PROJECT REFERENCE NUMBER-: 46S_BE_3163

TITLE OF THE PROJECT-: DESIGN ANALYSIS AND DEVLOPMENT OF PISTON USING S.L.A.M.

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KEYWORDS-:

1) **Design**
2) **Analysis**
3) **Development**
4) **Connecting rod**

INTRODUCTION-:

Connecting rods are critical components in internal combustion engines, transmitting the forces generated by the piston to the crankshaft. Design optimization of connecting rods aims to enhance their strength, stiffness, and reliability, while minimizing their weight and cost. There are several factors that need to be considered when optimizing the design of connecting rods, including the material properties, manufacturing process, geometry, and loading conditions. The goal is to balance these factors to achieve the best possible performance.

OBJECTIVES-:

Design and Analysis of the connecting rod based on the input parameters and then modelling of the connecting rod in the CATIA software. FEM tool software CATIA is given model and material input based on the parameters obtained. To determine the Von-Misses stresses, Translational displacement, Principal stress and to optimize in the existing Connecting rod design. To calculate stresses in critical areas and to identify the spots in the connecting rod where there are more chances of failure. To determine the structural analysis and modal analysis of the connecting rod with different materials.

The main aim of the project is to determine the Von-Misses Stresses, Translational displacement, Principal stress on which the new material can be compared with the existing material used for Connecting Rod.

METHODOLOGY-:

MATERIAL USED IN CONNECTING ROD MANUFACTURING

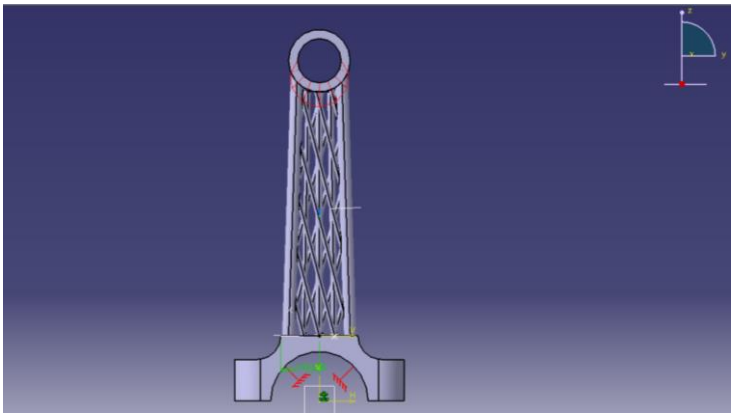
Connecting rods are typically made from high-strength materials that can withstand the high stresses and forces generated during engine operation. The most common materials used in connecting rod manufacturing are:

1. **Aluminium:** Aluminium is a lightweight material that is often used in high-performance engines. Aluminium connecting rods are typically made from forged aluminium, which is a strong and durable material that can withstand high stresses and forces.
2. **Titanium:** Titanium is a lightweight and high-strength material that is often used in high-performance and racing engines. Titanium connecting rods are typically made from forged titanium, which is a strong and durable material that can withstand high stresses and forces.

The material used for a connecting rod depends on the engine's design, operating conditions, and performance requirements. The choice of material can impact the connecting rod's strength, weight, durability, and cost.

To optimized model design was completely carried out using try and error method. Where, the initial base design was referred from reference model of connecting rod and the complex design of optimized model inspired from chaos car. We carried out 13 iterations to reach this present optimized model.

Optimized Final Model



RESULT AND CONCLUSION-:

Connecting rod design optimization is a complex process that involves a number of considerations, including material selection, geometry, stress analysis, and manufacturing methods. After conducting a thorough analysis and optimization process, a number of conclusions can be drawn to ensure the best possible design for the connecting rod.

1. From results it is clear that titanium alloy is best material for manufacturing of connecting rod although it has more weight than the aluminium alloy it having more factor of safety and high natural frequency which optimizes the design of connecting rod.
2. Aluminium alloy is second choice for production of manufacturing of connecting rod.
3. Cast iron is not effective with regarding to mass and it increases the weight of connecting rod.

In conclusion, the design optimization of a connecting rod requires a thorough analysis and consideration of material selection, geometry, stress analysis, and manufacturing methods. By optimizing each of these factors, a connecting rod can be designed to withstand the loads imposed by the engine and environment while also being lightweight and reliable.

SCOPE FOR FUTURE WORK-:

Although our designed model has slightly failed due to Von Mises stress exceeding the allowable stress, this outcome provides valuable insights for future research. We can further investigate the mechanical properties of the materials used in the connecting rod, the design and manufacturing process, and the impact of external factors such as operating conditions on the performance of the connecting rod.

One potential area of research could be exploring alternative materials or material combinations that could better withstand the stresses involved in the operation of the connecting rod. This could include conducting experiments with new materials or investigating the effects of material microstructure on the performance of the connecting rod.

Another potential improvement could be in the design and manufacturing process itself. We could explore different manufacturing methods, such as additive manufacturing or 3D printing, to see if they can improve the performance of the connecting rod.

Additionally, we could optimize the design of the connecting rod using simulation tools and finite element analysis to minimize the stress concentrations and improve its overall performance.