Branch and Bound based methods to minimize the energy consumed by an electrical vehicle on long travels with slopes

This paper presents extensions to a Branch and Bound (B&B) based method for minimizing the energy consumption of an electric vehicle during long travels with slopes. The authors address a mixed-integer optimal control problem derived from the vehicle's electrical and mechanical dynamics. An efficient Branch and Bound algorithm was developed for short, flat routes (100m). This work extends the approach to more realistic scenarios: long distances and routes with varying slopes.

Key contributions include the development of two new heuristics for computing bounds, which improve efficiency and reliability compared to earlier methods. The Branch and Bound algorithm is also enhanced to handle long travels by using variable time discretization, focusing on acceleration and deceleration phases. Additionally, the model is extended to incorporate slopes, and a new algorithm is introduced to manage slope changes effectively. The paper emphasizes the importance of adding acceleration constraints to ensure realistic solutions.

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