

---

## Editorial

---

### Francesco Longo

DIMEG, MSC-LES Lab,  
University of Calabria,  
Cube 44C, Third Floor, 87036 Rende, Italy  
E-mail: f.longo@unical.it

**Biographical notes:** Francesco Longo is currently an Assistant Professor and the Director of the Modelling and Simulation Center – Laboratory of Enterprise Solutions at DIMEG, University of Calabria. His research interests are the development of innovative and advanced simulation approaches in different domains including industry, defence and logistics. He actively supports the organisation of the most important international conferences in the field of modelling and simulation serving as the General/Programme Chair. He has published more than 170 scientific articles on international conferences and journals.

---

The main goal of this special issue is to investigate advanced solutions based on modelling and simulation (M&S) to face the new research challenges in the ‘extended’ areas of industry and supply chains. Nowadays, industry and supply chains have to be regarded as extended areas (Longo, 2011) where boundaries are not clearly marked and where the infiltration from other domains (e.g., cyberspace, defence, homeland security, and financial markets) plays a critical role for building the 21st century enterprises (McQuay, 2001). Indeed, over the past 20 years many crises (e.g., terrorist attacks, natural disasters, and financial crises) have continually undermined the capabilities of human enterprises to survive and evolve in global markets. Human-caused crises have introduced many risks and vulnerabilities, particularly for industry and supply chains unable to react properly and adapt themselves to new competitive scenarios. This is particularly true in those countries that, after years of war or civil disorders, are now starting the reconstruction process (Bruzzone et al., 2011). On the other hand, many natural disasters and human errors have pointed out the importance of research and development activities in other domains such as healthcare (Sloane, 2008).

However, companies and societies that have invested in R&D of advanced solutions and tools have always quickly adapted their structures to smooth the effects of crises (Kim et al., 2004), achieving control of business efficiency and reducing risks and vulnerabilities. In such a context, M&S must be regarded as a critical technology to support the creation of agile virtual enterprises (Xu et al., 2000); indeed, already many years ago the USA recognised M&S as one of the technologies ‘most essential to develop in order to ensure long-term security and economic prosperity’. Therefore, on the one hand, this special issue presents applications and case studies in which M&S is used as a critical technology/methodology for building new and advanced solutions in industry and supply chains, on the other hand it considers alternative points of view for solving problems in other domains that by ‘infiltration’ usually have

a major impact on the efficiency and profitability of industry and supply chains. In this context, the application of simulation to new fields, theoretical solutions based on M&S, and multidisciplinary approaches involving simulation as trait d’union may be profitably used for facing the 21st century research challenges and developing advanced solutions in the extended industry and supply chains domains.

The articles included in this special issue are extended versions of the best articles submitted and presented to the International Multidisciplinary Modelling and Simulation Multiconference 2011 (I3M-2011). All the special issue papers, after their extensions (devoted to include latest results and scientific achievements) have undergone rigorous peer review and revision process. However, the special issue also includes regular papers that underwent the normal journal submission process. Such regular papers seem to fit very well the aim of the special issue enlarging the research challenges view to other ‘infiltration’ areas, including finance and healthcare. Therefore, the articles included in this special issue can be subdivided as follows:

- M&S for developing advanced solutions and solve research challenges to support design and decision support in industrial plants and construction engineering (Schoech et al.; Armenzon et al.; Hu et al.).
- M&S for developing advanced solutions and solve research challenges to support design and decision support in supply chains (Solis et al.).
- M&S for developing advanced solutions and solve research challenges in defence and homeland security (Bruzzone; Tremori et al.).
- M&S for developing advanced solutions and solve research challenges to support design and decision support in healthcare (Mould and Bowers; Syafruddin and Noorani).

- M&S for developing advanced solutions and solve research challenges to support decision support in financial markets (Hedjazi et al.).

In 'Optimising plant layout decisions based on emulation models – technical framework and practical insights', by Schoech, Schmid, Hillbrand, and Fleisch, the authors face, by using discrete event simulation, one of the most important problems in industrial plants: the optimisation of the plant layout. An advanced decision support system (DSS) is presented and discussed, together with a case study based on a real manufacturing system to provide evidence on the relevance of the proposed DSS.

In 'Advanced design of the pasta drying process with simulation tools', by Armenzoni, Solari, Marchini, Montanari, Bottani, Vignali, and Ferretti, the authors propose a simulation model to evaluate multiple alternatives and improve efficiency in the industrial drying process of pasta. As in the previous paper, the layout problem is investigated; indeed, the ultimate aim of the paper is to investigate the performance of the drying process as a function of the dryer configuration in order to optimise it.

In 'An agent-based simulation study for exploring organisation design under environmental uncertainty', by Wang, Hu, and Li, the authors discuss the relationships between the Chinese environment and project-based organisation (PBO) based on the perspective of contextuality of organisation design. First, the background of organisations in the construction engineering consultancy area (EC-PBO) is introduced, and factors that affect their performance are analysed by using an agent-based simulation model.

In 'Analysis of demand-supply interaction and inventory build-up strategies for products with short life cycles', by Solis, Pan, Paul, and Nicoletti, the authors propose a production and inventory build-up strategy for short life cycle products under different demand-supply scenarios. A cost model (including different types of costs) is discussed and the optimal production rate is determined in order to minimise the total cost.

In 'Intelligent agent-based simulation for supporting operational planning in country reconstruction', by Bruzzone, an interesting overview of conceptual models for supporting operational planning in complex scenarios characterised by critical issues such as natural disasters, crisis, asymmetric warfare is proposed. The author highlights the importance that social and psychological aspects have in such contexts and proposes an the implementation of special intelligent agents and computer generated forces able to include human aspects as well as the impact of social networks. The general architecture of a simulator is presented with an overview on the verification, validation and accreditation process.

In 'Interoperable simulation for asymmetric threats in maritime scenarios: a case based on virtual simulation and intelligent agents', by Tremori, Massei, Madeo, and Reverberi, the authors propose an approach based on M&S to simulate asymmetric threats (piracy attacks, terrorist attacks, etc.) on complex maritime scenarios in order to

support both decision makers and trainers in applying operational and organisational procedures.

In 'A comparison of process modelling methods for healthcare redesign', by Mould and Bowers, the authors compare two process modelling methods (pathway mapping and simulation), commonly used in healthcare redesign. While the two modelling methods are compared, two case studies are proposed to help the reader in understanding when pathway mapping is more suitable than simulation and vice-versa.

In 'Lyapunov function of SIR and SEIR model for transmission of dengue fever disease', by Syafruddin and Noorani, the authors show (in a different way from the previous article) how simulation can be successfully used in healthcare problems. Indeed, the authors construct a new Lyapunov function for a variety of SIR and SEIR model in epidemiology. Lyapunov functions are used to show that when the basic reproduction ratio is less than or equal to one, the disease-free equilibrium is globally asymptotically stable, and when the basic reproduction ratio is greater the one, the endemic equilibrium is also globally asymptotically stable for both models.

Finally, in 'Multi-agent financial market simulation: evolutionist approach', by Hedjazi, Ahmed-Nacer, Aknine, and Benatchba, the authors focus their attention on another critical aspect that provides research challenges for building the 21st century enterprise: the financial markets. The authors show that M&S of financial markets requires the use on the one hand of a suitable technology, that is multi-agent systems (MAS), to model the various actors of a market, and on the other hand, the evolutionary game theory to formalise interactions and heterogeneous investment strategies.

This special issue is the result of an ongoing cooperation (started in 2008) between the *International Journal of Simulation and Process Modelling* and the International Multidisciplinary Modelling and Simulation Multiconference, therefore, I would like to express my gratitude to the authors for their contribution and reviewers for their effort in providing feedbacks that have increased the scientific relevance of the papers. Furthermore, my sincere gratitude goes to Dr. M.A. Dorgham (Editor-in-Chief of the *IJSPM*) and Dr. Richard Sharp for their continuous and invaluable support in producing this special issue.

## References

- Bruzzone, A.G., Tremori, A., Tarone, F. and Madeo, F. (2011) 'Intelligent agents driving computer generated forces for simulating human behaviour in urban riots', *International Journal of Simulation and Process Modelling*, Vol. 6, No. 4, pp.308–316.
- Kim, B.H., Choi, B.K. and Choi, B-W. (2004) 'R&D activities in Korea on virtual manufacturing (review)', *Journal of Advanced Manufacturing Systems*, December, Vol. 3, No. 2, pp.193–204.
- Longo, F. (2011) 'Advances of modeling and simulation in supply chain and industry', *Simulation*, Vol. 87, No. 8, pp.651–656.

- McQuay, W.K. (2001) 'Distributed collaborative environments for 21st century modeling & simulation', *Proceedings of SPIE – The International Society for Optical Engineering*, Vol. 4367, pp.164–173.
- Sloane, E. (2008) 'Systems of systems (SoSE) engineering for the 21st century healthcare enterprise', *2008 IEEE International Systems Conference Proceedings, SysCon 2008*, Article number 4519013, pp.228–231.
- Xu, X., Ye, D., Li, Q. and Zhan, D. (2000) 'Dynamic organization and methodology for agile virtual enterprises', *Journal of Computer Science and Technology*, July, Vol. 15, No. 4, pp.368–375.