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Development of an Intelligent Regenerative Braking Control Strategy for Electric Vehicles using MATLAB/Simulink

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Abstract: *This paper introduces a detailed MATLAB/Simulink model for simulating a regenerative braking system in an Electric Vehicle (EV). Regenerative braking is a big plus for EVs because it converts the vehicles kinetic energy during slowing down into electrical energy, when is then sent back to the battery. This improves the vehicle's energy efficiency and increases how far it can go in single charge. The simulation model includes important parts of the regenerative braking system such as the vehicle's movement, the electric hub motor, battery, and control system that switches between regenerative and mechanical braking. Different ways of controlling how braking force are shared between regenerative and friction brakes is studied. The results of the simulation show how well the model can capture the energy recovery process under various driving situations, like different slowing rates and vehicle speeds. This focus is particularly relevant to the development of affordable and sustainable transport solutions, such as the retro-fit hybrid E-bike, where an existing Internal Combustion (I.C.) engine motorcycle is converted by adding an electric motor and battery system. The study also looks at how different control strategies for regenerative braking affect energy recovery and overall braking performance. This research offers useful information for designing and improving regenerative braking systems in EVs, which helps in making transportation more energy-efficient and eco-friendly.*

Keywords: Electric Vehicle (EV), Regenerative Braking, MATLAB/Simulink, Energy Efficiency, Braking Control Strategy, Simulation