Project Title: Design and Structural Analysis of an Internal Combustion Engine Connecting Rod

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Task 1: CAD Modelling & Design Specification

Objective

The primary objective was to design a robust **Connecting Rod** for automotive applications. The design focuses on optimizing the weight-to-strength ratio while ensuring compatibility with standard crankshaft and piston pin dimensions.

Design Parameters & Geometry

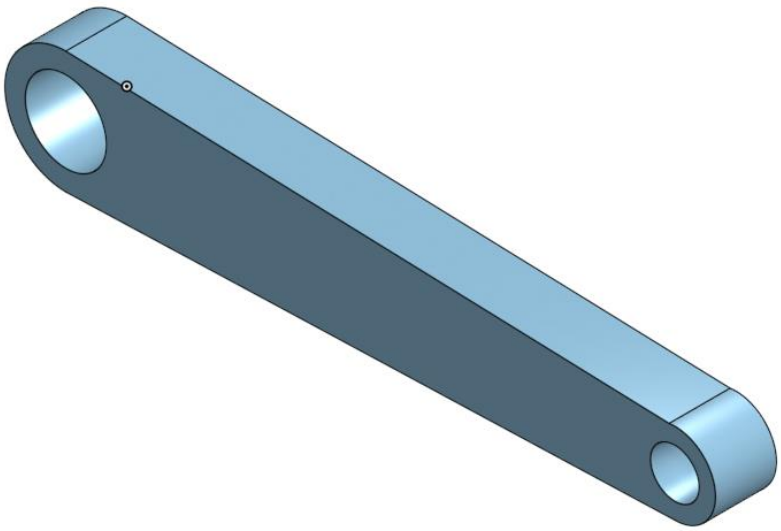
- **Big End (Crankshaft Side):** Designed with an outer diameter of **30mm** and an inner bore of **20mm** to accommodate the crankpin bearing.
- **Small End (Piston Side):** Designed with an outer diameter of **20mm** and an inner bore of **12mm** for the gaugeon pin.
- **Centre-to-Centre Distance:** A total length of **150mm** was maintained to ensure the correct compression ratio within the engine cylinder.
- **Extrusion Depth:** The part was extruded to a uniform thickness of **15mm**.

Modelling Workflow

1. **Sketching:** Utilized the "Front Plane" for 2D geometry. Used **Constraints (Tangency)** to ensure smooth transitions between the circular ends and the connecting shank.
2. **Trimming:** Applied the **Trim Tool** to remove internal overlapping arcs, creating a single continuous profile.
3. **3D Generation:** Used the **Extrude Tool** to transform the 2D profile into a 3D solid body.

Material Selection

- **Material: Hardened Alloy Steel**
- **Justification:** This material was selected due to its high yield strength and excellent fatigue resistance, which are critical for components subjected to millions of cyclic loading sessions.



Task 2: Structural Simulation & Finite Element Analysis (FEA)

Objective

To validate the structural integrity of the design under a simulated peak combustion load of **1000N**.

Simulation Setup

- **Fixed Support:** The inner surface of the **Big End** was fixed in all degrees of freedom to simulate its connection to the crankshaft.
- **Force Application:** A tensile load of **1000N** was applied to the inner surface of the **Small End**, simulating the upward pull during the intake stroke.
- **Mesh:** The model was discretized into finite elements to calculate stress distribution.

Results & Observations

- **Stress Distribution:** The highest stress concentrations were observed at the transition zones between the shank and the ends.
- **Structural Safety:** Under the 1000N load, the displacement was negligible, and the stress levels remained well below the yield strength of Hardened Alloy Steel, confirming a high **Factor of Safety (FoS)**.