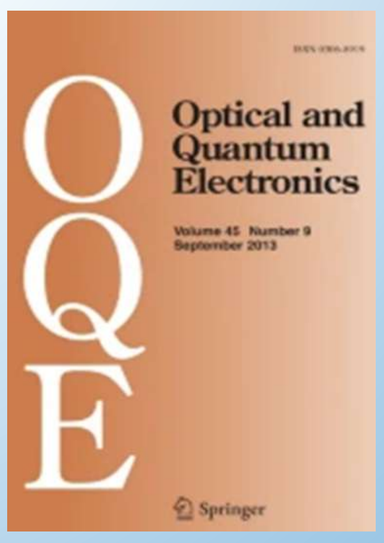

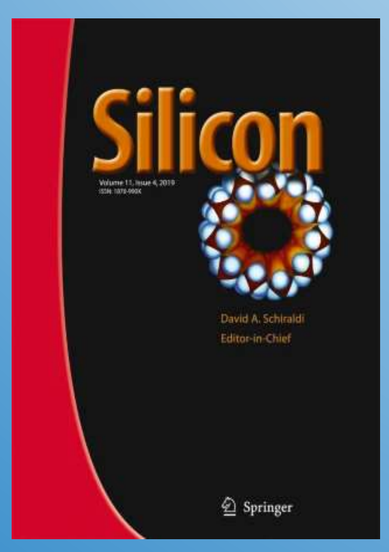

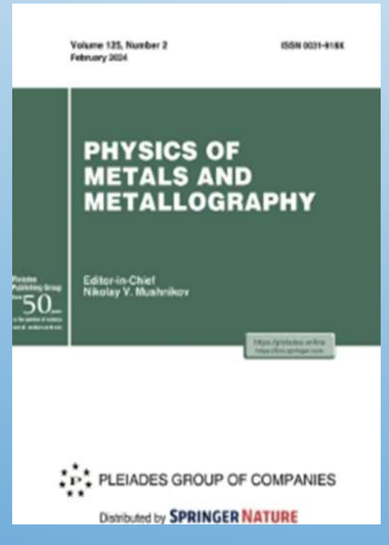

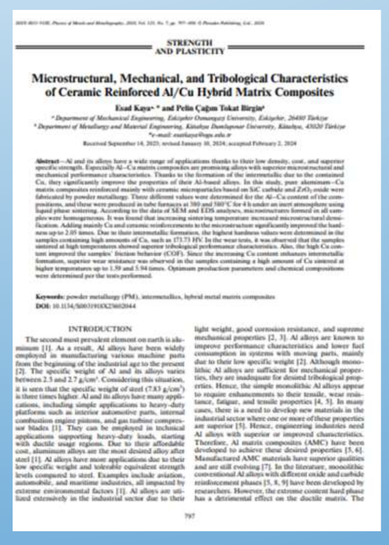

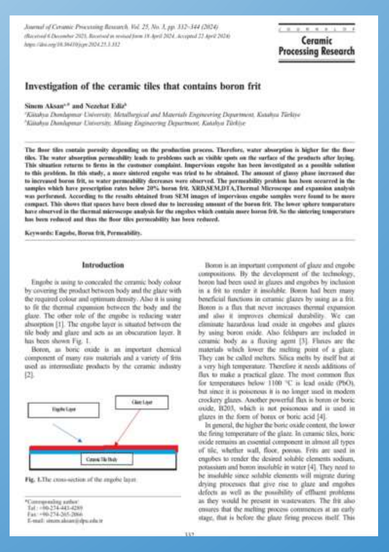

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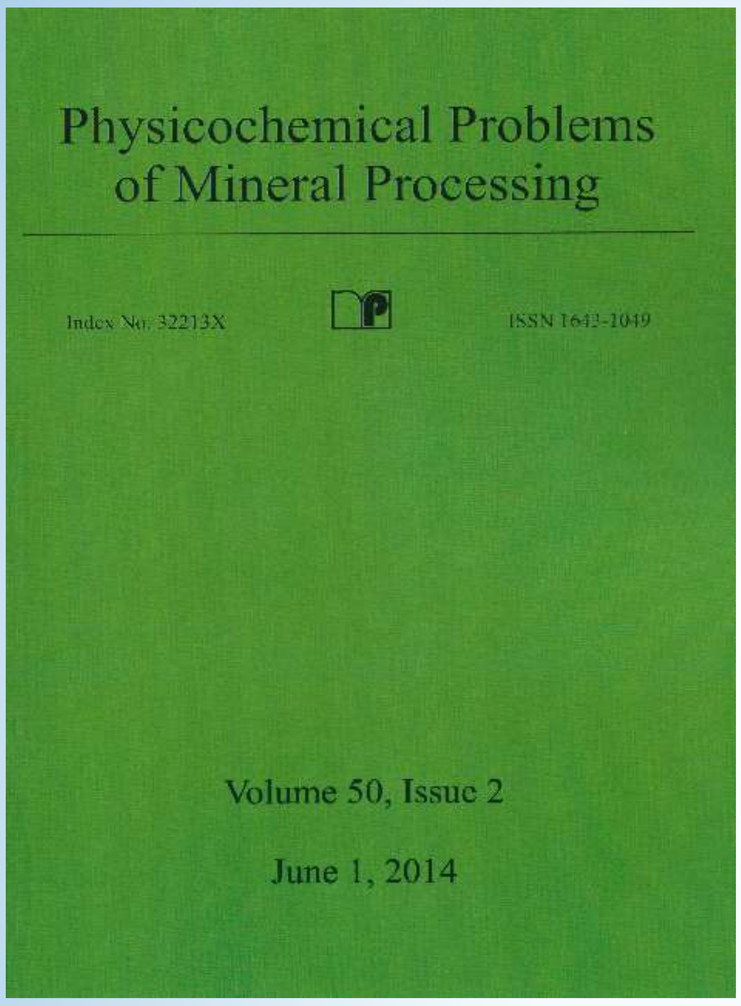

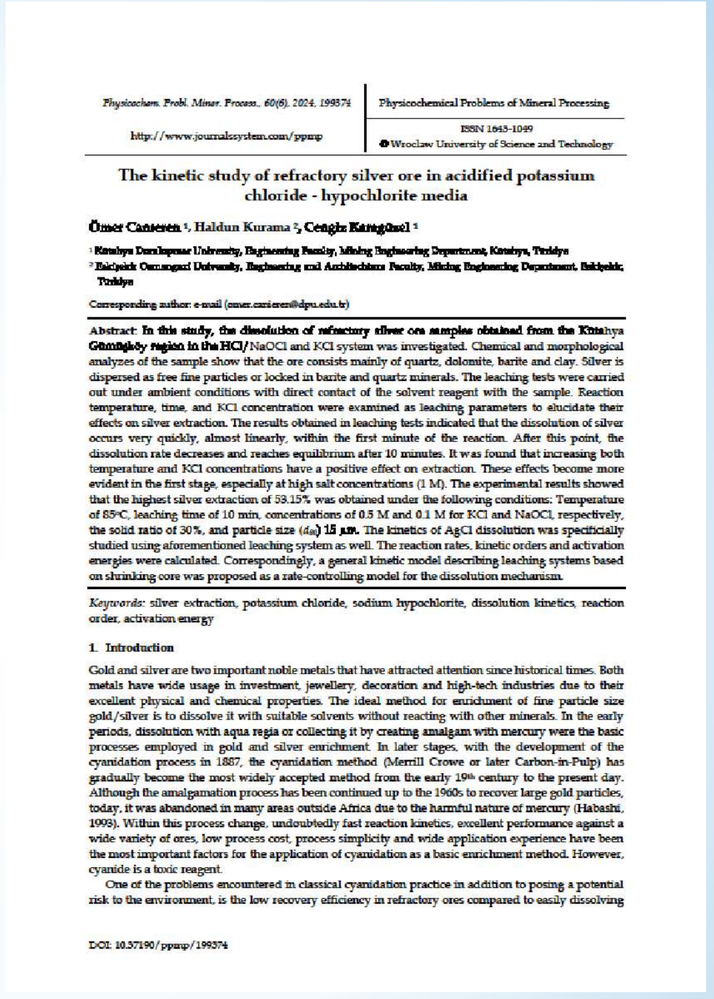
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The kinetic study of refractory silver ore in acidified potassium chloride - hypochlorite media

Ömer Cantürk [1], Haldun Kurama [2], Cengiz Kantürk [1]

[1] Kütahya Dumlupınar University, Engineering Faculty, Mining Engineering Department, Kütahya, Türkiye
[2] Hacettepe Osmangazi University, Engineering and Architechture Faculty, Mining Engineering Department, Eskişehir, Türkiye

Corresponding author: e-mail (omer.canturk@dpu.edu.tr)

Abstract: **In this study, the dissolution of refractory silver ore samples obtained from the Kütahya Gümüşköy region in the HCl/**NaOCl and KCl system was investigated. Chemical and morphological analyzes of the sample show that the ore consists mainly of quartz, dolomite, barite and clay. Silver is dispersed as free fine particles or locked in barite and quartz minerals. The leaching tests were carried out under ambient conditions with direct contact of the solvent reagent with the sample. Reaction temperature, time, and KCl concentration were examined as leaching parameters to elucidate their effects on silver extraction. The results obtained in leaching tests indicated that the dissolution of silver occurs very quickly, almost linearly, within the first minute of the reaction. After this point, the dissolution rate decreases and reaches equilibrium after 10 minutes. It was found that increasing both temperature and KCl concentrations have a positive effect on extraction. These effects become more evident in the first stage, especially at high salt concentrations (1 M). The experimental results showed that the highest silver extraction of 53.15% was obtained under the following conditions: Temperature of 85°C, leaching time of 10 min, concentrations of 0.5 M and 0.1 M for KCl and NaOCl, respectively, the solid ratio of 30%, and particle size (d_{80}) **15 µm.** The kinetics of AgCl dissolution was specifically studied using aforementioned leaching system as well. The reaction rates, kinetic orders and activation energies were calculated. Correspondingly, a general kinetic model describing leaching systems based on shrinking core was proposed as a rate-controlling model for the dissolution mechanism.

Keywords: silver extraction, potassium chloride, sodium hypochlorite, dissolution kinetics, reaction order, activation energy

1. Introduction

Gold and silver are two important noble metals that have attracted attention since historical times. Both metals have wide usage in investment, jewellery, decoration and high-tech industries due to their excellent physical and chemical properties. The ideal method for enrichment of fine particle size gold/silver is to dissolve it with suitable solvents without reacting with other minerals. In the early periods, dissolution with aqua regia or collecting it by creating amalgam with mercury were the basic processes employed in gold and silver enrichment. In later stages, with the development of the cyanidation process in 1887, the cyanidation method (Merrill Crowe or later Carbon-in-Pulp) has gradually become the most widely accepted method from the early 19th century to the present day. Although the amalgamation process has been continued up to the 1960s to recover large gold particles, today, it was abandoned in many areas outside Africa due to the harmful nature of mercury (Habashi, 1993). Within this process change, undoubtedly fast reaction kinetics, excellent performance against a wide variety of ores, low process cost, process simplicity and wide application experience have been the most important factors for the application of cyanidation as a basic enrichment method. However, cyanide is a toxic reagent.

One of the problems encountered in classical cyanidation practice in addition to posing a potential risk to the environment, is the low recovery efficiency in refractory ores compared to easily dissolving

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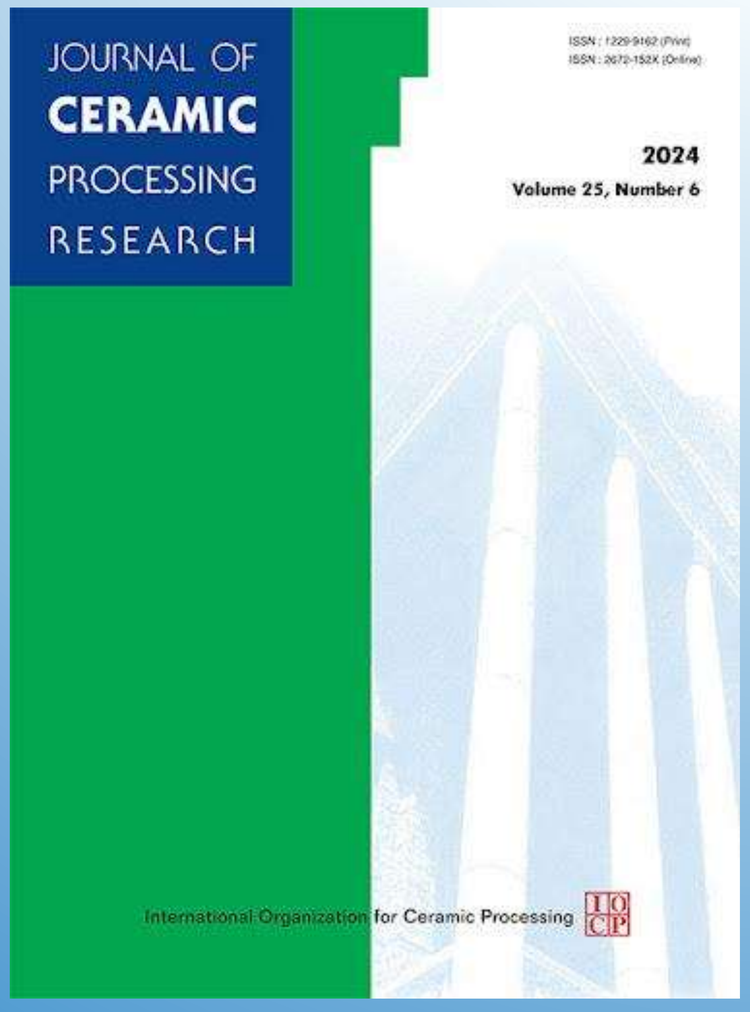

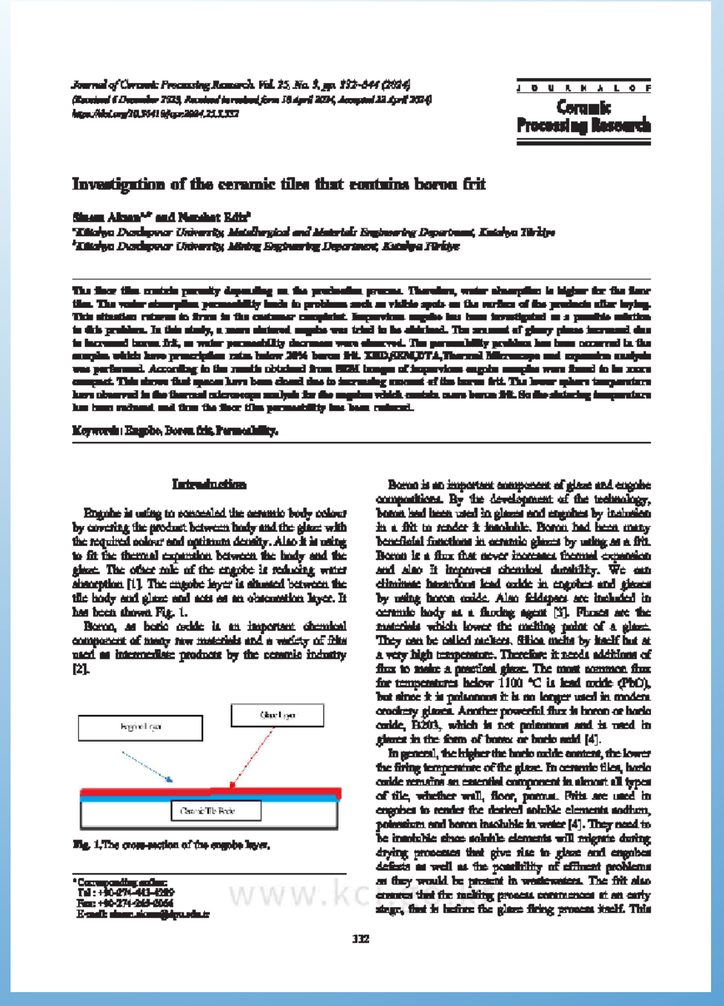
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Investigation of the ceramic tiles that contains boron frit

Sinan Akkaş[a,*] and Nazmiye Edit[b]
[a]Kütahya Dumlupınar University, Metallurgical and Material Engineering Department, Kütahya Türkiye
[b]Kütahya Dumlupınar University, Mining Engineering Department, Kütahya Türkiye

The floor tiles contain porosity depending on the production process. Therefore, water absorption is higher for the floor tiles. The water absorption permeability leads to problems such as visible spots on the surface of the products after laying. This situation returns to them as the customer complaint. Impervious engobe has been investigated as a possible solution to this problem. In this study, a more sintered engobe was tried to be obtained. The amount of glassy phase increased due to increased boron frit, as water permeability decreases were observed. The permeability problem has been occurred in the samples which have prescription ratio below 20% boron frit. XRD,SEM,DTA,Thermal Microscope and expansion analysis was performed. According to the results obtained from SEM images of impervious engobe samples were found to be more compact. This shows that spaces have been closed due to increasing amount of the boron frit. The hemi sphere temperatures have observed in the thermal microscope analysis for the engobes which contain more boron frit. So the sintering temperature has been reduced and thus the floor tiles permeability has been reduced.

Keywords: Engobe, Boron frit, Permeability.

Introduction

Engobe is using to concealed the ceramic body colour by covering the product between body and the glaze with the required colour and optimum density. Also it is using to fit the thermal expansion between the body and the glaze. The other role of the engobe is reducing water absorption [1]. The engobe layer is situated between the tile body and glaze and acts as an obscuration layer. It has been shown Fig. 1.

Boron, as boric oxide is an important chemical component of many raw materials and a variety of frits used as intermediate products by the ceramic industry [2].

Fig. 1.The cross-section of the engobe layer.

*Corresponding author:
Tel : +90-274-443-4289
Fax: +90-274-265-2066
E-mail: sinan.akkas@dpu.edu.tr

Boron is an important component of glaze and engobe compositions. By the development of the technology, boron had been used in glazes and engobes by inclusion in a frit to render it insoluble. Boron had been many beneficial functions in ceramic glazes by using as a frit. Boron is a flux that never increases thermal expansion and also it improves chemical durability. We can eliminate hazardous lead oxide in engobes and glazes by using boron oxide. Also feldspars are included in ceramic body as a fluxing agent [3]. Fluxes are the materials which lower the melting point of a glaze. They can be called melters. Silica melts by itself but at a very high temperature. Therefore it needs additions of flux to make a practical glaze. The most common flux for temperatures below 1100 °C is lead oxide (PbO), but since it is poisonous it is no longer used in modern crockery glazes. Another powerful flux is boron or boric oxide, B_2O_3, which is not poisonous and is used in glazes in the form of borax or boric acid [4].

In general, the higher the boric oxide content, the lower the firing temperature of the glaze. In ceramic tiles, boric oxide remains an essential component in almost all types of tile, whether wall, floor, porous. Frits are used in engobes to render the desired soluble elements sodium, potassium and boron insoluble in water [4]. They need to be insoluble since soluble elements will migrate during drying processes that give rise to glaze and engobes defects as well as the possibility of effluent problems as they would be present in wastewaters. The frit also ensures that the melting process commences at an early stage, that is before the glaze firing process itself. This

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Bu Kitap Cumhuriyetimizin 100. yılı Anısına Kütahya Dumlupınar Universitesinin '100.Yılımızda 100 Kitap' Projesinde Listelenmektedir.

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8. BÖLÜM
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DOÇ. DR. ENES ZENGİN

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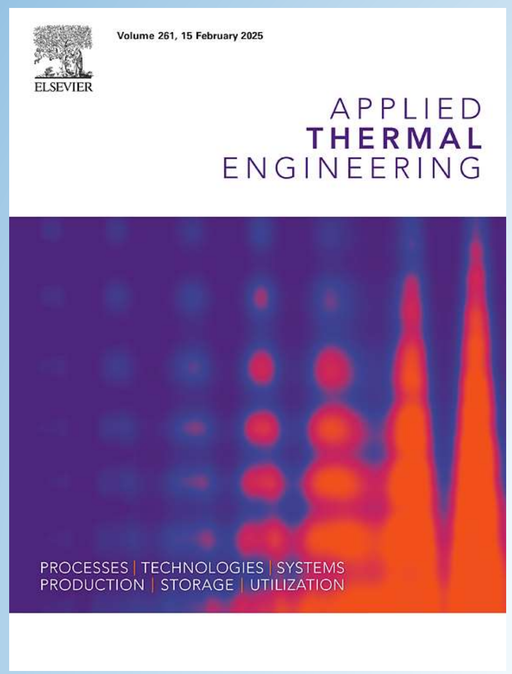

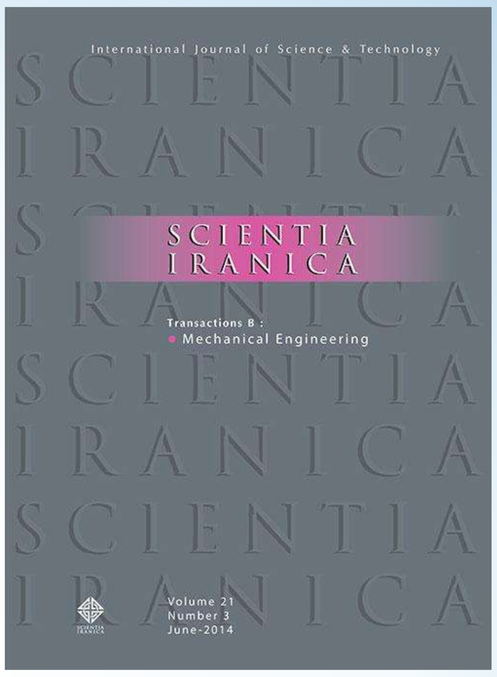

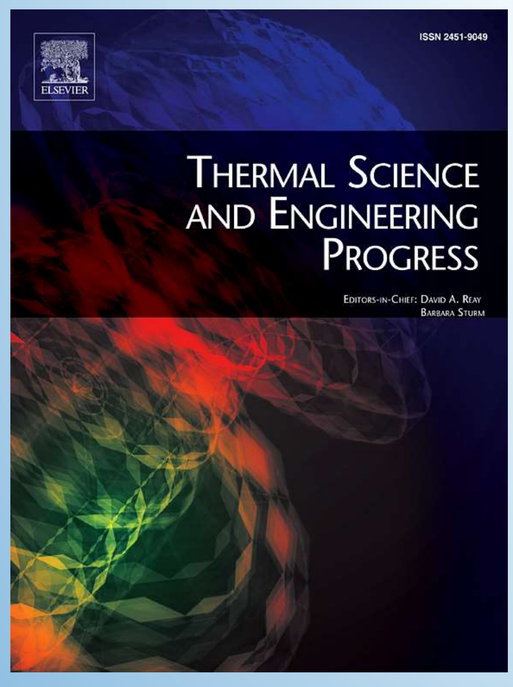

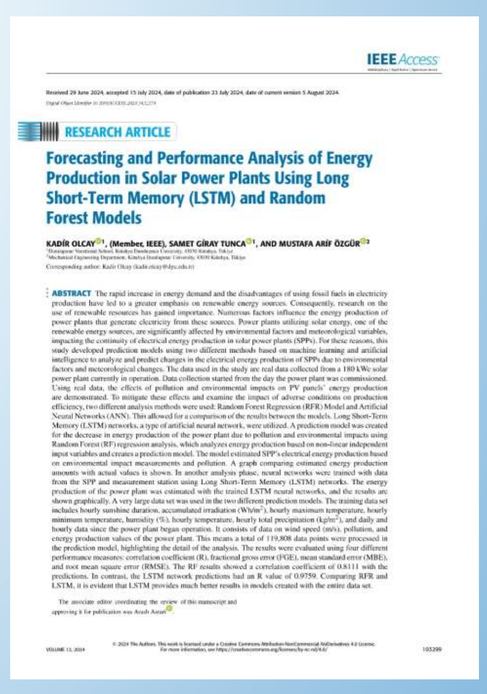

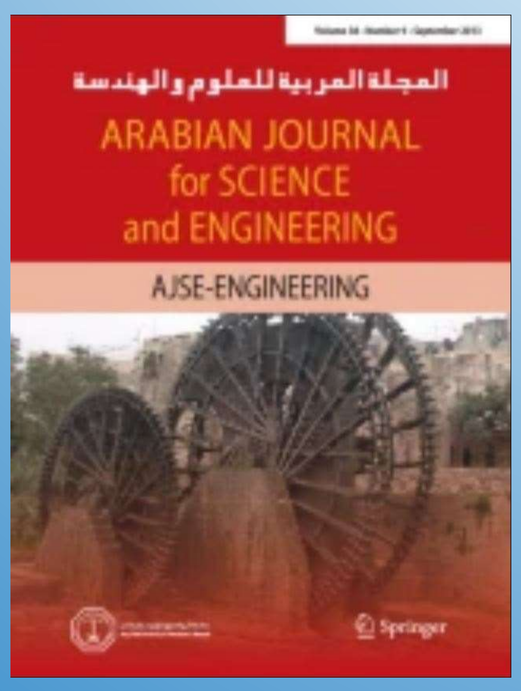

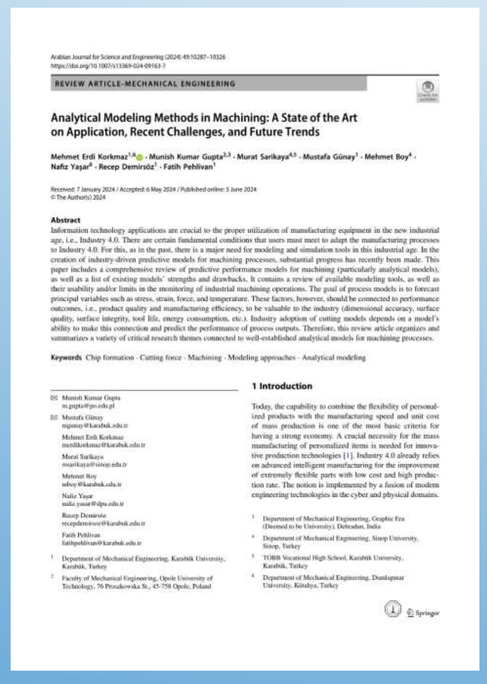

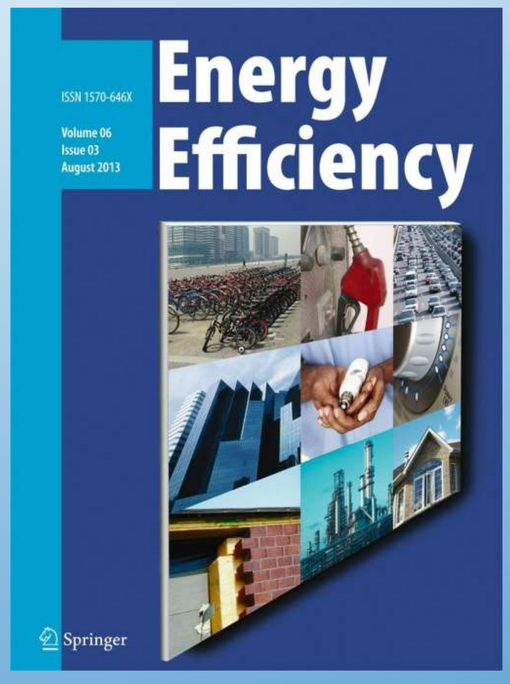

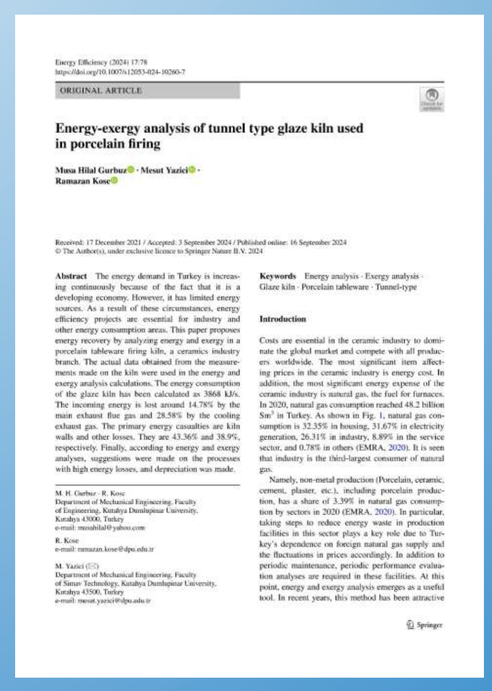

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Pure Appl Geophys
Pure and Applied Geophysics

Soil Characterization Using HVSR and MASW Techniques: A Case Study (Kütahya Dumlupınar University Campus)

Hatice Dumanı[1]


Chemical Geology 668 (2024) 122349
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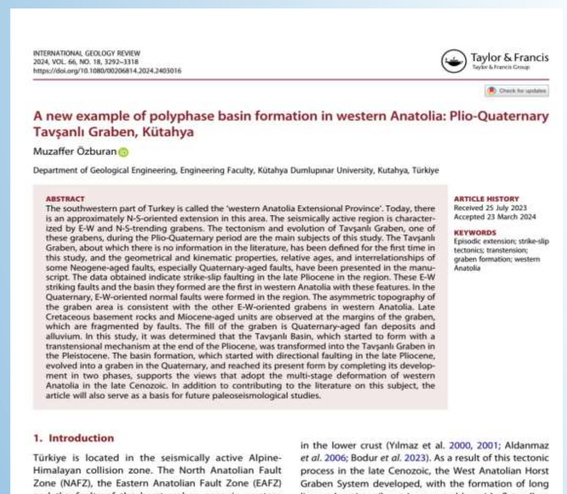
Helium and carbon isotope compositions of thermal fluids in the northeastern Anatolia: Implications for the heat source and volatile flux

Harun Aydin[a,*], Hüseyin Karakuş[b], Halim Mutlu[c], Nilgün Güleç[d]


International Journal of Earth Sciences (2024) 113:187–214
ORIGINAL PAPER

The M_w = 5.8 2019 Silivri earthquake, NW Turkiye: is it a warning beacon for a big one?

Murat Utkucu[1] · Fatih Utkucu[1] · Hatice Durmuş[2] · Süleyman Sami Nalbant[3] · Cengiz İpek[2] · Şefik Ramazanoğlu[4]


INTERNATIONAL GEOLOGY REVIEW
2024, VOL. 66, NO. 18, 3292–3318
https://doi.org/10.1080/00206814.2024.2403016
Taylor & Francis

A new example of polyphase basin formation in western Anatolia: Plio-Quaternary Tavşanlı Graben, Kütahya

Muzaffer Özburan


INTERNATIONAL JOURNAL OF ENVIRONMENTAL ANALYTICAL CHEMISTRY
2024, VOL. 104, NO. 18, 6782–6804
https://doi.org/10.1080/03067319.2022.2154661
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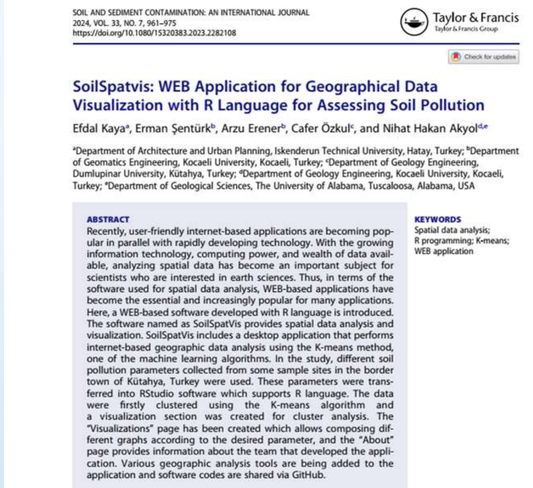
Spatial distribution and ecological risk assessment of heavy metals contamination of urban soils within Uşak, western Turkiye

Umit Yildiz and Cafer Ozkul[b]


SOIL AND SEDIMENT CONTAMINATION: AN INTERNATIONAL JOURNAL
2024, VOL. 33, NO. 7, 961–975
https://doi.org/10.1080/15320383.2023.2282108
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SoilSpatvis: WEB Application for Geographical Data Visualization with R Language for Assessing Soil Pollution

Efdal Kaya[a], Erman Şentürk[b], Arzu Erener[b], Cafer Özkul[c], and Nihat Hakan Akyol[d,e]


Environ Geochem Health (2024) 46:58
https://doi.org/10.1007/s10653-024-01856-0
ORIGINAL PAPER

Heavy metals contamination and ecological risks in agricultural soils of Uşak, western Türkiye: a geostatistical and multivariate analysis

Umit Yildiz · Cafer Ozkul


Middle Eocene Climatic Optimum (MECO): The first record based on planktonic foraminifera and stable isotopes from SW Anatolia/Türkiye

Deniz İbilioğlu[1*] and Fatih Köroğlu[2, 3*]


SOIL AND SEDIMENT CONTAMINATION: AN INTERNATIONAL JOURNAL
2024, VOL. 33, NO. 7, 1117–1133
https://doi.org/10.1080/15320383.2023.2296527
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Sorption and transport of atrazine for stable manure-amended agricultural soil from Kahramanmaraş, Turkey

Mustafa Emre Tuncel[a], Umit Yildiz[b], Yusuf Uras[a], Gokce Akyol[c], Cafer Ozkul[c], and Nihat Hakan Akyol[d,e]

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Fakülte Projeleri

Proje Adı	Destekleyen Kuruluş	Proje Çalışanları
Üç Boyutlu Yazıcı Kullanarak Oluşturulan Prototipin Rüzgar Tünelinde İncelenmesi: Aerodinamik Testlerde Yenilikçi Bir Yaklaşım	Kütahya Dumlupınar Üniversitesi-BAP	Dr. Öğr. Üyesi Abdullah KEÇECİLER Prof. Dr. Mustafa Arif ÖZGÜR Dr. Öğr. Üyesi Onur KOŞAR Araş. Gör. Kaan Can AKBABA
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Hazırlık Ve Tasıma Süreli Öğrenme Etkisi Tabanlı Melez Akış Tipi Çizelgeleme Probleminin Çözümü için Çok Amaçlı Genetik Algoritma Tabanlı Karar Destek Sistemi: Bir Üretim Tesisinde Vaka Çalışması	TÜBİTAK/1002	Doç. Dr. Derya DELİKTAŞ Mahide TEKÇE
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DPU TTO 2. Ar-Ge Proje Pazarı	Türkiye Bilimsel ve Teknolojik Araştırma Kurumu (TÜBİTAK)	Doç. Dr. Durmuş ÖZDEMİR
		Toplam Bütçe: 803.629,60 TL
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3000M İrtifaya Ulaşabilen Model Roketin Aviyonik Ve Mekanik Tasarımı	TÜBİTAK / 2209-A	Akademik Danışman Dr. Öğr. Üyesi İnci UMAKOĞLU Yürütücü Öğrenci Ilgar BENLİ Proje Ortağı Muzaffer ÖZKOÇ Proje Ortağı Burak AKDEMİR
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İHA ile Derin Öğrenme Yardımlı Kaçak Yapılaşma Tespiti	TÜBİTAK / 2209-A	Yürütücü: Emine Aydın, Araştırmacılar: Ezgi Karaduman, Mustafa Sait Başak, Danışman: Doç. Dr. Mustafa Namdar
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Gömülü Cihazlar Üzerinde Derin Öğrenme ile Mikroskobik İdrar İçeriğinin Belirlenmesi	Kütahya DPÜ-BAP	Proje Yürütücüsü Prof. Dr. Hamdi Melih SARAOĞLU , Yardımcı Araştırmacı Dr. Öğr. Üyesi Kadir VARDAR , Yardımcı Araştırmacı Doç. Dr. Ömer Faruk ÖZER , Yardımcı Araştırmacı Mühendis Yunus Emre YÖRÜK , Yardımcı Araştırmacı Mühendis Mert AYSOY , Yardımcı Araştırmacı Mühendis Enes Abdüllatif YAKACI
		Toplam Bütçe:168.600TL

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Proje Adı	Destekleyen Kuruluş	Proje Çalışanları
Bor Temelli İleri Teknoloji Seramik Kompozisyonların Sentezi, Karakterizasyonu ve Süperkapasitör Elektrot Malzemesi Olarak Kullanımının Araştırılması Tamamlandığı Tarih: 13.06.2024 Harcanan Bütçe 477.172,97 TL	DPU-BAP	*Proje Yürütücüsü* Prof. Dr. Mustafa TUNCER *Yardımcı Araştırmacı* Prof. Dr. Emre ERDEM Araş. Gör. Dr. Sait ALTUN
Düşük Maliyetli Seramik Pigment Üretiminde Demir İçerikli Endüstriyel Atıklarının Kullanımının Araştırılması Tamamlandığı Tarih: 28-08-2024 Harcanan Bütçe 67.427 TL	DPU-BAP	*Proje Yürütücüsü* Prof. Dr. Eda TAŞÇI , *Yardımcı Araştırmacı* Dr. Öğr. Üyesi Muhterem KOÇ
		Toplam Bütçe:544.599,97 TL
Standardization and Digitalization of Rescue Education in Mining	Türkiye Ulusal Ajansı	Prof. Dr. Oktay ŞAHBAZ Prof. Dr. Hakan AYKUL Prof. Dr. Kaan ERARSLAN Dr. Öğr. Üyesi Nagihan YAĞMUR Doç. Dr. Özer ÖREN Öğr. Gör. Vehbi Onur DEMİRCİLER Arş. Gör. Beyza İNCEÇAM Dr. Öğr. Üyesi Tayfun ŞENGÜL
VR/AR Teknolojileri Kullanılarak Madenlerde Arama Kurtarma Eğitimi	Kütahya Dumlupınar Üniversitesi - BAP	Prof. Dr. Oktay ŞAHBAZ Prof. Dr. Kaan ERARSLAN Prof. Dr. Cengiz KARAGÜZEL Prof. Dr. Hakan AYKUL Doç. Dr. Özer ÖREN Dr. Öğr. Üyesi Mehmet ÖZDEMİR Dr. Öğr. Üyesi Nagihan YAĞMUR Arş. Gör. Mehmet Ali DURSUN Arş. Gör. Beyza İNCEÇAM
Yüksek Basınçlı Öğütme Sistemlerinde Kırılma Dağılım Fonksiyonunun Ayrık Elemanlar Yöntemi (AEY) İle Belirlenmesi	Kütahya Dumlupınar Üniversitesi - BAP	Prof. Dr. Ali UÇAR Prof. Dr. Ahmet Hakan BENZER Doç. Dr. Hakan DÜNDAR Arş. Gör. Dr. Sevgi KARACA
Eti Maden Rize -Çayeli Bakır Sahası Araştırma ve Değerlendirme Projesi	Eti Maden İşletmeleri Genel Müdürlüğü	Prof. Dr. Zeynal Abiddin ERGÜLER Doç. Dr. Hüseyin KARAKUŞ Prof. Dr. Önder UYSAL Dr. Öğr. Üyesi Sunay BEYHAN
Mermer Tehlikesiz Atık Geri Dönüşüm Tesisi Uygunluk Araştırma Projesi	Atlı Grup DanışmanlıkMühendislik Teknik ve Eğitim Hizm. İnş. Oto. Orm. Ür. San ve Ltd. Şti.	Prof. Dr. Cengiz KARAGÜZEL Prof. Dr. Hasan GÖÇMEZ
Manganez Zenginleştirme Tesisi Atıklarının Asit Üretim Potansiyelinin Belirlenmesine ve Çözüm Önerilerine Yönelik Proje	Hızal Nak. Tur. İnşaat ve Dış Ticaret Ltd.	Prof. Dr. Cengiz KARAGÜZEL Doç. Dr. Özer ÖREN Dr. Öğr. Üyesi Uğur DEMİR Dr. Öğr. Üyesi Ömer CANIEREN
		Toplam Bütçe: 1.970.000 TL + 184.368 €
Güncel Aerodinamik Problemlerin Rüzgar Tüneli İle Deneysel Analizleri	Kütahya Dumlupınar Üniversitesi -Önap	<u>Yürütücü</u> Prof. Dr. Mustafa Arif ÖZGÜR <u>Yardımcı Araştırmacılar</u> Prof. Dr. Ramazan KÖSE, Dr. Öğr. Üyesi Onur KOŞAR Dr. Öğr. Üyesi Abdullah KEÇECİLER Öğr. Gör. Samet Giray TUNCA.
	Toplam Bütçe:	