Abstract

OptiDrive: A Practical Solution for the Computation of Energy-Optimised Operating Speed Profiles

Research conducted by ENOTRAC for the Rail Safety and Standards Board (RSSB) in the UK has identified smart driving techniques as one area where quick wins can be made in terms of energy saving. Consequently, ENOTRAC has developed a desktop simulation tool, code-named OptiDrive, for the computation of energy-optimised operating speed profiles.

OptiDrive solves the following problem. A train has to travel from A to B, using as little energy as possible. What speed profile should it follow considering track and train characteristics as well as operating constraints? OptiDrive implements a powerful genetic algorithm, which determines, heuristically, the operating speed profile that will minimise energy consumption while taking into account the aforementioned parameters and constraints.

OptiDrive has been developed as a Java desktop application. The software programme is compatible with Linux and Windows operating systems. It features a straight-forward user interface that reduces the learning curve for the engineers. There is also a possibility of running simulations in batch mode and querying simulation work progress.

The output of OptiDrive is a table showing where, along the line, trains should accelerate, coast and decelerate to minimise energy consumption while keeping to the existing timetable. The results can be directly fed into FABEL, ENOTRAC's railway simulator, to assess the impact of new driving regimes at system level taking into account signalling, timetable and traction power network. OptiDrive also provides operators with a practical, inexpensive and readily available solution to benchmark their present driving regime with theoretically optimised driving regimes.

In 2007 and 2008 EUROLUM (VEOLIA Transport) carried out several measurement campaigns on the Rouen tramway network (France) to improve management of the network and reduce the energy consumption of the system. The measures, thus obtained, offer a rare opportunity to compare real-life with theoretical results from OptiDrive.

A detailed model of the Rouen tramway was built and simulated into OptiDrive. It was found that, on this particular system, a flat-out driving regime (i.e. accelerate as quickly as possible and decelerate as late as possible) consumes 33% more energy than average real-life operations. Energy-optimised driving regime, as computed by OptiDrive, resulted in 7% energy saving when compared with average real-life operations.

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