Project C7: Strategies for Minimising Railway Energy Consumption

Researchers:

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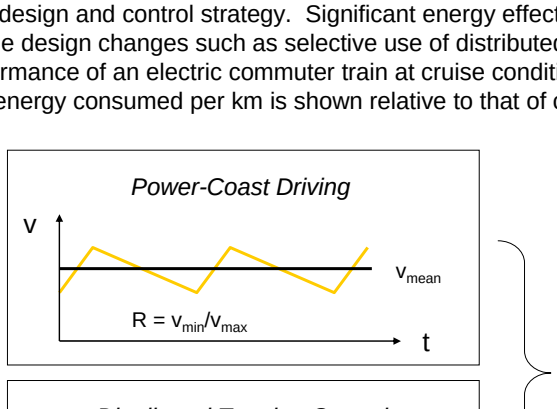
Background:

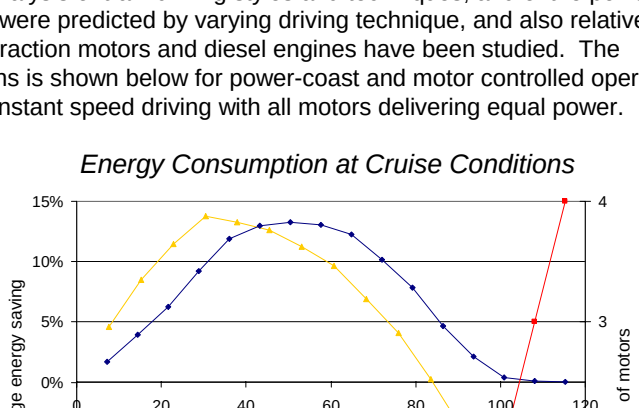
There is an increasing awareness within the railway sector that it faces real economic and environmental challenges, coupled with new technology opportunities. This has particular significance in the UK where there is a heavy reliance upon diesel (fossil fuelled) traction; some 50% of total train miles in comparison with 10-15% on other major European railways. The key to future sustainability lies in the development of technological solutions and energy management options that deliver improved environmental performance at reduced cost.

The project has focused primarily on computer simulation of rail vehicles to assess traction energy use and the potential for energy reduction of measures including improved driving techniques, regenerative braking with onboard energy storage and intelligent power-train control.

Work Done:

Vehicle simulation has been used to conduct fundamental analysis of train driving styles and techniques, and of the power-train design and control strategy. Significant energy effects were predicted by varying driving technique, and also relatively simple design changes such as selective use of distributed traction motors and diesel engines have been studied. The performance of an electric commuter train at cruise conditions is shown below for power-coast and motor controlled operation. The energy consumed per km is shown relative to that of constant speed driving with all motors delivering equal power.





Future Work:

The development of the computer simulation tool will include a train driver model based on analysis of recorded journey data. The energy consumption for realistic duty cycles will be calculated to assess the performance of energy saving measures.

The evaluation of potential new traction technologies will focus on kinetic energy storage systems (consisting of composite flywheels and continuously variable transmissions) identified as potentially efficient and cost effective options for enabling regenerative braking on diesel powered rail vehicles (particularly those with hydrodynamic transmissions).

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