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(57) Abstract :
The design and modelling of a optimized wheel hub, utilizing cutting-edge engineering techniques to enhance both structural integrity and performance. The project leverages advanced methodologies, specifically topology optimization, to systematically refine the internal structure of the wheel hub through finite element analysis (FEA) and computational algorithms. The resulting design achieves an optimal balance between strength, durability, and weight reduction, paving the way for lightweight and high-performance automotive components. Incorporating advanced materials such as high-strength alloys and composite blends is a critical aspect of the topology-optimized wheel hub. The abstract details the strategic placement of these materials within the optimized structure, highlighting their superior mechanical properties. Furthermore, the research places significant emphasis on the validation process. Complex simulations and analyses, including FEA, assess stress distribution, fatigue life, and structural integrity under diverse loading conditions, ensuring the design meets rigorous performance criteria. The use of computational algorithms and optimization techniques further refines the topology, iteratively enhancing the wheel hub's efficiency. The abstract underscores the practical applications of the topology-optimized design, emphasizing its ability to withstand off-road stresses, contribute to overall vehicle dynamics, and reduce unsprung mass. The potential implications achieved through weight reduction and enhanced aerodynamics, make this research pivotal not only for advancing wheel hub design but also for broader developments in lightweight and high-performance automotive system.

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