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Green Wave Control Strategy for Optimal Energy Consumption by Model Predictive Control in Electric Vehicles

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Abstract : Electric vehicles are becoming increasingly popular asa sustainable alternative to traditional combustion engine vehicles. However, to fully realize the potential of EVs in reducing environmental impact and energy consumption, efficient control strategies are essential. This study explores the application of green wave control using model predictive control for electric vehicles, coupled with energy consumption modeling using neural networks. The use of MPC allows for real-time optimization of the vehicles' energy consumption while considering dynamic traffic conditions. By leveraging neural networks for energy consumption modeling, the EV's performance can be further enhanced through accurate predictions and adaptive control. The integration of these advanced control and modeling techniques aims to maximize energy efficiency and range while navigating urban traffic scenarios. The findings of this research offer valuable insights into the potential of green wave control for electric vehicles and demonstrate the significance of integrating MPC and neural network modeling for optimizing energy consumption. This work contributes to the advancement of sustainable transportation systems and the widespread adoption of electric vehicles. To evaluate the effectiveness of the green wave control strategy in real-world urban environments, extensive simulations were conducted using a high-fidelity vehicle model and realistic traffic scenarios. The results indicate that the integration of model predictive control and energy consumption modeling with neural networks had a significant impact on the energy efficiency and range of electric vehicles. Through the use of MPC, the electric vehicle was able to adapt its speed and acceleration profile in realtime to optimize energy consumption while maintaining travel time objectives. The neural network-based energy consumption modeling provided accurate predictions, enabling the vehicle to anticipate and respond to variations in traffic flow, further enhancing energy efficiency and range. Furthermore, the study revealed that the green wave control strategy not only reduced energy consumption but also improved the overall driving experience by minimizing abrupt acceleration and deceleration, leading to a smoother and more comfortable ride for passengers. These results demonstrate the potential for green wave control to revolutionize urban transportation by enhancing the performance of electric vehicles and contributing to a more sustainable and efficient mobility ecosystem.

Keywords : electric vehicles, energy efficiency, green wave control, model predictive control, neural networks
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