Preface

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Biographical notes: Lin Li is a Technical Specialist in Nikola Corporation. He received his PhD in Mechanical Engineering from Virginia Tech in 2008, and his Master's and Bachelor's in Automotive Engineering from Jiangsu University in 2003 and 2000, respectively. He is an Associate Editor of SAE *International Journal of Commercial Vehicles*, a speaker and organiser of SAE Commercial Vehicle Congress, and a 2018 SAE Forest R. McFarland Award Recipient. He is also a committee member of ASME AVT (Advanced Vehicle Technology). His research interests are vehicle dynamics, multibody dynamics, as well as suspension and tyre development.

Yang Chen is a Research Scientist at the Center for Vehicle Systems and Safety (CVeSS) at Virginia Tech. He received his PhD (2017) in Mechanical Engineering from Virginia Tech and his MEng (2013) in Mechanical Engineering from Stevens Institute of Technology. His research focuses on modeling and simulation analysis of vehicle dynamics, development of advanced systems for improved vehicle dynamic performance, and vehicle dynamics testing and data analysis. He is the Chair of the SAE Commercial Vehicle Congress Chassis Design and Vehicle Dynamics Committee from 2020 to 2021.

Massimiliano Gobbi is Full professor of Mechanical Engineering at Politecnico di Milano. He was awarded a Master's degree in Mechanical Engineering in 1994 (100/100 cum laude) from Politecnico di Milano and a PhD in Applied Mechanics in 1998. He was a full time visiting scholar in the Department of Mechanical Engineering of the University of California, Vehicle Dynamics Laboratory, Berkeley in 1998. From 2002 to 2017, he had been an Associate

Professor at Politecnico di Milano in the Department of Mechanical Engineering. He is Co-founder of the Spin-off-company SmartMechanical. More than 200 technical papers have been published in well-known, international, peer reviewed journals or presented at reputed international conferences. He is author of seven international patents and of three books. He had been Chair of the Vehicle Design Committee (VDC) of the ASME from 2015 to 2017.

Commercial vehicle rollover has been a serious public safety issue worldwide for many decades, not only on highway commercial vehicles, but also on industrial, off-highway, military, sports and recreational vehicles, agricultural machines, mining and construction equipment. Rollover accidents are particularly violent and can cause much severer injuries and fatalities than other types of vehicle crashes. To alleviate this problem, a great number of innovations on anti-roll devices, on designs and control methodologies of semi-active/active suspensions, as well as on steering and braking strategies have been devised, using various rollover criteria developed together with the systems.

To help promote awareness of new research efforts in such areas, we arranged the special issue and collected new and original contributions on advanced research associated with commercial vehicle roll dynamics studies, as well as state-of-the-art rollover-mitigation technologies. We believe that a better understanding of commercial vehicle roll dynamics and evaluation with or without human drivers is essential to better designs of vehicle structures and smart control systems. The special issue includes eight papers from several research groups worldwide. These papers represent a broad spectrum of vehicle roll dynamics studies, from the mathematical modelling for rollover and handling analysis, to the developments of active suspension and steering and braking control systems, and to the effect of off-centred loading on vehicle roll stability and beyond.

Recognising the importance of the physical modelling on the rollover limit prediction, the researchers from Politecnico di Milano propose a mathematical model for the rollover limit computation of farm tractors in “Mathematical model for farm tractors towing single axle trailer rollover prediction”. The model is used to study the static rollover threshold of the vehicle on slopped surface. The numerical results indicate that adding a single-axle trailer behind the tractor results in a reduction in the rollover limit and sliding limit. With the condition of no braking torque applied, the reduction of the slope angle is approximately 50% in both uphill and downhill situations. In the case of the trailer brakes, the sliding limit in the downhill case is found to be nearly the same as those of the tractor without the trailer. Another relevant modelling effort is presented in “A light-duty truck model for the analysis of on-centre handling characteristics” conducted by Duan et al., in which a multi-body vehicle dynamic model is developed for the analysis of the on-centre handling characteristics of light-duty trucks. The model that was established includes detailed and accurate parameterisation of the nonlinear power steering system, the friction hysteretic characteristics in the steering and suspension systems, and the nonlinear tyre characteristics. The effort to validate the model against data collected from field testing is also presented in their study.

Among the eight papers in the special issue(s), four of them are focusing on chassis control systems development and performance assessment. “GA tuned H infinity roll

acceleration controller based on series active variable geometry suspension on rough roads" by Nazemi et al. proposes a suspension system capable of actively controlling the roll motion of the vehicle using the H-infinity algorithm to achieve reduced propensity of wheel tip-up and vehicle rollover. The study indicates that the proposed control approach results in reduced roll angle and rollover index by 85% as compared to the traditional PID controller. In "Roll stability enhancement in a full dynamic ground-tour vehicle model based on series active variable-geometry suspension", Najafi and Tehrani conduct a comparative analysis of the dynamic performance of the vehicles equipped with PID, Fuzzy PID, and LQR suspension controllers. Their study provides guidance for finding the desired solution for vehicle ride quality and roll stability by using the three suspension controllers or any combination of them. The paper titled "Roll Dynamics of Long Combination Semi-trailers with Steerable Axles" investigates the dynamic performance of an A-double long combination vehicle (LCV) from the active steering perspective. The results of a co-simulation in TruckSim® and Simulink® indicate that the trailer steerable axle system enables a significant improvement on the off-tracking performance of the LCV at low speeds while maintaining the roll and yaw stability of the vehicle within the accepted performance standards for high-speed steering manoeuvres. In "Active trailer braking control for car-trailer combination based on multi-objective fuzzy algorithm" by Su et al., an active trailer braking control system for the car-trailer combination is proposed. The authors demonstrate the effectiveness of the proposed controller in a co-simulation using TruckSim® and Simulink®, with results indicating that the use of the controller reduces the yaw rate and lateral acceleration of the trailer by about 30%, achieving better lane-keeping and improved roll stability of the trailer.

The last two papers in the special issue(s) are associated with the analytical investigation of commercial truck roll stability. The researchers at the Center for Vehicle Systems and Safety (at Virginia Tech) provide a simulation-based study on the effect of the off-centred loading on the roll stability of 28-ft double-trailer trucks in "Effect of off-centred loading on roll stability of multi-trailer trucks". The study shows that front- and side-loading of the rear trailer results in the largest lateral load transfer ratio and tip-up, as compared with loaded and unloaded cases. The loaded case is, however, more prone to rollover than the partially loaded and unloaded conditions. In addition, in "Analytical and experimental investigation of roll stability of a truck towing a special purpose trailer with no suspension", the researchers from the National Research Council of Canada offer a simulation investigation on the roll stability of three vehicles towing a special-purpose trailer that has no brakes and suspensions. Track-test data is used to tune and validate the multi-dynamic model adopted in the study. The simulation results suggest that the three vehicles that are considered in the study meet the roll stability standards for the case of a smooth surface, whereas the introduction of road roughness dramatically decreases the roll stability of the trailer due to the lack of suspensions.

We believe that the eight papers collected in the special issue(s) will offer valuable references for readers in the field of commercial vehicle roll dynamics. We would like to thank the authors for their contributions and the anonymous reviewers for their invaluable time and efforts. In addition, our special thanks go to Dr. Xiaobo Yang, the editor of the *International Journal of Vehicle Performance*, for his support to make the special issue possible.