Numerical modelling and simulation for systems engineering applications: Novel methods in design, development, monitoring, diagnostics and prognostics

Preface for the JoMaC Special Issue

NUMERICAL MODELLING AND SIMULATION FOR SYSTEMS ENGINEERING APPLICATIONS: NOVEL METHODS IN DESIGN, DEVELOPMENT, MONITORING, DIAGNOSTICS AND PROGNOSTICS

Systems engineering is an interdisciplinary field of engineering that focuses on designing and managing complex engineering systems over their whole life cycle. Issues such as requirements definition, reliability, logistic support, testing and evaluation, maintainability, and many other disciplines necessary for the successful system design, development, implementation, and decommission become more complicated when dealing with large or complex projects.

To this purpose, overlapping several disciplines, systems engineering ensures that all main aspects of a project or a system are considered and correctly integrated into a complex. Several tools are used at various stages of the systems engineering process, depending on their application. In particular, modelling techniques and numerical simulation environments are gradually playing increasingly essential roles in this process, both in the early stages of conceptual design, preliminary draft, and system development, but also the design and tuning of control or monitoring systems and development of diagnostic and prognostic algorithms. These topics are now in the spotlight of the scientific community and arouse a growing interest in several industrial sectors (e.g., aerospace, automotive, automation, and more).

Therefore, I believe that a collection of selected works that provide an overview of the state of the art and highlight the most recent and promising studies could be received with interest by the technical-scientific community.

Therefore, based on the previous considerations, I decided to promote this special issue of the International Journal of Mechanics and Control entitled "Numerical Modeling and Simulation for Systems Engineering Applications: Novel Methods in Design, Development, Monitoring, Diagnostics and Prognostics" that aims to collect innovative documents by proposing new approaches and original applications of numerical modeling and simulation techniques applied in the different fields of systems engineering. In this regard, I wish to thank prof. Andrea Manuello Bertetto, Editor in Chief of JoMaC, and the Editorial and Scientific Boards members that accepted and supported this project.

Six valuable contributions, covering a wide range of disciplines and applications, are presented here. Giuseppe Petti et al. propose a new prognostic method based on an artificial neural network analysing back-EMF coefficients of electromechanical actuators (pp. 03-09).

Vincenzo Niola et al. study the cavitation phenomena in a directional spool valve through the vibrational analysis of the acquired accelerometric signals (pp. 11-16).

Luca Pugi et al. propose a new generation of electric directional drilling machines and studied simplified models for preliminary sizing, design, and calibration (pp. 17-29).

Simone Arena et al. study an efficient distribution of the products of a delivery drugs Italian company by developing LRP analysis and finding solutions aimed at minimizing the total logistic system cost. (pp. 31-43).

Mohammad Reza Homaeinezhad and M. Homaeinezhad examine a new electrical machine theory for simultaneous velocity and torque tracking control of the permanent magnet DC motors (pp. 45-59).

Alberto Concu et al. show a prototype of a smart face mask, named AG47-SmartMask that, in addition to the function of both an active and passive anti-COVID-19 filter by an electro-heated filter brought to a minimum temperature of 38°C, also allows the continuous monitoring of numerous cardio-pulmonary variables (pp. 61-76).

I wish to express my sincere appreciation to all researchers having contributed to this special issue, for their valuable support to the growth of this fascinating discipline.

Matteo D. L. Dalla Vedova

Guest Editor of JoMaC for the Special Issue

“Numerical Modelling and Simulation for Systems Engineering Applications:
Novel Methods in Design, Development, Monitoring, Diagnostics and Prognostics”

ISSN 1590-8844
International Journal of Mechanics and Control, Vol. 22, No. 01, 2021