Modelling Driving Behaviour and its Impact on the Energy Management Problem in Hybrid Electric Vehicles

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Abstract

The problem of optimally splitting the power demands among the different energy sources (namely batteries and fuel) in a Hybrid Electric Vehicle (HEV) has been extensively addressed in literature. Existing studies focus mostly on applying optimal control techniques to minimize fuel consumption and pollutant emissions subject to charge sustenance constraints, over predefined driving cycles (for example NEDC of FTP75). The optimality of those solutions relies on the *a priori* knowledge of the driving cycle, while perfect knowledge of future driving conditions can be rarely assumed. Driving conditions depend on traffic conditions and road profile, but also on driver's style.

Since the performance of a control strategy in terms of fuel consumption and emissions is strongly affected by the vehicle power demands, accurate predictions of future driving conditions are required in order to optimize the energy management in the vehicle. This paper examines different methods to model driving patterns with a stochastic approach. Despite all the addressed methods are based on the statistical analysis of previous driving patterns to predict future driving conditions, some of them employ current vehicle sensors while others require non-conventional sensors (for instance, GPS). The different modelling techniques to estimate future driving conditions are evaluated with real driving data and optimal control techniques, trading off model complexity with performance.