Modelling realistic energy losses from variable efficiency and vehicle systems, in determining energy efficient train control l

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May 2022

Abstract

The reduction of the energy consumption is an increasingly important topic of the railway system. Energy efficient train control (EETC) is one solution, which refers to mathematically computing when and how much to accelerate, the cruising speed, possibly coasting over a suitable space and where and how much to brake. Most approaches in literature and industry simplify greatly a lot of non-linear effects, such that they ignore mostly the dynamic losses and the auxiliary component power consumption. To fill this research gap, a series of non-linear realistic losses from a variety of processes is modelled, and evaluated for real life vehicles. An algorithm based on dynamic programming is able to solve the problem of evaluating paths given constraints on total travel time. This allows the evaluation of multiple test cases, which highlight the influence of the dynamic losses and the auxiliary component power consumption on railway trajectories, including also the one optimized without including the realistic losses. The results of the research and optimization highlight the practical potential of different EETC schemes, which suggest larger energy saving, when the realistic losses are considered.

Keywords

Train trajectory optimization, Energy-efficient train operations, Dynamic efficiency