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Design and Optimization Analysis of Two-Wheeler EV Chassis

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Abstract: *The rapid growth in electric two-wheelers has led to the increased need for lightweight and stiff chassis systems. The chassis is an important member affecting rider safety, stability, and overall performance, while also making a significant contribution to the total weight of the vehicle, which can affect energy efficiency and range. Conventional materials such as steel and aluminium will generally compromise weight versus stiffness, which can negatively impact efficiency and range in even the most efficient electric vehicle.*

This study investigates a design, analysis, and optimization process of an electric two-wheeler chassis system fabricated using AISI 4130 Chromoly Steel. Chromoly steel was selected for its high strength-to-weight ratio and excellent weldability. A solid 3D model was produced in SolidWorks followed by an analysis using ANSYS Workbench for static loading to determine maximum stress and deformation, as well as factor of safety. Additionally, there was topology and size optimization for weight improvement while maintaining the structural integrity of the chassis system.

The optimized (revised) version of the chassis reduced weight by roughly 22.5% while maintaining a Factor of Safety (FOS) of 2 or greater. This would indicate better stiffness-to-weight ratio, lower center of gravity, and improvements in energy efficiency and handling. Overall, the work is meant to provide a useful avenue toward practical lightweight and performance chassis designs for electric two-wheelers.

Keywords: Two-Wheeler EV, Lightweight Chassis, AISI 4130 Chromoly Steel, Structural Analysis, Topology Optimization, Factor of Safety, ANSYS

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