Journal of Dynamic Systems, Measurement, and Control

Guest Editorial

Special Issue: Optimal Energy Management and Control in Connected and Automated Vehicles

The world of personal mobility is undergoing major changes. The majority of vehicles sold in the U.S. today contain some form of connectivity and driver assistance systems. Both automotive OEMs and major technology/software companies have launched deployment and testing programs for autonomous vehicles (ranging from SAE L2 to L5 automation) over the next 10 years.

In the last decade, several studies have confirmed the potential offered by connected and automated vehicle technologies to reduce traffic congestion, expand and improve mobility options, and increase safety. However, the opportunity to improve the energy efficiency of individual vehicles and fleets by exploiting the capabilities offered by advanced driver assistance systems has been only recently explored. Recent contributions in the field have demonstrated that eco-routing, eco-driving, hybrid energy flow optimization, platooning, and other connected and L1–L3 automation techniques can significantly improve individual vehicle energy efficiency.

On the other hand, the deployment and commercial success of future connected and automated vehicles requires an unprecedented effort in advancing and applying physics-based and data-driven modeling, optimization, and control methods to manage the information available from the expanded sensing and different levels of automation. Furthermore, the requirement of executing the control functions in the vehicle with limitations in the available processing and memory capabilities poses further challenges in the creation of computationally efficient methods for solving complex energy efficiency optimization problems in real-time. The complexity of such challenges is further compounded by the presence of multiple layers of interactions among the individual vehicle, surrounding vehicles, and transportation systems at large, in a context where vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communication is becoming a mainstream technology.

This Special Issue of the ASME *Journal of Dynamic Systems, Measurements, and Control* contains a representative collection of research works that focuses on the use of connectivity and automation to co-optimize vehicle operation and powertrain controls, with the ultimate goal of reducing energy consumption and emissions. The contributions selected for the Special Issue include recent advancements in modeling, optimization, model predictive control, and application of artificial intelligence for energy-efficient operation and control of vehicles and hybrid electric powertrains, showing the importance of balancing model-based and data-driven methods for incorporating information, data and enhanced sensing in the design of robust and computationally-efficient optimization and control algorithms.

The Guest Editors would like to express their gratitude to the Authors for their efforts in preparing their contributions, as well as all the Reviewers for their assistance in reviewing articles. We also thank the ASME *Journal of Dynamic Systems, Measurements, and Control* Editor-in-Chief, the Editorial Office, and the ASME Production Team. It is our hope that our readers will find the topics discussed in this Special Issue useful, stimulating further thoughts and research activities oriented at improving the sustainability of automotive and transportation systems.

Marcello Canova
Department of Mechanical and Aerospace Engineering,
Center for Automotive Research,
The Ohio State University,
Columbus, OH 43212
e-mail: canova.1@osu.edu

Mahdi Shahbakhti
Department of Mechanical Engineering,
University of Alberta,
Edmonton, AB T6G 1H9, Canada
e-mail: mahdi@ualberta.ca

Hoseinali Borhan
Research and Technology,
Cummins Inc.,
Cummins Technical Center,
Columbus, IN 47201
e-mail: hoseinali.borhan@cummins.com

Scott Hotz
Automotive Propulsion Systems Department,
Southwest Research Institute,
Ann Arbor Technical Center,
4622 Runway Building,
Ann Arbor, MI 48108
e-mail: scott.hotz@swri.org