

Preface

This volume is dedicated to Prof. Jaime Gil Aluja, President of the Royal Academy of Economic and Financial Sciences (RACEF—Real Academia de Ciencias Económicas y Financieras of Spain), a world famous scientific and scholarly corporation aimed at the promotion of broadly perceived economic and financial sciences as well as many related areas of science and technology exemplified by humanities and social sciences, organizational sciences, cognitive sciences, systems science, just to name a few. Among the RACEF members, there are many prominent scientists and scholars, including 10 winners of the Nobel Prize in Economics, but also many financial and political leaders from all over the world.

By dedicating this book to Prof. Gil Aluja, we, the editors, on behalf of the entire research and professional community, wish to present a small token of appreciation for his great scientific and scholarly achievements, long-time service to many scientific and professional communities, notably those involved in economics, finance and management and, more specifically, the foundations and applications of tools and techniques for dealing with uncertain, imprecise and incomplete information, notably by using fuzzy logic and possibility theory. At a more personal level, we also wish to thank him for a constant support of what we and many of our students and collaborators have been undertaking for so many years.

The volume is divided into six parts that cover main issues related to the topic of the volume. Part I, “Basic Issues in Economic, Organization and Management Systems”, deals with some basic and foundation issues in broadly perceived economic, organization, and management systems that are crucial for the understanding, analyses, and even shaping of the main aspects that concern our society and economy.

Finn E. Kydland, the winner of the Nobel Prize in Economics in 2004, in his paper “Does Policy Consistency Affect Economic Growth?” provides an in-depth analysis of some issues related to uncertainty in the economic and business environment the extent of which is extremely high in the present world, in particular over the last couple of decades. Many reasons can be quoted for this, notably a lack of clarity in economic policy making that exists in virtually all countries. It is obvious that all decisions that are meant to stimulate growth, innovation,

investments, etc., require a clarity as to the policy environment, not only now but in the future, sometimes quite distant. This can include many aspects including tax policy, spending, and debt policy, extent of trade restrictions, just to name a few. It is contended that, taking into account what has been known in economic theory, the increase in policy uncertainty over the past decade has been normal and predictable to a large extent. This claim is illustrated by an analysis of the Euro zone, the United States, and China. The lessons learnt are summarized and some possible solutions for the future are pointed out.

Fernando Casado Juan (“Perception and Reality of the Spanish Economy”) provides an insightful summary of the situation of the Spanish economy. First, the author starts by pointing out a positive state of the Spanish economy in recent years that has experienced the annual GDP growth of more than 3%. This positive situation is then analyzed, mainly by emphasizing as the main causes, paying a special attention to the strong performance of the external sector in the current global economic context. Moreover, the paper analyzes the key macroeconomic factors underpinning the Spanish economy, as well as the increase of the GDP, the public deficit, labor market, foreign investment, tourism, training, infrastructure, and company size. The author concludes his paper by highlighting the importance of the digitalization process on all aspects and areas of the economic and social life. The paper, though mainly focused on the Spanish economy, can also be very useful for people who are interested or involved in similar analyses related to other countries.

Mario Aguer Hortal (“The Virtual Company as a Value Generator in the New Economy”) is concerned with the analysis of a new techno-economic paradigm, based on an interconnected combination of technological innovations which permit the company to cope in an environment that is increasingly dynamic and uncertain, and in which people more and more work together being physically in places which are distant from each other. This increasingly common work practice, and its underlying processes, result in the creation of virtual companies, factories, offices, and virtual communities. Basically, the virtual companies are those which conduct their activities in a virtual way, in part or even fully. The most important ones among them are those dedicated to logistic operations, commerce and trade, marketing, sales, design, etc. One can distinguish three creative components that are crucial for a virtual company: intellectual capital, information and technology. Needless to say that information plays in this context a crucial role, and various aspects related to information are analyzed, exemplified by the measuring of information quality. The same can be said about communication. The author then analyzes a very important aspect of the lack of dimensionality of the virtual company itself which partly results from the absence of physical dimensions. This makes classic procedures of, for instance, accounting or evaluations difficult to apply. Moreover, the proliferation of e-commerce and the Internet usage have had an enormous impact on all aspects of corporate activities. The author indicates potentials of results from the General Theory of Systems for the analysis and synthesis of such socioeconomic systems. In general, information and the intellectual capital within the company call for a correct evaluation method and require tools and techniques for this measuring of intangible assets. The virtual company’s

absence of dimensionality makes accounting and evaluation criteria different from the traditional ones. Virtual communication need to be objective, meaningful and valuable, referring to judgments and perceptions. This all poses a challenge for research and practice.

Camilo Prado-Román, Francisco Díez-Martín, and Alicia Blanco-González (“The Origin of the Legitimacy of Organizations and Their Determining Factors”) are concerned with the analysis of to what extent personal characteristics have an influence on the assessment process of organizational legitimacy. For this purpose, a questionnaire is used which examines the effect of five personal characteristics on four types of legitimacy. Then, the regression analysis is applied on a sample of 258 individuals. The results obtained show that people with a higher social awareness are more prone to making decisions about organizations taking into account the moral, regulatory, and cognitive legitimacy. This type of assessment also occurs when the fear of receiving a social sanction increases. Likewise, in the perception of a higher economic risk inherent to the result of a decision, people are more likely to make decisions based on cognitive and pragmatic legitimacy. The results of this study extend the knowledge in the field of institutional theory about the origin of organizational legitimacy. It can also facilitate to improve the strategic planning of organizations by displaying the legitimacy preferences based on each person’s profile.

José María de-Goñi-Oslé and Arturo Rodríguez-Castellanos (“A Model for the Management in Organizations Based on People and Knowledge: Aspects to be Considered in its Design”) take as a point of departure that uncertainty and complexity in business and economic systems highlight a relevant role of people who that is crucial for the generation of intangible resources that are the source of business competitiveness. Therefore, the relevance of intangible assets and other aspects in the current society, especially those based on knowledge and people, makes them a strategic issue for the organizations. The broadly perceived intangibles are under research and study both in the academic and corporate communities. The authors consider some aspects related to the design and implementation of an efficient model for the management in organizations that is based on people and knowledge. First, an extensive review of the literature is provided, including analyses of models and their implementations. The results, especially from the observation of practical cases, suggest that there is an enormous difficulty in the timely implementation and then maintenance of these models, possibly due to difficulties that occur while evaluating their actual cost and benefits obtained. These issues are then analyzed and conclusions are provided.

Part II, “Decision Making and Systems Modeling”, provides information on some important formal tools and techniques that can be used to represent uncertainty and imprecision, model systems under consideration, and determine proper decisions or strategies.

Joan Carles Ferrer Comalat, Xavier Bertran Roura, Salvador Linares Mustarós, and Dolors Corominas Coll (“Six Experimental Activities to Introduce the Theory of Fuzzy Set”) are concerned with some important problems related to a proper presentation of the theory of fuzzy sets, the importance and potentials of which have

been justified by many studies, in a way that can best convince a potential user. The authors have presented their highly innovative approach to the presentation of the main ideas underlying the concept of a fuzzy set by employing artworks, notably pictures exhibited in a gallery.

Galyna Kondratenko, Yuriy Kondratenko, and Ievgen Sidenko (“Fuzzy Decision Making System for Model-Oriented Academia/Industry Cooperation: University Preferences”) discuss some important, and effective and efficient models of cooperation of universities and IT companies. Moreover, the authors propose a new hierarchic approach to the development of decision support systems (DSS) based on fuzzy logic that can be useful for solving the problems considered. Special attention is paid to the use of fuzzy logic in that DSS that is meant to be an advisor for choosing the most appropriate cooperation model for a certain department of a university that tries to become a partner for a certain IT company. The article features a hierarchic structure, results of rule bases, and DSS software based on an approximation of fuzzy systems with discrete output. It also contains the results of simulations of a process of developing the most rational model of cooperation of the “University—IT company” type.

Leonardo Concepción, Gonzalo Nápoles, Isel Grau, Koen Vanhoof, and Rafael Bello (“Towards the Convergence in Fuzzy Cognitive Maps Based Decision-making Models”) consider the decision-making process meant as a process to select a decision (or decisions) among a set of possible alternatives in a given decision setting. Since most real-life problems are unstructured in nature, often involving vagueness and uncertainty, it is difficult to apply exact models and that is why a good solution may be to use approximate methods based on soft computing. In recent years, the fuzzy cognitive maps have experienced much popularity and have been used in designing various decision support systems due to their capability for explaining the underlying reasoning process, including the development of learning methodologies for adjusting parameters. Less attention has been given to the map convergence and its implications in the decision process. The authors study the convergence issues of the fuzzy cognitive map based models used in decision-making. More specifically, they present a learning procedure for improving the network convergence by preserving the ordinal relation between the alternatives. Numerical simulations show a practical usefulness of the method proposed.

Michał Jakubczyk, Bogumił Kamiński, and Michał Lewandowski (“Eliciting Fuzzy Preferences Towards Health States with Discrete Choice Experiments”) are concerned with some issues related to health (quality and duration of life) that is clearly extremely important both from an individual and societal points of view. However, since people rarely choose between health states, their preferences are often not well-formed; moreover, the quality of life is frequently defined using imprecise terms. The authors propose to model preferences related to health states (precisely: disutilities of worsening health dimensions in the EQ-5D-5L descriptive system) as fuzzy, more specifically, each worsening is assigned an interval instead of a crisp number. They elicit such preferences with discrete choice experiment (DCE) data, using a maximum likelihood approach and bootstrapping to evaluate

the estimation error. The authors' approach overcomes one of the nonintuitive features of the standard approach to DCE, in which even a clearly dominated alternative has a positive probability of being chosen, in that in the authors' model, if the disutility ranges do not overlap, the worse alternative will never be chosen. Also, the model is more consistent regarding the constant proportional trade-off condition in that the probability of a given health state being chosen in a pair will not change if durations are scaled proportionally which does not hold in the standard DCE model.

Silvia Bortot, Mario Fedrizzi, Michele Fedrizzi, Ricardo Alberto Marques Pereira, and Thuy Hong Nguyen ("The Soft Consensus Model in the Multidistance Framework") investigate the reformulation of the soft dissensus measure in relation with the notion of multidistance, recently introduced by Martín and Mayor, which is an extension of the classic concept of a binary distance obtained by means of a generalization of the triangular inequality. The new soft dissensus measure introduced by the authors is a particular form of the sum-based multidistance. This multidistance is constructed on the basis of a binary distance defined by means of a subadditive scaling function which in general puts more emphasis on small distances and attenuates large distances in preferences. The authors present a detailed study of the subadditive scaling function which is analogous but not equivalent to the one used in the traditional form of the soft consensus model.

Yamilis Fernández-Pérez, Ailyn Febles-Estrada, Carlos Cruz, and José Luis Verdegay ("Fuzzy Multi-Criteria Decision Making Methods Applied to Usability Software Assessment: An Annotated Bibliography") present a very interesting analysis of the main developments in the use of fuzzy multicriteria decision-making models for the analysis of usability of software assessment. Issue related to software development, maintenance, and use is very important and costly, and therefore it is essential to assess the impact on the sustainability. An important feature is here associated with the very meaning of the software usability, and one of crucial aspects is the ease of use which is difficult to define and hence measure. The authors first analyze main recent approaches employed for this purpose. Basically, these models have evolved from the use of conventional statistical techniques and soft computing methods. In this work, the authors present a critical account of a collection of annotated bibliography entries about the characteristics, attributes, and metrics used in the usability assessment, focused on the use of soft computing techniques.

F. González Santoyo, B. Flores Romero, A. M. Gil Lafuente, J. Flores Juan, and R. Chávez Rivera ("Production Systems Optimization Using Hierarchical Planning") consider a very interesting and important problem of production planning for lumber production which is relevant for many countries, including Mexico. The authors propose a new, effective, and efficient heuristic algorithm to solve the problem of hierarchical production planning in sawmills. The proposed solution is based on the mixed integer linear programming (MILP) formulation using Benders' decomposition and the Lagrangian relaxation techniques. The new method proposed is computationally efficient, better than methods applied, as shown on numerical examples.

Yuriy P. Kondratenko, Oleksiy V. Kozlov, Galyna V. Kondratenko, and Igor P. Atamanyuk (“Mathematical Model and Parametrical Identification of Ecopyrolysis Plant Based on Soft Computing Techniques”) present the development of a mathematical model and system for the parametric identification of the ecopyrolysis (EPG) plant as a complex multi-coordinate control object using soft computing techniques. The synthesis procedure of the main parts of the EPG plant’s mathematical model, including its fuzzy parametric identification system, adaptive-network-based fuzzy inference system for the calculation of the temperature of the multiloop circulatory system (MCS), and the Mamdani type fuzzy inference system for the determination of the reactor load level are shown. The analysis of computer simulation results in the form of graphs of static and dynamic characteristics of the EPG plant confirms that the complex neuro-fuzzy model proposed is a proper solution. The developed mathematical model with the parametric identification based on neuro-fuzzy technologies gives an opportunity to investigate the behavior of the given complex control object in steady and transient modes, in particular to synthesize and adjust the intelligent controllers of the multi-coordinate automatic control system of the EPG plant.

Part III, “Intelligent Data Analysis and Processing”, provides an overview of some important and promising tools and techniques for broadly perceived data analysis that is crucial for all kinds of analyses, syntheses, and implementations in virtually all problems and settings encountered.

Andrzej Pownuk, Vladik Kreinovich, and Songsak Sriboonchitta (“Fuzzy Data Processing Beyond Min t-Norm”) are concerned with some algorithmic issues related to the use of fuzzy data. The authors show that though the use of the minimum as an operation corresponding to “and”, which is widely employed notably while using Zadeh’s extension principle, can give good results, the use of other triangular norms (t-norms) can also be a viable and effective and efficient solution.

Leszek J. Chmielewski and Arkadiusz Orłowski (“Detecting Changes in Time Sequences with the Competitive Detector”) discuss and then extend the concept of the competitive edge detector which, in the case of one-dimensional signals, can be denoted as the detector of changes. In such a detector, two approximators are used, one working on the “past” and one working on the “future” side of the considered data point. The difference of their outputs makes it possible to find the change of the value and the derivative of the signal. The new features introduced consist in performing a robust analysis and in adding an option to use a quadratic function as an approximator. A weighted voting of elementary subsets is used with weights related to the significance of a subset for the result. Results of change detection on test data as well as some real-life economic data are encouraging.

Vikas Singh and Nishchal K. Verma (“Deep Learning Architecture for High-Level Feature Generation Using Stacked Auto Encoder for Business Intelligence”) consider a crucial problem in the present day science and technology which is related to huge data sets that are commonly encountered and have to be handled. The handling of such large amount of data by conventional machine learning algorithms is difficult because of their usually heterogeneous nature and large size.

Deep learning, a new direction in machine learning, meant to deal with such heterogeneous nature and large size of data and to extract high-level representations of data through a hierarchical learning process, can be a viable and promising tool in this context. The authors propose a novel multilayer feature selection model with the conjunction of a stacked auto-encoder (SAE) to extract high-level features or representations, and eliminate lower level features or representations from data. The proposed approach is validated on the Farm Ads dataset and the result is compared with various conventional machine learning algorithms. The proposed approach has outperformed conventional machine learning algorithms for the given dataset.

Daniela Sánchez, Patricia Melin, and Oscar Castillo (“Comparison of Type-2 Fuzzy Integration for Optimized Modular Neural Networks Applied to Human Recognition”) present optimization techniques for the Modular Neural Networks (MNNs) and their combination with a granular computing approach. A Firefly Algorithm (FA) and a Grey Wolf Optimizer (GWO) are developed to perform the MNN optimization. These algorithms perform the optimization of some parameters of the MNN such as the number of submodules, percentage of information for the training phase and number of hidden layers (with their respective number of neurons) for each submodule and learning algorithm. The MNNs are applied to human recognition based on the face, iris, ear, and voice. The minimization of the recognition error is the objective function. To combine the responses of the MNNs, different type-2 fuzzy inference systems are proposed and a comparison of results is performed.

Part IV, “Sustainability”, is devoted to the discussion of various aspects of broadly perceived sustainability that is one of the most widely used terms in various scientific, political, economic, etc., discussions. Briefly speaking, it concerns various ways of how human societies, maybe more generally various systems, can survive, endure, and prosper in the conditions of global changes, overwhelming uncertainty, ecosystem degradation, social and political unrest, resource limitations, to just name a few.

Gorkhmaz Imanov (“Fuzzy Measure of National Sustainable Development Aggregate Index”) proposes a fuzzy measure of a national sustainable development aggregate index (NSDAI) taking into account subindices of economic, social and environmental sustainability. The discussion is illustrated by examples corresponding to Azerbaijan. The author uses for measuring the subindices some elements of the intuitionistic fuzzy set, generalized entropy measure of intuitionistic fuzzy set, Zadeh’s compositional rules of inferences, etc. Then, using the fuzzy method of forgotten effects proposed by Kaufman and Gil Aluja, relations between socioeconomic indicators are analyzed.

Massimiliano Ferrara and Bruno Antonio Pansera (“A Dynamic Game For A Sustainable Supply Chain Management”) develop a dynamic game to allocate the corporate social responsibility (CSR) to the members of a supply chain. They propose a model of a three-tier supply chain in a decentralized state that includes the supplier, manufacturer, and retailer. For the analysis of the supply chain performance in the decentralized state and of the relationships between the members of the supply chain, the authors use the Stackelberg game and consider a

hierarchical equilibrium solution for a two-level game. In particular, they formulate a model that involves multiple periods and propose a dynamic discrete Stackelberg game. An equilibrium point is obtained at which both the profits of members and the level of the CSR taken by the supply chains are maximized.

Ingrid Nineth Pinto López, Anna María Gil Lafuente, and Guillermo Sánchez Flores (“Pichat’s Algorithm for the Sustainable Regional Analysis Management: Case Study of Mexico”) consider a multidimensional analysis for a group of regions with common similarities that can allow them an improvement of competence management, support its integration processes, as well as strengthen the social and economic development. The analysis of such groups of regions calls for the application of concepts, models, and algorithms that allow the analysis of ambiguous variables. The model proposed by the authors tries to contribute to an informed decision-making, getting closer to reality while identifying those regions that, because of their characteristics, share common features. The goal of this work is to design a process of grouping regions based on the analysis of sustainability indicators. An approximation method based on Pichat’s algorithm is proposed using sustainable development indicators of each region as a reference and suggesting the degree of similarity among the regions so that the determination of similar groups be possible.

Vicente Liern and Blanca Pérez-Gladish (“Companies’ Selection Methods for Inclusion in Sustainable Indices: A Fuzzy Approach”) are concerned with the selection of companies to be included in sustainability indices. Since sustainability indices involve concepts which are both numeric and nonnumeric, the use of fuzzy logic can be advantageous. Usually, these indices follow a three-step process to define sustainable investment universes. The first step consists of a sustainability assessment. In the second step, assets are rated based on the previously assessed sustainability scores and, final in the third step, the best assets are selected. This last step relies on the construction of a global score reflecting the performance of the assets in the main sustainability dimensions. The authors deal with the third step of the selection process. They review the aggregation process used by the sustainability indices to obtain overall sustainability scores and propose the use of flexible aggregation operators for the obtaining of a global score describing the sustainability degree of a firm that takes into account the characteristics of different dimensions to be aggregated. Assets are then ranked using this score from the most to less sustainable. The proposed approach is compared with the three-step selection process applied by Euronext in their selection of companies in the Euronext Vigeo family of sustainability indices.

Part V, “Financial Analyses”, deals with various aspects of financial analyses.

Alfonso M. Rodriguez (“About Formal Construction of Financial Analysis”) discusses some basic and foundation aspects of broadly perceived financial analyses. Though the conventional financial mathematics boils down to financial calculi, an important financial phenomenon, the preference for liquidity, should always be present in the studies. The financial value considers, jointly with the monetary amount, its temporal deferral, i.e., its liquidity. Both of them must be formalized in a binary vector. The financing financial operations (FFOs) and investment financial

operations (IFOs) are very different financial operations (FOs), with the FFO only pretending to get an interest, the financing price by its financial service. The IFO intends to get an investment yield, its economic result. The interest and investment yield are different economic magnitudes. The interest is reached by a financial market and it defines the financial equilibrium of the FFO (finance equivalence). The investment yield is an economic result attained at the financial disequilibrium of IFO. It is the reason why to investigate an investment yield as a financial equilibrium as an implicit interest, it is the grave financial mistake that IRR (Internal Rate of Return) commits, confusing investment yield with interest and an IFO with a FFO, with erroneous consequences to its definition and possible to investment decisions. The new methodological approach to financial mathematics makes it possible to revise conventional concepts as interest as the investment yield, financial productivity, financial profitability, etc., and to incorporate another unknown concepts as the financial degeneration, financial immunity, etc., and to know some other financial instruments.

Martín Iglesias Caride, Aurelio F. Bariviera, and Laura Lanzarini (“Stock Returns Forecast: An Examination by Means of Artificial Neural Networks”) analyze—taking into account as a point of departure the validity of the efficient market hypothesis that has been under severe scrutiny since several decades but with the evidence against it being not conclusive. The authors discuss the possibility to use the artificial neural networks (ANN) as a model-free means to analyze the prediction power of past returns based on the knowledge of current returns. They analyze the predictability in the intraday Brazilian stock market using a backpropagation artificial neural network. The authors selected 20 stocks from the Bovespa index, according to different degrees of market capitalization, as a proxy for the stock size. They find that the predictability is related to the capitalization. In particular, larger stocks are less predictable than smaller ones.

Maciej Janowicz, Leszek J. Chmielewski, Joanna Kaleta, Luiza Ochnio, Arkadiusz Orłowski, and Andrzej Zembrzuski (“Persistent Correlations in Major Indices of the World Stock Markets”) are concerned with the time-dependent cross-correlation functions that are calculated between returns of the major indices of the world stock markets. The authors consider one-, two-, and three-day shifts and find that, surprisingly enough, high, and persistent-in-time correlations are found among some of the indices. Part of those correlations can be attributed to the geographical factors, for instance, strong correlations between two major Japanese indices have been observed. The reason for other, somewhat exotic correlations, seems to be as much accidental as obvious. It seems that the observed correlations may be of a practical value in the stock market speculations.

Ezequiel Avilés Ochoa, Ernesto León Castro, Ana María Gil Lafuente, and José María Merigó Lindahl (“Forgotten Effects in Exchange Rate Forecasting Models”) try to use the methodology of forgotten effects, hidden variables that influence the behavior of the forward exchange rate of US dollar—to—Mexican peso (USD/MXN) to then incorporate them into a structured model from the postulates of the theory of Purchasing Power Parity (PPP) and, thus, to reduce the forecast error. The authors discuss the problem if it is possible to decrease the prediction

error of the PPP model by using the methodology of the forgotten effects to detect and include hidden or forgotten variables. It is found that the inclusion of hidden or forgotten variables in the PPP model decreased the forecast error for the exchange rate USD/MXN in 2015.

Antonio Terceño, M. Gloria Barberà-Mariné, Laura Fabregat-Aibar, and Maraia Teresa Sorrosal-Forradellas (“The Behaviour of Non-surviving Spanish Funds According to Their Investment Objectives”) present an attempt to determine if the characteristics which define the non-surviving funds are different according to their investment objectives. The authors use the Self-Organizing Maps (SOMs) to cluster the mutual funds that disappeared in 2013, 2014, and 2015, based on the variables that define its survival capacity and, as a result, to analyze if these variables take similar values for all of them, or different values depending on the funds’ investment objectives. The authors propose to analyze nine categories: bond funds, bond mixed funds, equity funds and equity mixed funds, distinguishing between those that invest their assets in national or international markets, and passive investing funds. Numerical results are shown for illustration.

Part VI, “Applications in Business and Technology”, is an important part of the volume in which various applications of modern tools and techniques that stem from the area of broadly perceived intelligent systems are employed.

Igor Atamanyuk, Yuriy Kondratenko, and Natalia Sirenko (“Management System for Agricultural Enterprise on the Basis of Its Economic State Forecasting”) present a new management system (MS) for an agricultural enterprise that is based on the use of economic state forecasting. The system makes it possible to estimate the results of the enterprise functioning in the future under the realization of certain reorganization acts (change of land resources, labor resources, fixed assets). The method for the calculation of forecasts of economic indices of agricultural enterprises on the basis of a vector polynomial exponential algorithm for extrapolation of the realizations of random sequences is proposed. The prognostic model makes it possible to estimate the results of enterprise functioning (to estimate future gross profit, gross production) after its reorganization, and it does not impose any restrictions on the forecast characteristics (linearity, stationarity, Markov behavior, monotonicity, etc.) and thus allows to fully take into consideration stochastic peculiarities of functioning of agricultural enterprises. The simulation results confirm a high efficiency of the introduced calculation method. The method can be implemented in a decision support systems for agricultural and nonagricultural enterprises with various sets of economic indices.

Marina Z. Solesvik (“Partner Selection in Green Innovation Projects”) considers issues related to green innovation strategies, and in particular, focuses on the issues related to R&D strategic alliances aimed at developing green technologies in the maritime sector. Though still the managers often use their feelings to select partners from the prospective candidates, expensive R&D projects aimed at developing radical green innovations need a thorough preliminary analysis of collaborators. For this purpose, the author applies a fuzzy logic based formal concept analysis based approach to facilitate decision-making of management teams who are responsible for the selection of partners for collaborative green innovation projects.

Mario Versaci and Francesco Carlo Morabito (“Evaluation of Structural Integrity of Metal Plates by Fuzzy Similarities of Eddy Currents Representation”) present an innovative practical application of the methodologies introduced by Gil Aluja and Zadeh in civil and electrical engineering. More specifically, they consider metallic plates which when biaxially loaded deform producing dangerous mechanical stresses that are not visible. Since the representation of such stress conditions by 2D images is extremely complex, the authors propose to generate suitable Eddy currents (ECs) images to translate the information content of mechanical stresses into representative electric signals that would be easier to show. By grouping the produced images in different classes related to different biaxial loads and in a single class all the images referring to plates in absence of loads, the evaluation of the integrity of a plate is transformed into a problem of classification/decision. This further step is carried out by means of some measure of fuzzy similarity between the 2D EC signal and the prototype classes. The attained performance is comparable to more established approaches that are commonly plagued by a higher computational load. The proposed methodology is also shown to be able to manage uncertainty in an application of relevant industrial interest.

C. Berger-Vachon, P. A. Cucis, E. Truy, H. Thai Van, and S. Gallego (“Cochlear Implants: Consequences of Microphone Aging On Speech Recognition”) are concerned with a very important problem related to aging, specifically to the cochlear implants (CI) that are designed for the rehabilitation of a profound deafness. One relevant aspect in this context concerns the microphone as an ongoing drift occurs over the time. The authors discuss the consequences of this for the speech recognition. A general population of CI users and subjects using a CI simulator is involved. Words are presented to the listeners in noise with a variable signal to noise ratio (SNR) and the percentage ranged from 0% to 100%. For the CI simulator, the drift is simulated from data coming from figures measured on regular hearing aids. The results are compared before and after cleaning the microphones. Moreover, in a subgroup of CI users, the replacement of the head filter protecting the microphone is done and the recognition percentages are compared with those coming from the standard “brush and blow” cleaning procedure. The results have been revisited and quantified after a curve fitting. The results indicate that the “CIS-like” coding schemes are less sensitive to aging than the n -of- m strategies, and the cleaning improves the recognition performance but not too much. Furthermore, the improvement mainly occurs in the middle of the SNR range where the noise was not too intense.

Brigitte Werners and Yuriy Kondratenko (“Alternative Fuzzy Approaches for Efficiently Solving the Capacitated Vehicle Routing Problem in Conditions of Uncertain Demands”) deal with the analysis of fuzzy models and fuzzy approaches for an effective and efficient solution of the transportation and vehicle routing problems (VRP) with constraints on the capacity of the vehicles. The authors focus on the VRPs for marine bunkering tankers and on the planning and optimization of tanker’s routes in the conditions of uncertain fuel demands at nodes. The triangular fuzzy numbers are proposed for the modeling of uncertain demands and the optimization problem is considered as a multicriteria problem with: (a) the

minimization of the total length of planned routes, (b) the satisfaction of all orders at nodes (ships, ports), (c) the maximization of the total sale volume of unloaded fuel, (d) the minimization of the fleet size. Two alternative fuzzy approaches for efficiently solving such marine VRPs are discussed. The first alternative deals with the development of a multistage iterative heuristic procedure and the second alternative concerns the development of a fuzzy decision-making system for the evaluation of satisfaction values for uncertain order realizations. The solutions proposed are advantageous.

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Economics, Management and Engineering

Dedicated to Professor Jaime Gil Aluja

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