Editorial

Qianfan Xin

Engine Performance and System Integration,
CAE Analysis,
Navistar, Inc.,
2601 Navistar Drive, Lisle, IL 60532, USA
E-mail: Harry.Xin@navistar.com
E-mail: QianfanHarryXin@yahoo.com

Biographical notes: Qianfan Xin (also known as Harry Xin) is the Guest Editor for the special issue of 'Advances in powertrain system integration' of *International Journal of Powertrains*. He obtained his Doctor of Science (DSc) degree in Mechanical Engineering in 1999 from Washington University in St. Louis, USA. He is an Engineering Manager in advanced analysis of diesel engine performance and system integration at Navistar, Inc. He has been the Chairperson for the sessions of engine performance and system design in Society of Automotive Engineers (SAE) Commercial Vehicle Engineering Congress (COMVEC) during past several years, and was the Chairman of the 2012 Powertrain and Drivetrain Committee of COMVEC. He is the author of the book *Diesel Engine System Design*.

The original motivation of this special issue is to reflect advances in engine system design and powertrain integration. During the process of calling for papers, I realised that it is immature to a certain extent for the industry to prepare for such a theme, although several excellent papers have been collected in this special issue. Accordingly, the title of the issue has been changed to 'Advances in powertrain system integration' in order to reflect engine technologies/techniques in various areas so that system engineers can obtain insights from these system or component level topics. Advocating system design is not an easy task in the industry and academia, and I wish to see more progresses in this important area.

Engine system design is a core part of modern design techniques for internal combustion engines. System design and component design techniques have been evolving to two main related techniques in the engine industry. System design uses systems engineering principles and analytical precise design techniques to cover a majority of the work in system integration, especially in job functions of analysis and design. It integrates different product attributes of engines (i.e., performance, durability, packaging, and cost) and different subsystems and components via optimisation. It focuses on advanced simulation analysis and generating detailed system design specifications in the early stage of product development, as well as cascading and maintaining the specifications during the entire process of product R&D. A core group of personnel in an academic specialty or an enterprise is system staff. One of the most important modern design techniques is system design technique. Advocating and supporting the development of system technologies/techniques from higher education to product R&D is strategically important. The area of engine system design includes three pillars:

1 design and optimisation of system performance specifications

2 development of advanced analysis methods and simulation techniques

3 development of advanced core engine technologies via performance simulation analysis.

To be more specific, engine system design is an area that has the following features or functions:

- leads modern design processes
- focuses on engine air system performance
- is constrained by durability and reliability requirements
- addresses thermodynamic and energy distribution topics
- pursues precise system design specifications and virtual engine calibration.

This area covers a series of inter-related fields, including systems engineering theories for internal combustion engines, organisation theory, system durability and reliability, optimisation techniques, engine in-cylinder working processes and air flow networks, engine-vehicle matching, powertrain dynamics, engine braking performance, combustion, emissions, engine calibration, aftertreatment integration and matching, valvetrain system design, engine friction and NVH, heat rejection and cooling systems, air system design, transient performance and electronic controls, system specification design and subsystem interactions, as well as operating characteristics and design features of different engine applications.

Ideally, I would like to organise a special issue to report the progresses in the above-mentioned fields related to system design, especially focusing on the following important ones:

- system durability and reliability prediction of engines and vehicles
- engine-vehicle system integration processes
- diesel engine aftertreatment and vehicle integration and system-level modelling
- powertrain cooling and vehicle-in-use or altitude cooling capability in system integration
- engine air system design such as turbocharging and EGR systems
- engine/powertrain controls such as analytical engine controller design and virtual sensors/sensing
- engine/powertrain transient performance, steady-state and transient calibration, engine air system controls, and OBD
- engine/powertrain system NVH
- innovative powertrain concepts.

Although the collected papers do not cover all of the above aspects, the paper recruiting effort was basically successful in many areas. The authors for this special issue come from different areas, and their viewpoints provide great insights to system design

engineers about related technologies or techniques. Seven papers are collected in this issue. The paper by Dr. Lambert et al. on medium-duty diesel engine nitrous oxide (N_2O) emission is an excellent and very timely contribution to the literature and presents a system-level understanding on this emission related to diesel engine urea SCR performance and greenhouse gas regulations. The paper offered by Dr. Zheng et al. is a good illustration of light-duty diesel engine aftertreatment system development including SCR-DOC-DPF performance characteristics and CFD modelling. The paper authored by Dr. Mallamo et al. provides an excellent example of light-duty diesel engine model-based calibration and optimisation. The paper authored by Dr. Zheng and Professor Ohta on piston slap and engine vibration analysis is an extension of Professor Ohta's famous research on piston slap modelling dated back to 1980s. The paper by Liu et al. on turbocharged diesel engine intake noise investigation comes from a group of researchers in a reputable engine NVH laboratory in China. In regards to innovative powertrain concepts, the paper offered by Dr. Li et al. from prestigious Zhejiang University in China and the paper written by Dr. Zanforlin and Dr. Frigo provide good examples.

Finally, I would like to greatly appreciate the authors of this special issue for their contributions and congratulate their good work. I wish this issue is helpful and insightful for both system engineers and component engineers.