Preface

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The utilisation of electric propulsion systems in passenger and goods vehicles is rapidly increasing with the commercial introduction of plug-in hybrid and battery electric vehicles (PHEVs and BEVs) to supplement the already robust presence of hybrid-electric vehicles (HEVs). The subsystems adopted in HEVs, i.e., batteries, electric machines, power converters and mechanical transmissions, will see different duty cycles as a consequence of the all-electric range characteristics of PHEVs and BEVs.

A significant variety of hardware layouts is possible for electric propulsion systems for BEVs, in terms of number of electric motor drives, centrally located or individually controlled (and in this case the in-wheel or on-board variants are possible), and mechanical transmission system configurations (e.g., single-speed or multiple-speed). The number of possible architectures is even larger in the case of HEVs and PHEVs, where the interaction between the internal combustion engine and the electric motor drive is the focus of current research. The range of solutions simulated, assessed and optimised by industrial and academic researchers is increased by the possibility of adopting architectures with central or distributed (e.g., one for each electric powertrain) energy storage units, either formed by a battery or the combination of a battery and a

supercapacitor. Moreover, the precise controllability of the torque generated by the electric motor drives can improve vehicle drivability and dynamics.

The articles of this special issue encompass a representative sample of the wide range of traditional and novel research aspects of electric propulsion systems, from energy storage unit analysis and modelling, to the vehicle dynamics enhancement allowed by vehicle electrification. The paper by Sorniotti et al. describes and simulates a novel dual-motor electric drivetrain layout potentially capable of improving the overall vehicle efficiency along the examined driving schedules. The contributions from Lex et al. and Shyrokau et al. deal with the enhancements of vehicle dynamics and brake regeneration achievable through drivetrain topologies with individually controlled motors, coupled with optimal controllers. Yurkovich and Guezennec present an advanced simulation methodology of battery pack imbalance; Monte Carlo simulations and the effect of the failure of an individual cell are analysed in detail. The article by Biasini et al. illustrates a novel rule-based controller for the power management of a medium duty hybrid truck, showing an energy consumption performance within 3% of the global optimal one obtained through dynamic programming. Finally, the potential benefits of drivetrain electrification in terms of HEV drivability are evaluated in Galvagno et al.

We hope that this special issue will attract the interest of the researchers in the subject area and inspire further work in the development of efficient and high performing electric propulsion systems.