# Editorial

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**Biographical notes:** Ahmad Taher Azar received his MSc in 2006 and PhD in 2009 from the Faculty of Engineering, Cairo University, Egypt. He is currently a full time Associate Professor from the Faculty of Computers and Information, Benha University, Egypt. He is the Editor-in-Chief of *International Journal of System Dynamics Applications* (*IJSDA*) published by IGI Global, USA. He is also the Editor-in-Chief of *International Journal of Intelligent Engineering Informatics* (*IJIEI*), Inderscience Publishers, Olney, UK. He is a senior member of IEEE since 2013 and has worked in the areas of control theory and applications, process control, chaos control and synchronisation, nonlinear control, robust control, computational intelligence and has authored/co-authored over 200 research publications in peer-reviewed reputed journals, book chapters and conference proceedings. He is an editor of many book in the field of intelligent control, sliding mode control, fuzzy logic control, chaos modelling and control, computational intelligence, and machine learning.

Sundarapandian Vaidyanathan is a Professor and Dean at the R&D Centre, Vel Tech University, Chennai, India. He received his DSc in Electrical and Systems Engineering from the Washington University, St. Louis, USA in 1996. He has published over 400 Scopus-indexed research papers. His current research focuses on control systems, chaos theory, chaotic and hyperchaotic systems, sliding mode control, neuro-fuzzy control, computational science, circuits and memristors. He is the Editor-in-Chief of *International Journal of Nonlinear Dynamics and Control* (*IJNDC*), Inderscience Publishers, Olney, UK. He is also in the editorial board of many control journals published by Inderscience, Olney, UK. He has delivered plenary lectures on control systems and chaos theory in many international conferences around the world. He has also conducted several workshops on modern control systems and chaos theory using MATLAB and SCILAB.

Intelligent control describes a class of control techniques that use various artificial intelligence (AI) techniques such as neural network control, Bayesian control, fuzzy logic control, neuro-fuzzy control, expert systems, genetic control, evolutionary algorithms and intelligent agents. Intelligent control systems are very useful when no mathematical model is available a priori and intelligent control itself develops a system to be controlled. Intelligent control is inspired by the intelligence and genetics of living beings. This special issue will focus on various applications of intelligent control on nonlinear control systems including chaotic systems.

Chaos theory, which occupies a central place in modem nonlinear dynamics, refers to a deterministic development with chaotic outcomes. This theory deals with the behaviour of dynamical systems and maps that are highly sensitive to initial conditions. The sensitivity to initial conditions is usually called the butterfly effect for dynamical systems and maps. Chaotic systems can be observed in many natural systems such as weather and climate. Chaos theory has applications in several areas such as vibration control, electric circuits, chemical reactions, lasers, combustion engines, computers, cryptosystems, encryption, secure communications, biology, medicine, management, finance, etc. Chaotic behaviour can be studied through the analysis of a chaotic mathematical model (discrete or continuous).

This special issue aims at presenting the latest developments, trends, research solutions and applications of intelligent control and nonlinear dynamics with real-world applications. In this special issue, we are delighted to select four research articles reporting on recent advances on intelligent control and nonlinear dynamics.

It is hoped that this special issue will provide a useful reference for informing recently developed technologies in intelligent control and nonlinear dynamics. The contents of the selected four articles are described briefly as follows.

The paper titled ‘Optimal placement of TCSC for congestion management in deregulated power system using firefly algorithm’ by A. Ahamed Jeelani Basha, M. Anitha and E.B. Elanchezhian explores the use of thyristor controlled series compensator (TCSC) for power flow control in congested network using firefly algorithm (FA). The optimal location of TCSC is identified based on real power performance index and reduction of total system reactive power loss methods. Furthermore, in the congestion management (CM) problem, single line outage analysis is also performed. FA is used to determine the minimum total cost which includes production cost and TCSC cost. Results of five bus, IEEE 14 and IEEE 30 bus test systems indicate that FA provides minimum cost compared to the previous literature. The efficiency of the proposed FA for obtaining the high quality solution is also established. The exhaustive analysis of TCSC-based CM problem by proposed FA proves that the proposed scheme has improved the loading capability of the transmission lines, thereby relieving the congestion in line. The computed result justifies the usefulness of the proposed method, giving convenience for implementation to any practical transmission network.

The paper titled ‘Chaotic inertia weight and constriction factor-based PSO algorithm for BLDC motor drive control’ by Manoj Kumar Merugumalla and Prema Kumar Navuri proposes the C-inertia weight and C-factor-based PSO algorithms for optimal tuning of BLDC motor drive controller. The motor drive system has been simulated using MATLAB/Simulink. Several simulation tests are performed to investigate the robustness of drive system and simulation results demonstrate the capability under set-point (reference speed) changes and sudden loads. The time domain parameters validate the effectiveness of C-inertia weight and C-factor in reducing system oscillations with zero

steady-state error and with low rise time and settling time. The simulation results of all PSO algorithms are compared and results confirm that chaotic inertia weight and constriction factor-based PSO algorithms exhibits excellent speed tracking performance and an optimised dynamic response of speed under sudden load disturbances and set-point changes.

The paper titled 'Operation state classification of power system using fuzzy logic techniques' by Asma Meddeb, Hajer Jmii and Souad Chebbi describes a methodology for operation state classification using the fuzzy logic technique. Using the fuzzy logic technique, complex system mathematical model can be avoided, while delivering good performance under different operating conditions. The proposed method requires the consideration of both equality and security constraints. The fuzzy logic controllers have been developed and integrated on an extensive base of simulation studies using the MATLAB software. The accuracy of the fuzzy rule-based controller is high and computation is fast enough for an online security assessment of power system.

The paper titled 'Analytical structures and stability analysis of the simplest Takagi-Sugeno fuzzy two-term controllers' by Ritu Raj and B.M. Mohan develops mathematical models of four classes of fuzzy controllers. The analytical structures of the simplest fuzzy controllers are developed using a modified rule base. The number of tuning parameters of the controllers is reduced by introducing a novel rule base consisting of two rules. These controllers are termed as 'the simplest' since minimal (two) number of fuzzy sets is used for fuzzification. Algebraic product (AP)/minimum (min) triangular norm, bounded sum (BS)/maximum (max) triangular co-norm, different universes of discourse (UoDs) of inputs, and centre of gravity (CoG) defuzzification method are chosen to derive the mathematical models of the fuzzy controllers. The simplest fuzzy controller with modified rule base is equivalent to a (nonlinear) variable gain/structure PI/PD controller. The BIBO stability of the closed loop control system is investigated using the small gain theorem. The gain of the controller either varies or remains constant in different regions of the input plane. The gain variations and the computational burden of the fuzzy controllers are also studied. Two examples of nonlinear dynamical systems are considered to validate the developed models of the fuzzy controllers.

The guest editors would like to thank all the authors for submitting their manuscripts in this special issue. We would want to acknowledge the reviewers for their contributions in reviewing the papers and providing constructive and useful comments to the authors. Finally, the guest editors would like to specially thank the Editor-in-Chief of *International Journal Process Systems Engineering* (*IJPSE*), Dr. Hossam A. Gabbar (University of Ontario Institute of Technology, Canada) for his great help and support in organising and coordinating the publication of this special issue.