IEEE Access
Multidisciplinary | Rapid Review | Open Access Journal

Date of current version June 7, 2017.

Digital Object Identifier 10.1109/ACCESS.2017.2694238

EDITORIAL

IEEE *Access* Special Section Editorial: Recent Advances on Modelling, Optimization and Signal Processing Methods in Vehicle Dynamics and Crash-worthiness

Due to the significant growth in transportation industries, the importance of interactions between vehicle technologies and humans from the safety aspect plays an important role in the new developments of complex vehicle systems. Therefore, from academic and industrial viewpoints, increasing attention has been paid to complex vehicle correlative technologies with full consideration of issues like safety, robust performance, impact analysis, optimization, automation, motion control, etc. All aforementioned issues provide a basis for the design and operation of practical vehicle systems in order to achieve desired complex tasks.

Different than a number of well-established vehicle journals such as the IEEE Transaction on Vehicular Technology, the IEEE Transactions on Intelligent Vehicles, the primary objective of this Special Section in IEEE *Access* is to provide an open-access forum for researchers and practitioners to exchange their latest achievements and to identify critical issues and challenges for future investigation on mathematical-based or computer-aided modelling, optimization and signal processing techniques in vehicle dynamics and crash-worthiness. Based on this focus the special section has accepted seven high-quality papers after rigorous peer-review processes, the contents of which are summarized as follows.

In the work done by Ma *et al.* (*Exploration of the reliability of automotive electronic power steering system using device junction electrothermal profile cycle*), the authors investigated the simulation of the electric power steering (EPS) device transient junction temperature and the accumulated damage estimation value owing to instantaneous thermal mechanical stress cycling to estimate EPS converter reliability. Moreover, an electrothermal model is developed and the obtained results are compared with those from EPS device temperature testing.

In the work by Meng and Ma (*Modeling, analysis, and experimental testing of a selective catalytic reduction dosing system*), the authors introduced a selective catalytic reduction (SCR) system, which is used in modern ship or vehicle diesel engines. SCR technique is a key enabler for NOx reduction, which is critical for the performance and fuel economy of both ship and vehicle diesel engines since a more advanced timing of the diesel injection can be used. The authors propose a new urea dosing sub-system of SCR, which realizes flow feedback with a flow sensor and a different control method. It is verified by simulation and experiment that the proposed system can successfully solve the precise control of the urea dosing system with nonlinear dynamics.

The work entitled '*Review of the energy saving hydraulic system based on common pressure rail*' by Shen *et al.* studied the development of an energy-saving hydraulic system based on CPR (Common Pressure Rail), which can be potentially applicable to construction machinery widely. Firstly, the principle of CPR is introduced. Then, the main components including hydraulic transformers and storage elements are reviewed followed by an analysis of the development and research efforts focused on energy saving application and control performance investigation. Finally, the challenges and the development direction are discussed.

In the work by Zhang *et al.* (*Study on self-tuning tyre friction control for developing main-servo loop integrated chassis control system*), the authors proposed the concept of inherent flexibility of hierarchical structure scheme with a main servo-loop control structure to the problem of integrated chassis control system for the vehicle. The proposed control strategies are verified by computer simulations. For the work done by Su (*Master–slave control for active suspension systems with hydraulic actuator dynamics*), the author studied a master-slave control design methodology for a vehicle active suspension system based on a robust H_∞ control and an adaptive backstepping control methodology. To this aim, a desired active control force is calculated by the master controller to guarantee performance indices of the active suspension system within the allowable constraints. Then, an adaptive backstepping algorithm is applied to solve the problems of nonlinearity and the time constant uncertainty of the hydraulic actuator. The effectiveness of the proposed method is verified by simulation.

Within the context of crashworthiness, Munyazikwiye *et al.* in the work entitled '*Optimization of vehicle-to-vehicle frontal crash model based on measured data using genetic algorithm*' presented a mathematical lumped model for vehicle-to-vehicle frontal crash with nonlinear behaviors of spring and damper characteristics. To

estimate and optimize the model parameters, a genetic algorithm (GA) approach is proposed. The proposed method is verified by simulation using real experimental data. On this research line, Wei *et al.* in the work entitled '*An EEMD aided comparison of time histories and its application in vehicle safety*' proposed a novel scheme of time histories comparison to be used in vehicle safety analysis. More specifically, each signal for comparison is decomposed into a trend signal and several intrinsic mode functions (IMFs) by Ensemble Empirical Mode Decomposition. To illustrate the effectiveness of the proposed scheme, the authors provide three vehicle crash cases.

Finally, it is understood that the selected topics and papers are not a comprehensive representation of the area of this special section on modelling, optimization and signal processing methods in vehicle dynamics and crash-worthiness. Nonetheless, they represent the rich and many-faceted knowledge that we have the pleasure of sharing with the readers. We would like to express appreciation to the authors for their excellent contributions, to the reviewers for the quality check of the special section, and to the IEEE *Access* Editor-in-Chief, Journal Manger and the Editorial office staff for their great support.

Hamid Reza Karimi
Politecnico di Milano, Italy

Dario Vangi
Università degli Studi di Firenze, Italy

Hermann Steffan
Technische Universitaet Graz, Austria

Junmin Wang
The Ohio State University, USA

Kalyana C. Veluvolu
Kyungpook National University, South Korea

HAMID REZA KARIMI (M'06–SM'09) was born in 1976. He received the B.Sc. degree (Hons.) in power systems from the Sharif University of Technology, Tehran, Iran, in 1998, and the M.Sc. and Ph.D. (Hons.) degrees in control systems engineering from the University of Tehran, Tehran, in 2001 and 2005, respectively. He is currently a Professor of Applied Mechanics with the Department of Mechanical Engineering, Politecnico di Milano, Milan, Italy. His current research interests include control systems and mechatronics. He received the 2016 Web of Science Highly Cited Researcher in Engineering. He is the Editor-in-Chief of the *Journal of Designs* and an Editorial Board Member for some international journals, such as the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, the IEEE TRANSACTIONS ON CIRCUIT AND SYSTEMS–I: REGULAR PAPERS, the IEEE/ASME TRANSACTIONS ON MECHATRONICS, the IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS: SYSTEMS, INFORMATION SCIENCES, the IEEE ACCESS, the *IFAC–Mechatronics*, the *Neurocomputing*, the *Asian Journal of Control*, the *Journal of the Franklin Institute*, the *International Journal of Control, Automation, and Systems*, the *International Journal of Fuzzy Systems*, the *International Journal of e-Navigation and Maritime Economy*, and the *Journal of Systems and Control Engineering*. He is also a member of the IEEE Technical Committee on Systems with Uncertainty, the Committee on Industrial Cyber-Physical Systems, the IFAC Technical Committee on Mechatronic Systems, the Committee on Robust Control, and the Committee on Automotive Control.

DARIO VANGI was born in 1963. He received the M.Sc. degree in mechanical engineering and the Ph.D. degree in quality engineering from Florence University, Italia, in 1988 and 1992, respectively. He founded the Road Safety and Accident Reconstruction Laboratory, Florence University, in 2007. He has authored or co-authored over 125 journal articles and holds one patent. His major research interests include road accident analysis and reconstruction, sustainable mobility applications, and non-destructive evaluation. He is a member of IGLAD–Initiative for the global harmonization of accident data, a member of the World Road Association–PIARC, and a member of EVU–European road accident analysis. He is an Editorial Board Member of the *Journal of Designs* and the *Journal of Transportation Technology*. He is the Scientific Director of the editorial collection *Road safety* (Florence University Press).

HERMANN STEFFAN, photograph and biography not available at the time of publication.

JUNMIN WANG (SM'14) received the B.E. degree (Hons.) in automotive engineering and the M.S. degree in power machinery and engineering from Tsinghua University, Beijing China, in 1997 and 2000, respectively, the M.S. degrees in electrical engineering and mechanical engineering from the University of Minnesota, Twin Cities, in 2003, and the Ph.D. degree in mechanical engineering from the University of Texas at Austin in 2007. He joined The Ohio State University and founded the Vehicle Systems and Control Laboratory in 2008. He has authored or co-authored 125 journal articles and holds 11 U.S. patents. His major research interests include control, modeling, estimation, optimization, and diagnosis of dynamical systems, especially for automotive, vehicle, transportation, and sustainable mobility applications. He is an IEEE Vehicular Technology Society Distinguished Lecturer in 2015, a SAE Fellow in 2015, and a ASME Fellow in 2016.

KALYANA C. VELUVOLU (S'03–M'06–SM'13) was born in 1981. He received the B.Tech. degree in electrical and electronic engineering from Acharya Nagarjuna University, Guntur, India, in 2002, and the Ph.D. degree in electrical engineering from Nanyang Technological University, Singapore, in 2006. From 2006 to 2009, he was a Research Fellow with the Biorobotics Group, Robotics Research Center, Nanyang Technological University. Since 2009, he has been with the School of Electronics Engineering, Kyungpook National University, Daegu, South Korea, where he is currently an Associate Professor. He is also attached to the School of Mechanical and Aerospace Engineering, Nanyang Technological University, as a Visiting Professor from 2016 to 2017. He has been a Principal Investigator or a Co-Investigator on a number of research grants funded by the National Research Foundation of Korea and other agencies. He has authored or co-authored over 100 journal and conference proceedings articles. His current research interests include nonlinear estimation and filtering, sliding mode-control, brain–computer interface, autonomous vehicles, biomedical signal processing, and surgical robotics.