

Design and Performance Enhancement of Internal Combustion Engine Connecting Rod Assembly through FEA and Optimization Techniques

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Abstract: *This paper presents a comprehensive design, modeling, and finite element analysis (FEA) of a connecting rod assembly for an internal combustion (IC) engine. The investigation encompasses structural stress analysis, thermal behavior assessment, dynamic load evaluation, and material comparison to identify an optimum configuration that balances mechanical performance with weight efficiency. The performance of the connecting rod was evaluated under cyclic loading conditions, and a comparative analysis was conducted between the existing material (gray cast iron) and the proposed alternative (aluminum alloy 6061) to quantify performance differences under identical loading and boundary conditions. The results show that gray cast iron demonstrates superior heat flux dissipation performance at 50,000 rpm operating conditions, indicating better thermal management potential compared to gray iron under high-speed engine operation. Additionally, the optimized design ensures improved structural integrity and operational efficiency.*

Keywords: Connecting Rod Assembly, Finite Element Analysis (FEA), Thermo-Mechanical Performance, Material Optimization, Dynamic Load Analysis.

