# Preface

In 1994, the United States government recognised the need to form an organisation that would respond to the needs of the automotive industry, the government and academia to enable the leveraging of resources and enhance technology transfer. This organisation, the US Army National Automotive Center (NAC), has fostered collaborative efforts leading to the development of a wide array of technologies in the areas of vehicle mobility and handling, lightweight structures, advanced internal combustion engines and hybrid propulsion systems, fuel cells, system integration and controls, vehicle intelligence, robotics, and human factors. The primary research arm of the US Army NAC is the Automotive Research Center (ARC), a U.S. Army Center of Excellence which focuses on engineering, modelling and simulation of ground vehicles and related technologies. Led by the University of Michigan, the ARC is a partnership currently including Wayne State University, Oakland University, University of Iowa, Clemson University, University of Tennessee, and University of Alaska, Fairbanks.

This special issue of *Heavy Vehicle Systems* is dedicated to highlighting various modelling techniques developed by the ARC and their application to heavy vehicle systems. Emphasis is placed on the design and optimisation of next-generation advanced hybrid vehicles for both commercial and military applications. These publications blend basic research with development of efficient modelling techniques and system level simulations. This synergistic approach provides an arsenal of tools for addressing critical automotive issues, e.g. increasing vehicle performance and fuel economy, reducing weight, improving vibration and noise characteristics, reducing usage and wear of components, and optimising complex systems based on given targets and constraints. Flexible, integrated engine-in-vehicle system simulations, coupled with optimisation frameworks, allow maximising vehicle attributes through optimal design. Novel approaches to controlling automotive systems, including power management of hybrid propulsion systems and combined optimisation of design and power management, are demonstrated on virtual and real vehicles. Several articles discuss minimising model complexity using decomposition and coordination techniques in an effort to reduce computational requirements, thus saving time and money. Fidelity and predictability of many of the models are thoroughly validated with experimental results. In addition, a technique for reverse engineering of existing parts for faster model development is described.

Every year, the ARC conducts an Annual Conference that brings together university, industry, and government stakeholders and showcases both collective research efforts, through integrated case studies presented in a plenary session, and contributions of individual researchers in parallel technical sessions. The case studies presented in the ARC conferences during the past two years, extended and refined based on feedback from participants and technical reviews, form the basis for the papers in this issue. These case studies demonstrate applicability of models and methodologies to real world problems, and illustrate benefits of a collaborative environment stimulating cross-cutting efforts linking multiple areas. The selection of topics and vehicle platforms emphasises dual-use, with results being relevant to both commercial and military vehicles.

In closing, we would like to express our appreciation to all the authors and the reviewers of the manuscripts for making this special issue possible. We would also like to acknowledge the technical and financial support of the US Army National Automotive Center, the US Army Tank-Automotive Research, Development and Engineering Center (TARDEC), and their parent organisation, the US Army Research Development and Engineering Command (RDECOM). Finally, we would like to thank our industry collaborators for their valuable contributions to the success of the ARC over the past ten years.

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