Editorial

Sundarapandian Vaidyanathan

Research and Development Centre,
Vel Tech University,
Avadi, Chennai-600 062, Tamil Nadu, India
Email: sundarvtu@gmail.com

Biographical notes: Sundarapandian Vaidyanathan is a Professor and the Dean at the Research and Development Centre, Vel Tech University, Chennai, India. He earned his DSc in Electrical and Systems Engineering from the Washington University, St. Louis, USA in 1996. His current research focuses on linear and nonlinear control systems, chaotic and hyperchaotic systems, chaos control and synchronisation, FPGA, backstepping control, sliding mode control, intelligent control, mathematical models of biology, computational science and robotics. He has published three textbooks on mathematics and six research books on computational intelligence, chaos and control systems. He has published over 230 Scopus-indexed research publications. He has delivered plenary lectures on control systems and chaos theory in many international conferences around the world. He has also conducted many workshops on computational science using MATLAB and Scilab.

The Second International Conference on Automation, Control, Engineering and Computer Science (ACECS-2015) was conducted during March 22–24, 2015 at Sousse, Tunisia. The conference provided an excellent forum for professionals, academics, and researchers to share knowledge and results on automation, control, engineering, computer science and information technology. Broad areas of ACECS-2015 were classified as computer science and IT, signal processing and communication, robotics, control and instrumentation, engineering and automation, and innovation and engineering management.

Control engineering is the engineering discipline that focuses on the mathematical modelling of systems of a diverse nature, analysing their dynamical behaviour and designing controllers that will cause the systems to behave in a desired manner. In process control, the term process is used in a very general sense and some typical examples of processes are: energy generation, electric power transmission, distribution systems, chemical and petrochemical industry, metallurgical industry, traffic and transportation systems, paper and pulp processing industry, food and fermentation industry, environmental systems, mining instrumentation, innovation and engineering management, etc. Simulation and process modelling has recently become one of the most exciting research topics in the broad area of process control. Recently, there is great interest in research in areas such as big data, cloud computing, etc., and their applications in simulation and process modelling.

In this special issue of the *International Journal of Simulation and Process Modelling* (*IJSPM*), we are delighted to select seven research articles reporting on recent advances in simulation and process modelling. The first five papers presented in the ACECS-2015 have been expanded in line with the reviewer recommendation and audience questions. The last two papers were selected from the open submissions received for this special issue with a mixed call for papers.

It is hoped that this special issue will provide a useful reference for informing recently developed technologies in simulation, processes and modelling. The contents of the selected seven articles are described briefly as follows.

The paper titled 'Modelling and simulation of predictive handover control mechanisms for fast moving mobile nodes in wireless networks', by Raman Kumar Goyal and Sakshi Kaushal, proposes a media independent handover (MIH)-based handover triggering scheme, which is based on the mobility prediction of a mobile node (MN). When a MN moves to another network, connection gets interrupted owing to change in IP address and signal loss. Terminal mobility includes the ability of the network to identify and locate the MN, and the MN should be able to access the services while moving. It consists of location management and handover management. When the MN is moving at high speed from one network to another network, the performance of mobile IP (MIP) is degraded as MN cannot complete the handover within the required time owing to delayed triggering of handover request. To ensure seamless connectivity without performance degradation, the traditional handover mechanism needs to be enhanced. In this work, handover triggering is predicted by calculating the link expiration time, which depends on the velocity, direction and distance of the MN from the access point. Router discovery time in MIPv6 is also removed by defining new MIH primitives. The scanning process required for traditional MIH networks is eliminated using an information server that estimates the received signal strength of candidate networks based on the location of the MN. Simulation results demonstrate that the proposed scheme reduces the handover latency and improves the throughput in homogenous networks at varying velocities of MN.

The paper titled 'Comparison of subspace and prediction error methods of system identification for cement grinding process', by Venkatesh Sivanandam, Ramkumar Kannan, Seshadhri Srinivasan and Guruprasath Muralidharan, addresses the suitability of two data-driven modelling approaches for the cement grinding process prediction error and subspace identification methods. Data collected from the cement grinding process is used to build the model of the same. The collected data is used to build different candidate state-space models using the prediction error and subspace identification methods. The candidate models are validated using Akaike's information criterion and mean square error to study the suitability of these modelling techniques. The validation tests are used to identify the most suitable candidate models for the prediction error and subspace methods. Two models, SSP8 and SSS4, are selected as good candidate models from the available choices that use both these methods for modelling. Correlation analysis is used to analyse the two models and to draw conclusions on the most suitable modelling approach. Simulation results are detailed, which show that the subspace identification provides more accurate models for the cement grinding circuit than the prediction error method for the cement industry studied in this investigation.

The paper titled 'Sensorless speed control of IM pumping system fed by solar power generation', by Hamzaa Bouzeria, Cherif Fetha, Tahar Bahi, Issam Abadlia, Zakaria Layate and Salima Lekhchine, presents the study of the photovoltaic pumping process driven by an induction motor. The configuration of the studied conversion chain, which contains the photovoltaic generator (GPV), is adapted by a DC-DC converter controlled using the fuzzy logic technique. The induction motor is controlled by a variable hysteresis band, in order to ensure the continuation of the maximum power point of a three-phase inverter and the two levels that it supplies. The objective of this process is to ensure the operation at maximum power of the photovoltaic (PV) system under various conditions of temperature and irradiation. The matching between the PV generator and the load is also performed, with the boost converter. Technical vector control sensors of induction motor have been developed and are presented in this paper. A control law without a mechanical sensor using an adaptive observer estimating the speed is based on proportional integral controller. Moreover, adaptation of the rotor time constant is powered by PV solar energy, and the latter control system adopts an inverter current control scheme with variable hysteresis band. A modelling and simulation study performs the proposed process. Electrical and mechanical characteristics of the proposed system are simulated and tested by MATLAB and SimuLink.

The paper titled 'Solar photovoltaic energy system-based shunt active filter for electrical energy quality improvement', by Salem Saidi, Rabeh Abbassi, Wafa Ben Hassen and Souad Chebbi, presents a harmonic compensation system using a GPV to improve the supply power quality. The proposed configuration is constituted by a grid-connected three-phase inverter, a PV array and a nonlinear load formed by a bridge rectifier feeding a resistive load in series with an inductor. An indirect current control via the method of active and reactive power is proposed to compensate the harmonic currents and reactive power at the point of common coupling while injecting active power from the solar system to the grid. The perturb and observe (P&O) method has been applied to track the maximum power point. Simulation results using MATLAB and SimuLink are shown to illustrate the robustness of the proposed control approach that simultaneously guarantees the compensation of harmonic currents, the correction of the power factor and the injection of PV power to the grid.

The paper titled 'Route to chaos and bifurcation analysis in a multi-cell DC/DC buck converter, modelling and simulation', by Karama Koubaâ, investigates the route to chaos in a multi-cell DC/DC buck converter controlled using a proportional controller. Nonlinear phenomena and discontinuities, inherent in this type of converter, yield to border collision bifurcation, owing essentially to a structural change in the system after hitting a boundary. This paper focuses on the degenerate flip bifurcation, characterised by degenerated cycles of double period when crossing the boundary and leads directly to robust chaos in cyclical sets. The distinctive feature in this study lies in the use of a simplified discrete model of the converter and the analysis of the route to chaos by the search of fixed points with their domains of stability and the appeal of the Feigin method to predict the route to chaos. The four-cell converter is treated in simulation to confirm the theoretical results.

The paper titled 'Real-time simulation of DEVS models in CD++', by Gabriel A. Wainer, details the implementation of a real-time simulation engine in the CD++ toolkit, which allows interaction between a simulated model and its surrounding environment. In a real-time simulation, inputs can be received by ports connected to real input devices such as sensors, timers, thermometers or even data collected from human interaction. Similarly, outputs can be sent through output ports connected to devices such as motors, transducers, gears, valves or any other component. In addition, all the available models developed for previous versions of CD++ may also be executed under the new real-time simulator without any modification. The simulation tool allows running similar DEVS models as others built in CD++, and executes them in real-time checking the real-time constraints. The new simulation technique allows the interaction between the model and its surrounding environment. Additionally, a non-hierarchical simulation approach is presented and introduced to CD++ in order to reduce the communication overhead. This paper also demonstrates the use of real-time CD++ to analyse models in a simulated environment and to execute these models in a hardware surrogate.

The paper titled 'Energy optimisation of single train operation based on tabu search', by Fang Cao and Shuqi Liu, presents a more accurate model of the train energy consumption by considering the control strategy of automatic train operation (ATO). This paper proposes two modifications of tabu search (TS) algorithm, which are

named as up-down modification (UDM) and left-right modification (LRM), to optimise a train recommended speed curve based on the presented model. The simulation results based on the Beijing Subway illustrate that the proposed approaches can achieve a good performance on energy reduction. Sensitivities of the parameters are analysed to illustrate that the proposed approach is practical and meaningful.

The guest editor would like to thank all the authors for submitting their manuscripts in this special issue, and to acknowledge the reviewers for their contributions in reviewing the papers and providing constructive comments to the authors. Finally, the guest editor would like to especially thank Professor Feng Qiao (the Editor-in-Chief of *IJSPM*) for his great help and support in organising and coordinating the publication of this special issue.