ANALYSIS OF THE EFFECT OF FRAME STRUCTURE ON STRESS, DISPLACEMENT AND FACTOR OF SAFETY IN ENERGY EFFICIENT VEHICLE CHASSIS USING SOLIDWORKS 2021 SOFTWARE

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ABSTRACT

This study analyzes the design of an energy-efficient vehicle frame using a ladder frame structure made from aluminum 6061, with two material structure: decacomb and hollow. The simulation results aimed to evaluate the effects of static load distribution on both materials in terms of maximum stress, displacement, and factor of safety. The decacomb structure demonstrated a maximum stress of 21.50 MPa and maximum displacement of 0.51 mm under a 70 kg (686 N) static load applied at the driver and engine support. In comparison, the hollow structure exhibited a higher maximum stress of 27.94 MPa and a displacement of 1.06 mm at the rear axle support, indicating higher deformation. The decacomb structure showed a minimum factor of safety of 12.84, outperforming the hollow structure's factor of safety of 9.88. This indicates that the decacomb material has a better load distribution and structural reliability, reducing stress concentration and enhancing overall frame durability. Therefore, the decacomb frame design is more efficient for use in energy-efficient vehicles due to its superior load-handling and deformation resistance characteristics.

Keywords: *frame design, energy-efficient vehicle, ladder frame, decacomb, hollow, aluminum 6061, factor of safety*