Editorial

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The impact of ground transportation on global warming, as well as the great economic potential associated to worldwide 'greening' of cars and light-duty and heavy duty vehicles, are nowadays pushing car makers, researchers and governments to concentrate significant efforts on increasing the use of clean energy for vehicle propulsion.

Despite the advancements in recent years at vehicle level design and integration of clean energy sources with either traditional or innovative powertrains, major technological and economical issues still need to be faced and, possibly, fully overcome to substantially enhance sustainable growth and market penetration of 'green' vehicles, including electric, hybrid electric, plug-in hybrid, fuel cell hybrid, pneumatic hybrid, alternative fuel and solar hybrid applications. The papers included in this special issue thus focus on design, optimisation, controls, analysis of socio-economic implications and experimental testing of advanced power and propulsion subsystems for 'green' powertrains.

The first paper, titled 'Greening the transportation sector: a methodology for assessing sustainable mobility policies within a sustainable energy action plan', proposes a study aimed at investigating the coupling of a given transportation system with fuel consumption and emissions associated to main vehicle categories' travelling within a worldwide representative urban traffic environment. To this aim, suitable modelling procedures are proposed and discussed, in view of their deployment to assess the impact of different mobility policies on fuel consumptions, as well as on vehicle emissions. The presented research outcomes lead to the following conclusions, which provide both methodological and applicative contribution to the field: bottom-up approach is more flexible with respect to both top-down and aggregate analyses, thus also allowing to be adapted to significantly different case studies with respect to the one here presented and discussed; vehicle fleet renewal has a strong impact on particle emissions reduction, whereas keeping greenhouse gases and fuel consumption at a sustainable level entails adopting transportation policies capable of effectively reducing car use, as well as increasing vehicle speed on the network by adopting suitable congestion reduction strategies.

In 'Architectural study of diesel hybrid propulsion systems to meet future fuel economy and emission regulations', the focus is on the electrification of the diesel propulsion system. In particular, Diesel hybrid propulsion system architectures are presented, that could potentially meet future fuel economy and emissions compliance standards for a given set of performance criteria. Three diesel hybrid electric vehicle (D-HEV) architectures: parallel hybrid (PH), power split (PS) and series hybrid (SH) are investigated, compared and evaluated considering trade-offs between fuel economy and emissions targets. Summarising, based on the results presented in this study, the authors conclude that

1 optimal control strategies are to be implemented in order to achieve both fuel economy and emission targets

2 NOx after treatment system is needed to maximise fuel efficiency while meeting the stringent NOx emission requirements

3 that the integration between the hybrid strategy, combustion strategy and after treatment system control strategy is required in order to attain the hydrocarbon emission requirements.

The paper 'Trip-based control strategy for simple and efficient use of plugin hybrid electric vehicles', proposes a robust and efficient, and then implementable in a state of the art ECU, optimised control strategy. The optimisation strategy is defined for any given trip, also taking into proper account the vehicle speed over the route. The main optimisation target demonstrated in this paper is the request of reaching a target SOC at the end of the trip although the application to other objectives (e.g., minimisation of emissions) is also feasible. The presented strategy was implemented and tested in a PHEV vehicle designed and realised at the University of Rome Tor Vergata and validated by experimental data directly acquired on several standard cycles and real-world routes.

Finally, the paper 'Numerical analysis of the benefits achievable by after-market mild hybridisation of conventional cars', presents a proposal of hybridisation of conventional cars by means of a kit composed of wheel motors, photovoltaic panels, an additional battery and a vehicle management unit connected to the OBD port. A study by simulation analysis has confirmed that the proposed mild-solar-hybrid conversion can give significant benefits in terms of fuel consumption, up to about 18%, even adopting in-wheel motors with limited power and without fully exploiting the capability of the system in terms of control strategies. It also emerged that the photovoltaic panels significantly enhance fuel savings. The upgrading of conventional vehicles to solar hybrid could have a significant impact on fuel consumption and CO_2 emissions, since it may potentially be applied to most of the today fleet, without requiring expensive reconversion of production lines for cars.

The papers presented in this special issue offer a partial but representative picture of the emerging topics in the field of 'green' powertrain for sustainable transportation, ranging from large-scale analysis for urban planning to studies on powertrain architecture and control, both for new vehicles and for converting the existing fleet.