

MODELLING AND SIMULATION IN BUSINESS, ECONOMICS AND MANAGEMENT

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1. Modelling and simulation in an uncertain world

In modern world, decision-making has become a key part for enterprises in order to maintain their competitiveness (Cabrerizo, Herrera-Viedma, & Pedrycz, 2013; Capuano, Chiclana, Fujita, Herrera-Viedma, & Loia, 2018). In this sense, there is a wide range of methods for doing that process (Engemann, Filev, & Yager, 1996; Gil-Aluja, 1999, Merigó, 2010). Since

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the appearance of uncertainty theories connected to the idea of fuzzy sets (Zadeh, 1965), these methodologies have evolved in order to include uncertainty in each step of the decision making process. The objective is to include the expectations, knowledge, aptitude and other qualitative elements to the results and in that sense generate better course of actions (Carrasco, Blasco, García-Madariaga, Pedreño-Santos, & Herrera-Viedma, 2018; Kacprzyk, Yager, & Merigó, 2019).

In today's competitive and unpredictable business world, modelling and simulation has been used as a tool to support decision making in different areas such as manufacturing, services, healthcare, public services and many more, being an essential element of daily process in enterprises (Jahangirian, Eldabi, Naseer, Stergioulas, & Young, 2010; Azab & AlGeddawy, 2012). Since the Monte Carlo method invented in 1947, many other simulation methods have emerged in order to determine the outcome of an experiment or event differentiating mainly between dynamic and static modelling (Mourtzis, Doukas, & Bernidaki, 2014; Perez et al., 2018).

One of the main problems with modelling and simulation is that it loses its effectiveness when decision alternatives become too many or the problem to be analysed has an important degree of uncertainty or misleading information (Azab & AlGeddawy, 2012). In order to overcome these limitations the use of different fuzzy techniques and aggregation of information operators have become an important part in modelling and simulation (Blanco-Mesa, Merigó, & Gil-Lafuente, 2017; Cabrerizo et al., 2017; Cid-López, Hornos, Carrasco-González, & Herrera-Viedma, 2018).

2. Applications in business, economics and management

The use of different fuzzy techniques combined with traditional modelling and simulation methods in business, economics and finance have become an interesting research field including the analysis of the exchange rate (León-Castro, Avilés-Ochoa, Merigó, & Gil-Lafuente 2018), stock markets (Cheng, Wei, Liu, & Chen, 2013), enterprise risk management (Olson & Wu, 2010; Blanco-Mesa, León-Castro, & Merigó, 2018), supply chains (Campuzano, Mula, & Peidro, 2010; Sandhu, Helo, & Kristianto, 2013), new market expansions (Merigó, Palacios-Marqués, & Soto-Acosta, 2017), governmental decisions (Dyson & Chang, 2005; Qi & Chang, 2011), investment decisions (Ustundag, Kılınc, & Cevikcan, 2010), logistics (Banomyong & Sopadang, 2010), supplier evaluation (Datta, Samantra, Mahapatra, Banerjee, & Bandyopadhyay, 2012) and personal selection (Sari, Oktay, & Tıvrik, 2010).

These new ideas help us to understand better the future situations that have different degrees of uncertainty and because of that, the traditional modelling and simulation techniques are not as useful as they should be. This is why the idea of generating new formulations, methods and processes that can provide new approaches and ways to solve different business problems are necessary to help companies increase profit and maintain their life in the market.

The first paper presented by Ernesto Leon-Castro, Luis F. Espinoza-Audelo, Ezequiel Aviles-Ochoa, Jose M. Merigo and Janusz Kacprzyk, introduced a new operator to calculate volatility using the ordered weighted average (OWA) operator. The aim is to improve aggregation information according to the decision maker knowledge, expectations and attitude. This approach is implemented in an exchange rate problem with EUR/MXN and EUR/USD for 2016.

The next paper, written by Fabio Blanco-Mesa, Xiomara Patiño-Hernandez, Julieth Rivera-Rubiano and Maribel Martinez-Montaño, presents an analysis in enterprise risk identification (ERI) and their relationship with corporate risk goals. This approach is done by the use of aggregation operators based on the adequacy coefficient and OWA operators. An application in large companies of Colombia using this new operator is also presented.

In the third paper, Hugo Baier-Fuentes, Paolo Saona, Laura Muro and Pablo San Martin present an analysis about how board gender diversity influences managerial opportunistic behavior. By the information obtained from indexed non-financial companies from Europe for the period 2006-2016 and the use of several panel data techniques the authors conclude that having a balanced board provides benefits to the company.

The fourth paper by Victor Alfaro-Garcia, Jose M. Merigo, Leobardo Plata-Perez, Gerardo Alfaro-Calderon and Anna M. Gil-Lafuente, presents a new extension of the OWA operator using logarithmic operators. The main purpose of this operator is to aid in decision making when a set of regions with different properties must be considered. An application in the United Nations World States information for global regions is presented.

Finally, Nelson Rangel-Valdez, Eduardo Fernandez, Laura Cruz-Reyes, Claudia G. Gomez-Santillan, Gilberto Rivera-Zarate and Julia P. Sanchez Solis present an evolutionary-based indirect parameter elicitation method that uses preference information embedded in assignment examples. This approach offers an analysis of their impact in a priori incorporation. By an extensive computed experiment over random test sets, the authors determine that the method estimated properly the model parameters values.

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