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An Optimal Control and Reinforcement Learning Approach with Multi-Fidelity Simulation Models for Motion Control of Four in-Wheel Motor Vehicles*

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***Abstract*— We address the motion control of an electric vehicle with four in-wheel motors, which comprises two main tasks: the first is a velocity tracking problem and the second is a trajectory tracking problem through a double lane change maneuver, while satisfying constraints and minimizing energy objective functions in both cases. Our approach to this problem consists of solving an open-loop optimal control problem to obtain the initial trajectory planning and utilizing reinforcement learning to devise the final policy. Simulation models with different degrees of complexity and fidelity, including unknown disturbances from the road surface, are used to train the reinforcement learning algorithm.**

***Index Terms*— Automotive control, Optimal control, Reinforcement learning.**

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