Preface

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Biographical notes: Agostino G. Bruzzone is a Full Professor at DIME University of Genoa, Director of M&S Net (international network involving 34 centres), Director of the MISS McLeod Institute of Simulation Science – Genoa Centre (28 centres distributed worldwide), Founder and President of the Liophant Simulation, member of the Simulation Team, Vice President and member of the Board of Movimento Italiano di Simulazione (MIMOS), and member of the NATO MSG. He works on innovative modelling and simulation, AI techniques, human behaviour modelling and GAs. He serves as the general coordinator of scientific initiatives (i.e., I3M General Chair). He teaches M&S for the DIMS PhD program (Doctorship in Integrated Mathematical M&S). He is the Director of the Master program in Industrial Plants for the University of Genoa. He is the Project Leader M&S at NATO STO CMRE – Centre for Maritime Research and Experimentation.

The modern world is evolving a long way from traditional paradigms and approaches. Many economic, social and technical contexts are changing rapidly, exhibiting a dynamic behaviour affected by unsteadiness and uncertainty. In this framework, technology, being an essential and unavoidable part of complex systems (regardless of their nature and type) has gained a leading role in driving the efforts of industry and academia toward new ways of thinking and acting. Indeed, people rely more and more on technology solutions as a means for decision support, problem solving, monitoring and control, to the extent that an ever-increasing demand for advanced and innovative tools affects market developments and drives research activities. In turn, technology developments are more challenged by the substantial increase in the number of requirements that have to be addressed, among others the capability of being smart and adaptive in nature. Being adaptive becomes a relevant condition to promote growth and development, as well as to ensure that a viable state could be maintained as long as possible. The need for adaptive tools able to support human activities at various levels calls into question modelling and simulation (M&S) as a means to deal with complexity and stand against competitive pressures. M&S has widely proved its potential to deliver ground-breaking solutions in many application fields, avoiding the most obvious pitfalls related to integration and deployment. Moreover, owing to its underpinning evolutionary approach and its capability to absorb new insights, approaches and solutions benefiting from the expertise coming from different areas, M&S consolidates its methodological foundations and brings about cutting-edge applications and technologies ceaselessly. As a showcase, the special issue on 'Cutting-edge methodologies, applications and technologies in M&S' seeks to capture actual trends in M&S developments proving meaningful insights on how and to what extent M&S can deliver sophisticated support tools for training, analysis, decision support and control. To sum up, a brief outline of the papers belonging to the special issue is given below:

- In 'Military serious game federation development and execution process based on interoperation between game application and constructive simulators', Choi et al. propose a development and execution process for military serious game federations, the Military Serious Game Federation Development and Execution Process (MSGFDEP). The MSGFDEP relies on interoperability (achieved through HLA) requirements between game applications and constructive simulators. The proposed methodology extends FEDEP, which is the federate development standard for IEEE1516, using the SoSES/FB framework.
- 'An advanced training environment for vessels' last mile navigation' Longo and Nicoletti proposes the design, development and prototyping of an advanced training environment for vessel operations in the last mile of navigation. The main idea is to recreate the typical conditions that operators are usually involved in through an architecture of interoperable simulators, including a vessel simulator, a tugboat simulator and a control tower simulator.
- 'Advanced interoperable simulators for training in car terminals' Nicoletti et al. presents a simulation-based training framework for drivers and parkers in car terminals. The proposed solution, called CTSIM, is made up of three interoperable simulators: an operator simulator, a ship simulator and a vehicle simulator. The vehicle simulator is able to simulate a medium car, a truck (tractor and trailer) and all the procedures

performed by a driver in a car terminal while the operator simulator simulates all the movements and gestures of a parker with a high accuracy, thanks to a technical solution that Kinect, a tracking glove and a joystick are part of.

- 'Using the RetSim simulator for fraud detection research' Lopez-Rojas et al. presents RetSim, a multi-agent-based simulator calibrated with real transaction data from one of the largest shoe retailers in Scandinavia. RetSim is a simulator of a retail store that generates a transaction data set that can be used for research into fraud detection. This way, synthetic transaction data generated through RetSim can be publicly shared and studied without leaking business sensitive information.
- 'Production function implementation in an agent-based simulation' Šperka and Spišák aims at describing the seller-to-customer negotiation in the business processes (sales) of a virtual company. An innovative approach to simulate, investigate and predict some of the key performance indicators of a trading company is proposed. In particular, the proposed framework relies on a multi-agent system seen as a basic component of a management information system integrated into the company (e.g., ERP system).
- 'An intuitive and efficient approach to integrated modelling and control of three-dimensional vibration in long shafts' Rideout et al. presents a nonlinear three-dimensional bond graph-based shaft model in which axial, torsional, and lateral vibrations can be predicted. The model is applied to an unbalanced rotating 80-metre oilwell drillstring collar section. Simulations show realistic axial, torsional and lateral vibrations, with lateral vibration comparable with a finite element model against which preliminary validation is carried out. Active lateral vibration control is implemented, in which actuators and strain gauges are placed 90 degrees apart around the pipe walls at multiple locations. A proportional controller acting on the strain gauge output significantly attenuates vibration and reduces wellbore contact.
- 'Bond-graph-based controller design for the quadruple-tank process' Nacusse and Junco address the design in the bond-graph domain of a robust controller having the volumetric flows of two pumps as manipulated variables and the level of the two lower tanks as the regulated outputs.
- In 'Bondgraphs model on cavitating pump system' Tanaka et al. cavitating flows and cavity volume have been solved by CFD in a cavitating pump system in order to represent pump cavitation phenomena by bond-graphs in a lumped parameter system. The cavitation compliance and mass flow gain factor have been calculated numerically.

Based on extensions of the best papers submitted to the International Multidiscinary Modelling and Simulation Multiconference (I3M 2013), this special issue collects relevant contributions to the literary background, thanks to the authors' and reviewers' remarkable work. Apart from authors and reviewers, a substantial contribution in setting up and finalising the special issue has been given by the *International Journal of Simulation and Process Modelling* staff, with particular reference to the editorial board members and journal managers, whom I thank sincerely.