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Editorial – Preface to the Special Issue on Numerical Techniques Meet with OR

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Abstract. This special issue of the Foundations of Computing and Decision Sciences, titled *"Numerical Techniques Meet with OR"*, is devoted to the numerical techniques and their applications in real-world phenomena. The special issue and its editorial present numerical algorithms as they meet with different research topics such as, e.g., from operational research, supply chain management, geometrical structures and Covid-19 effects on financial applications. Besides, the special issue covers instructional information about numerical techniques which are useful for OR research problems and real-world applications on such issues.

1. Introduction

Numerical methods play an important role in Operational Research (OR) problems. They apply in various branches of economics, finance, management, physics, biology, medicine, earth sciences, etc. Currently, new technologies and methodologies provide an opportunity to further advance those numerical methods. Wide fields of problem-solving techniques and procedures applied in OR are given by simulation and mathematical optimization, Markov decision processes, econometric methods, data envelopment analysis, neural networks, and decision analysis. Such methodologies are developed within the overlapping fields between Numerical Techniques in Operational Research. The rapidly growing interest in numerical techniques provides new developments in the field of OR and its applications. This has triggered the advancement of innovative mathematical methods and algorithms, aiding to solve some of the most complicated and hard problems in the areas of the OR.

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2. Published Research

The special issue "Numerical Techniques Meet with OR" contains 13 accepted manuscripts for publication after careful reviewing processes. The aim of the exclusive collection of papers are mainly to introduce the numerical approaches for the OR studies as well as their connection to the different fields. The special issue has been divided into two parts. At the first part, we have first seven published original research articles as they are mentioned in paragraphs, respectively which is in the Vol. 46, No. 1, 2021. The second part of the special issue contains the last six original research articles which is included in Vol. 46, No. 3, 2021.

The paper of Salima Nait Belkacem on "An Algorithm for Choosing, Ordering According a New Criteria and Solving a Minimum Cost-Flow Problem with Bi-objective Optimization" (employing, e.g., Nait-Belkacem, 2007, Kalaycı et al., 2020) provides a new perspective to the simplex network method, Ford Fulkerson's algorithm, to gain cycles, applied on a bi-objective minimum cost flow problem. The algorithm obtains to get a good order of many criteria in a rapid and an efficient way. Then together with the classification for the optimal area structure, it becomes possible to choose the best action in the objective space.

The paper of Alireza Goli et al. present "An Integration of Neural Network and Shuffled Frog-Leaping Algorithm for CNC Machining Monitoring" which is about the Acoustic Emission (AE) from Computer Numerical Control (CNC) machining operations (cf., e.g., Babaee Tirkolaee et al., 2020). Experimental measurements are performed on the CNC lathe sensors to provide the power consumption data. To this end, a hybrid methodology based on the integration of an Artificial Neural Network (ANN) and a Shuffled Frog-Leaping Algorithm (SFLA) is applied to data resulting from these measurements for data fusion from the sensors. This combination is called SFLA-ANN. The initial weights of ANN are selected using SFLA. The goal is to assess the potency of the signal periodic component among these sensors. The efficiency of the proposed SFLA-ANN method is analyzed and compared to hybrid methodologies of Simulated Annealing (SA) algorithm and ANN (SA-ANN) and Genetic Algorithm (GA) and ANN (GA-ANN).

Our special issue aims to show applications of diverse models so that Vasiliy Lemenkov et al. present "Using TEX Markup Language for 3D and 2D Geological Plotting" which is a technical application on of TEX high-level, descriptive markup language for processing geological dataset from soil laboratory. Geotechnical measurements underlying included equivalent soil cohesion, absolute and absolute deformation index, soil compressibility coefficient by time of immersion depth, exposure time to compressive strength to samples and physical and mechanical properties (humidity, density) (Sen et al. 2005, Zheng et al. 2020). The dataset was received from laboratory based experimental tests of physical and mechanical properties of soils. The data were converted to csv table and processed by LATEX. Methodology is based on LATEX packages: ftikzg, ftikz-3dplotg, ftikzpictureg, fpgfplotg, flecontetnsg, fspyg for 3D plotting, showing correlation in variables and descriptive statistical analysis based on the data array processing. Then LATEX scripts and graphics: 2D and 3D scatterplots, ternaries, bar charts, boxplots, zooming techniques detailing fragment

of the plot, flowchart results are shown. The technical approach of TEX language application for geological data processing and graphical visualization gives novelty to this research field. Besides, engineering graphics by TEX are demonstrated with screenshots of the codes used for plotting.

Tuba Ağırman Aydın et al. elaborate about "Morgan-Voyce Polynomial Approach for Quaternionic Space Curves of Constant Breadth". In this paper, the curves of constant width are special curves which are of practical importance in engineering, architecture and technology (cf. Türkyılmaz et al., 2016). These curves are considered according to different roofs in different spaces, and some integral characterizations of these curves are obtained. However, in order to examine the geometric properties of curves of constant width, more than a characterization is required. In this study, firstly differential equations characterizing quaternionic space curves of constant width are obtained. Then, the approximate solutions of the differential equations obtained are calculated by the Morgan-Voyce polynomial approach. The geometric properties of this curve type are examined with the help of these solutions.

Joseph Gogodze presents "Revealed Comparative Advantage Method for Solving Multicriteria Decision-Making Problems". Herein, a new method is introduced for the post-Pareto analysis of multicriteria decision-making (MCDM) problems (cf. Velasquez et al., 2013): the revealed comparative advantage (RCA) assessment method. An interesting feature of the suggested method is that it uses the solution to a special eigenvalue problem and can be considered an analogue or modification in the MCDM context of well-known ranking methods including the authority-hub method, PageRank method, etc., which have been successfully applied to such fields like economics, bibliometric and web search design. For illustrative purposes, this study discusses a particular MCDM problem to demonstrate the practicality of the method. The theoretical considerations and conducted calculations reveal that the RCA assessment method is self-consistent and easily implementable. Moreover, comparisons with well-known tools of an MCDM analysis shows that the results obtained using this method are appropriate and competitive. An important particularity of the RCA assessment method is that it can be useful for decision-makers in the case in which no decision-making authority is available or when the relative importance of various criteria has not been preliminarily evaluated.

Esmehan Uçar et al. point out with their study "Investigation of E-cigarette Smoking Model with Mittag-Leffler Kernel" that smoking is the most lethal social poisoning event (Kuga et al., 2020, Bathrinarayanan et al., 2018). The World Health Organization defines smoking as the most important preventable cause of disease. Around 4.9 million people worldwide die from smoking every year. This paper analyzes that matter and it investigates an e-cigarette smoking model with Atangana-Baleanu fractional derivative. Then it authors find conditions of existence for this fractional model utilizing fixed-point theory. After giving these existence conditions, some numerical results are introduced, supported by illustrative graphics.

Veysel Fuat Hatipoğlu describes an important subject on COVID-19 and OR applications and his study is titled "Understanding the Impact of COVID-19 on Global Financial Network Using Graph Based Algorithm: Minimum Spanning Tree Approach" (referring to Aslam et al., 2020, Kazemilari, 2017). In this paper, effects of COVID-

19 pandemic on stock market network are analyzed by an application of Operational Research with a mathematical approach. For this purpose two minimum spanning trees for each time period, namely before and during COVID-19 pandemic, are constructed. Dynamic time warping algorithm is used to measure the similarity between each time series of the investigated stock markets. Then, clusters of investigated stock markets are constructed. Numerical values of the topology evaluation for each cluster and time period is computed.

H. Kuşak Samancı et al. present "Some Characterizatons of the Harmonic and Harmonic 1-Type Curves in Euclidean 3-Space". The main purpose of the paper is to compute some new characterizations of space curves by using the N-Bishop frame in Euclidean 3-space (cf. Kocayiğit et al., 2011). Furthermore, some differential equation characterizations of the harmonic and harmonic 1-type curves, N-Bishop Darboux and normal Darboux are investigated, and some results regarding the condition of the helix are given.

Tuba Ağırman Aydın et al. present "Legendre Matrix Method for Legendre Curve in Sasakian 3-Manifold". In this study, unit-speed Legendre curves are introduced in Sasakian 3-manifold (cf. Legendre, 2011). At first differential equations characterizing Legendre curves are described and Legendre matrix collocation method is introduced in order to obtain approximate solutions of them. In addition, the geometric properties of this curve type are examined and a sample application is given.

Bekir Tanay et al. introduce "A Soft Interval Based Decision Making Method and Its Computer Application" (addressing Babaee Tirkolaee et al., 2020, Vahdani et al., 2013, Yue et al., 2013). The authors are present a valuable subject on decision making including complex data and as an application on soft set theory. The initial idea of this application is to report about a comparison of soft intervals (SI) as the generalization of interval soft sets (ISS). Then together with the comparison of the results that SIs are more effective than the ISSs is seen. A tabular form of SIs is used to construct a mathematical algorithm providing a decision for problems that involve uncertainties. Since these kinds of problems base on huge data, constructing new and effective methods for solving these problems and transforming them into machine learning methods is very important. An important advance of the presented method is being more general than the decision-making methods that base on special situations of soft set theory. The offered method can be used for all of them, while the others only apply in special cases. The structures obtained from the results of soft intervals are subjected to tests with examples. The designed algorithm is written in recently used functional programing language C# and applied to problems that have been published in earlier studies. This is a pioneering study, where this type of mathematical algorithm is coded and applied successfully.

Ayşe Anapalı Şenel et al. presents "New Numerical Approach for Solving Abel's Integral Equations". In this work, a numerical method for solving Abel's integral equations including the fractional derivatives is introduced (cf. Singh et al. 2009, Gürbüz et al. 2016). The numerical method is described by using Taylor expansions of the solution function and fractional derivatives and substituting their matrix forms into the equation. The main characteristic behind the approach employing this technique is that it reduces such problems to those of solving a system of algebraic

equations, thus greatly simplifying the problem. Numerical examples are offered to illustrate the preciseness and effectiveness of the new method.

Burcu Gürbüz introduces "A computational technique for solving singularly perturbed delay partial differential equations". In her study, singularly perturbed second-order delay parabolic convection-diffusion and reaction-diffusion type problems involving boundary and initial conditions are considered and their approximate solutions are obtained by a matrix method based on Laguerre series. (Here we refer to Ansari et al., 2007, Salama et al., 2017, Gürbüz et al., 2017, Gürbüz et al., 2018, Gürbüz et al., 2019, Gürbüz et al., 2020.) The approximate solution of the problem is obtained by truncated Laguerre series. Moreover, a test case is given and the error analysis is considered addressing different norms in order to show the applicability of the method.

Subsequently, Harun Yonar et al. introduce "Generalized estimating equations approach based on causality tests for evaluating countries gross domestic product data". In this study, the authors reach for the economic growth of the countries is conducted by "causality analyses" and also "generalized estimating equations" (GEEs) which is an extension of "generalized linear models" (GLMs). Eight different macro-economic variables as the gross domestic product (GDP), CO 2 emission, electricity consumption, energy use, import, export, foreign direct investment and population growth rate have been used (Zorn, 2001, Fitzmaurice et al., 2009). The countries have been categorized according to the Organization for Economic Cooperation and Development (OECD) memberships and income groups. The causes of the economic growth of these country groups have been determined by using the Toda-Yamamoto causality analysis (Toda et al., 1995). Furthermore, various GEE models have been established using not only the variables that are exactly known as the causes of the economic growth but also considered as the possible variables for the economic growth of each country group. These GEE models have been compared to examine the contribution of the causality to the statistical model establishment especially in GLMs. As a result, according to the causality analyses, GEE modeling of the economic growth profiles for each specific country group have been determined and GDP predictions are made for these groups.

3. Concluding Remarks

In this special issue, thirteen papers display miscellaneous kinds of numerical applications on the real-world problems including the topics of Operational Research topics. This collection of scientific works provides us a special opportunity to better understand the interdisciplinary approach, and to get a more visible conception of the bridges between different research fields.

As the Guest Editors we cordially thank the reviewers who provided us with essential comments during the processes of improving the manuscripts and their evaluation as well. Last but not least, we would like to express our deepest gratitude to the respected persons, who made it possible for bringing our ideas to existence, and who provided an excellent and friendly environment for this special issue. In particular,

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