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DESIGN ,STATIC STRUCTURAL ANALYSIS AND OPTIMISATION OF CRANKSHAFTS

MECHANICS OF MATERIAL EXPERIENTIAL LEARNING

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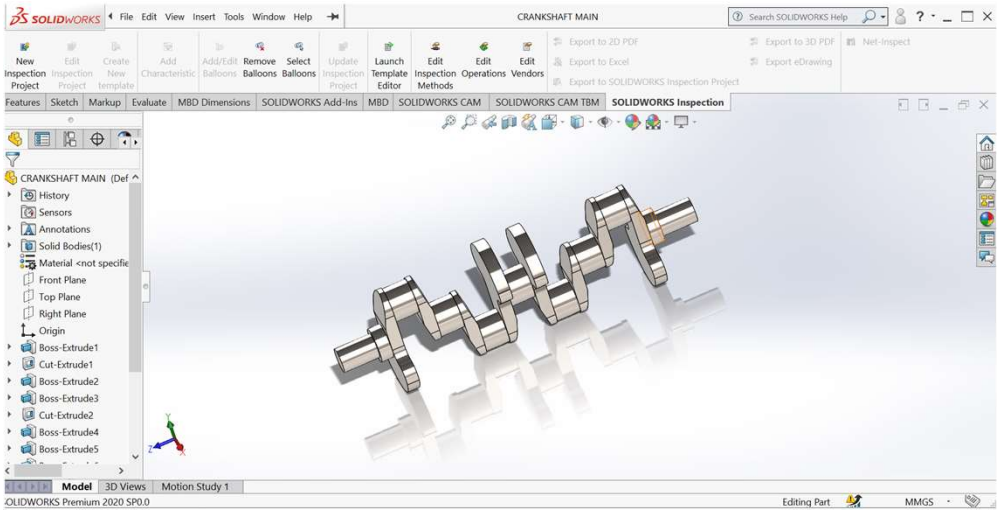
INTRODUCTION

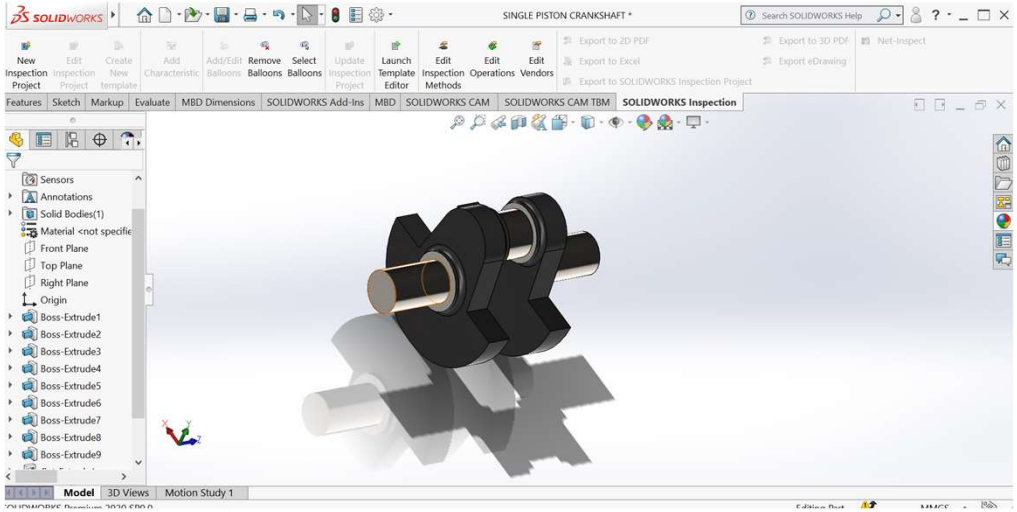
- A crankshaft related to crank is a mechanical part able to perform a conversion between reciprocating motion and rotational motion.
- In a reciprocating engine, it translates reciprocating motion of the piston into rotational motion; whereas in a reciprocating compressor, it converts the rotational motion into reciprocating motion.
- Crankshaft is one of the critical components for the effective and precise working of the internal combustion engine

MECHANISM OF CRANKSHAFTS

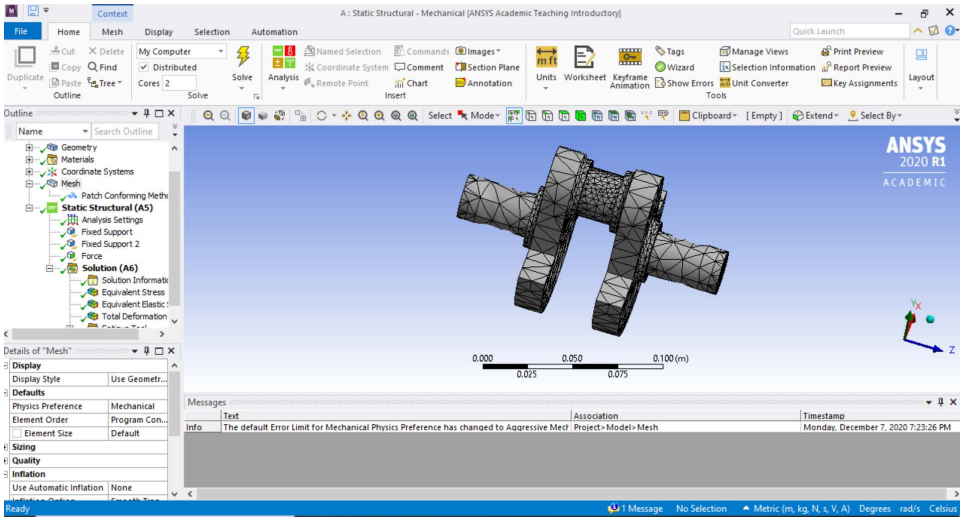
- A crank is an arm attached at right angles to a rotating shaft by which reciprocating motion is imparted to or received from the shaft.
- It is used to convert circular motion into reciprocating motion, or vice versa. The arm may be a bent portion of the shaft, or a separate arm or disk attached to it.
- Attached to the end of the crank by a pivot is a rod, usually called a connecting rod.
- The end of the rod attached to the crank moves in a circular motion, while the other end is usually constrained to move in a linear sliding motion.
- The term often refers to a human-powered crank which is used to manually turn an axle, as in a bicycle crank set or a brace and bit drill

SOLIDWORKS MODEL





MESHING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2020 R1
ACADEMIC
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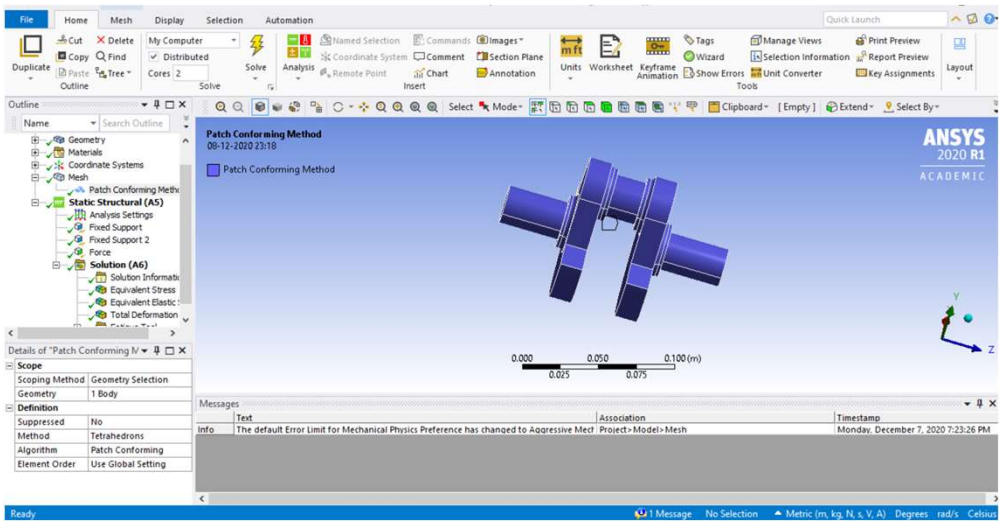
Coordinate Systems
Mesh
Static Structural (A5)
Analysis Settings
Fixed Support
Fixed Support 2
Force
Solution (A6)
Details of "Mesh"
Messages
Ready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Patch Conforming Method
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Messages
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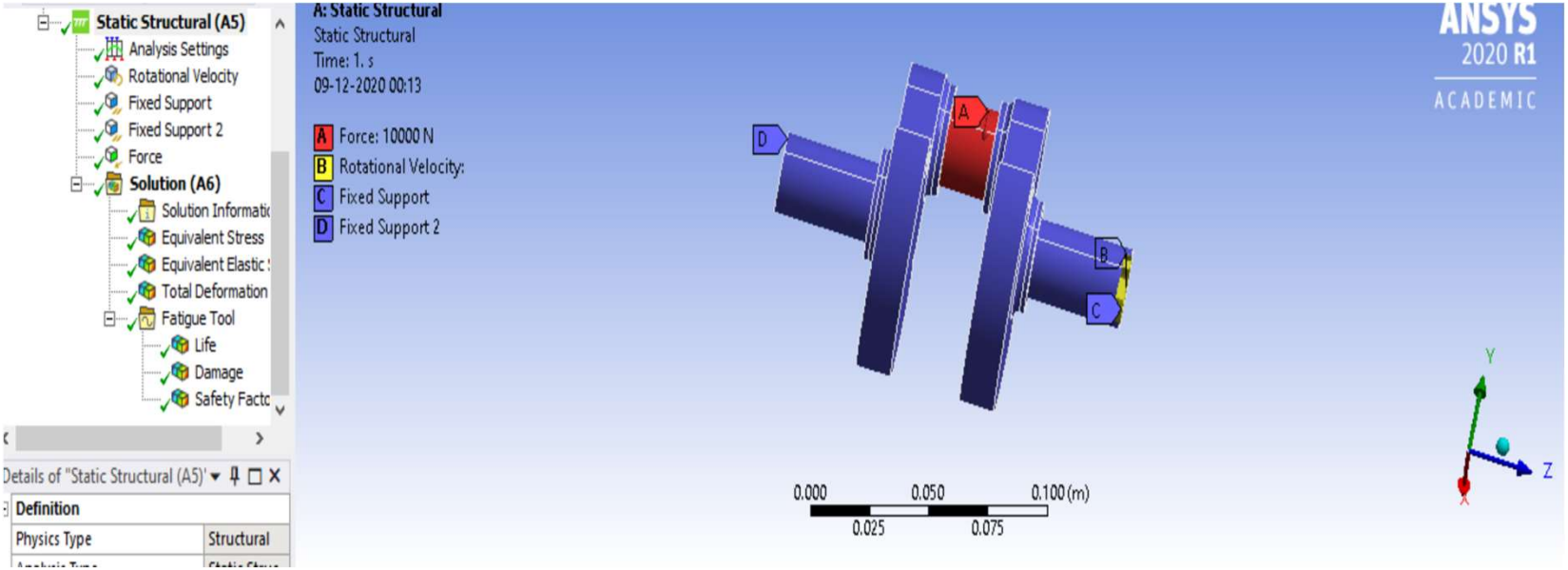
BOUNDARY CONDITIONS



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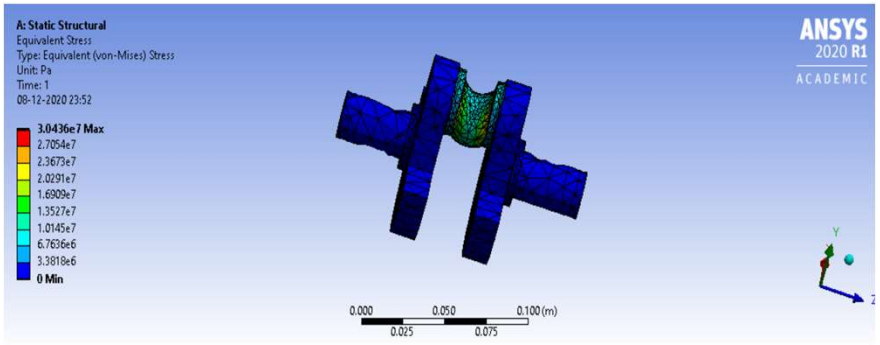
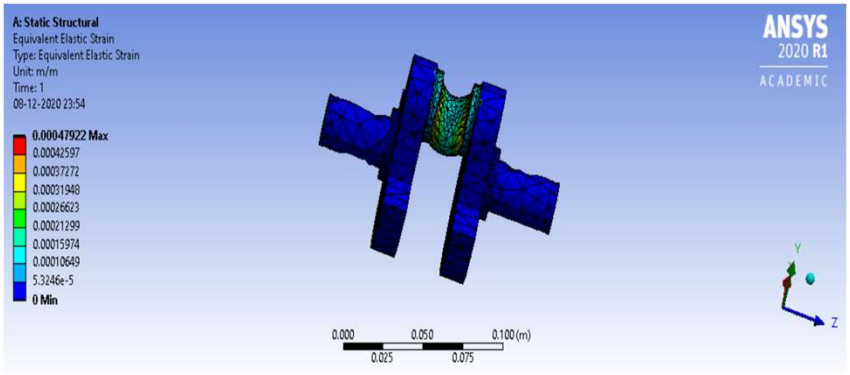
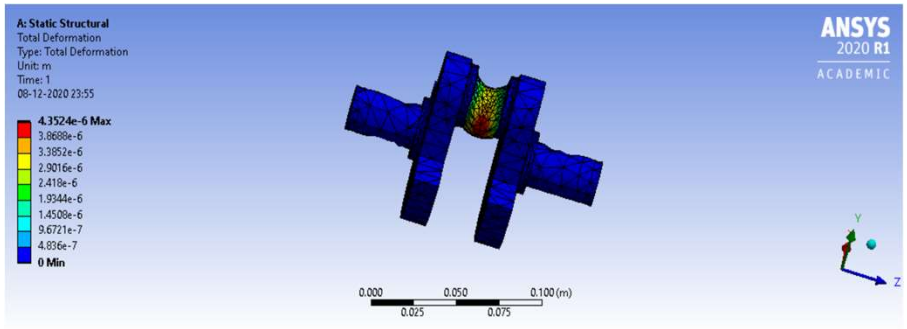
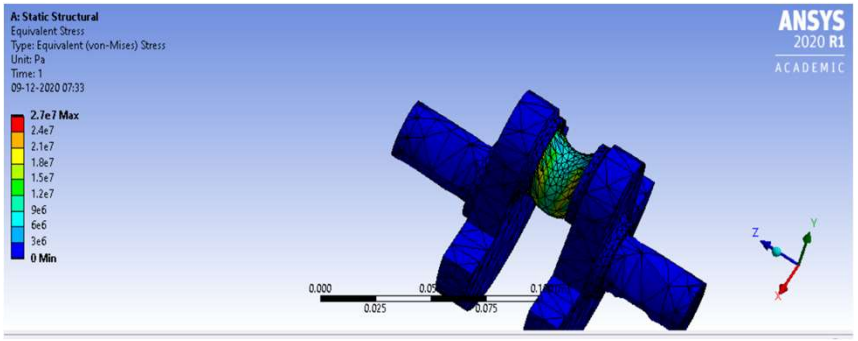
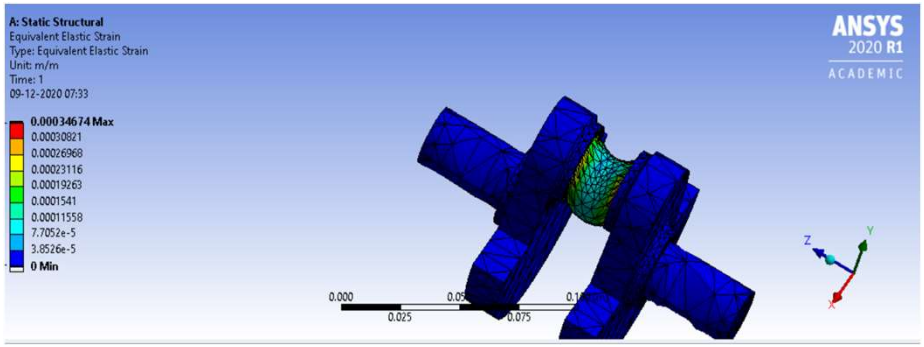


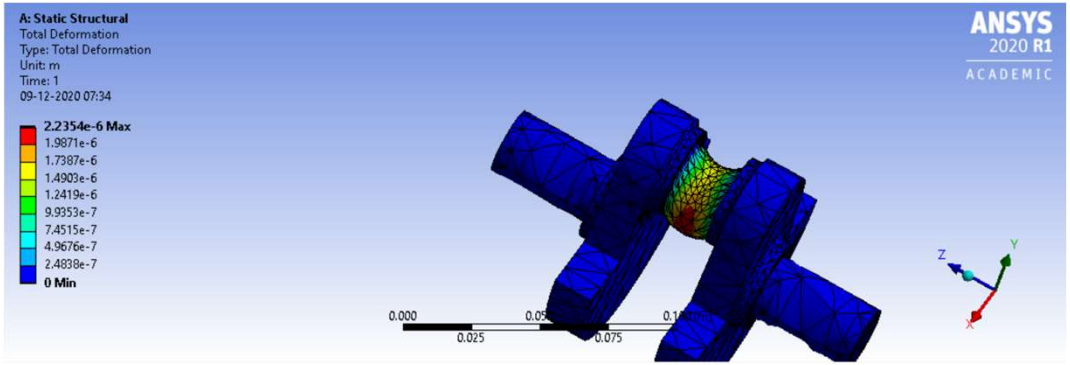




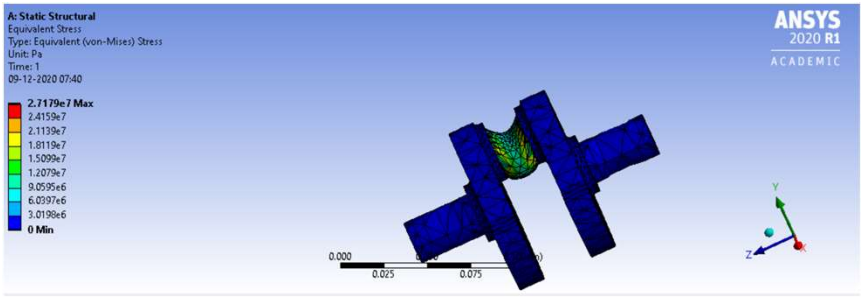
RESULTS- GREY CAST IRON

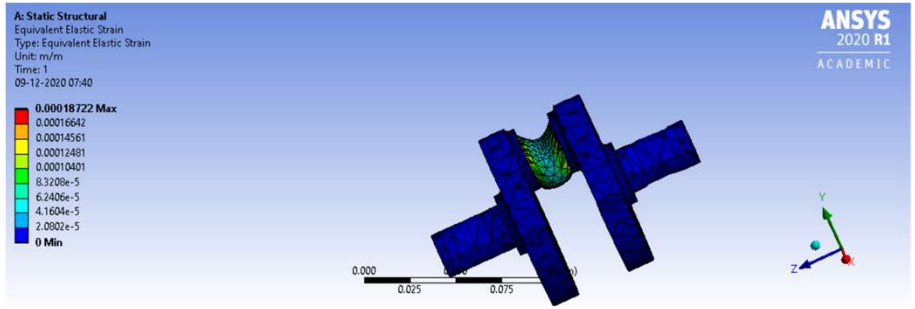


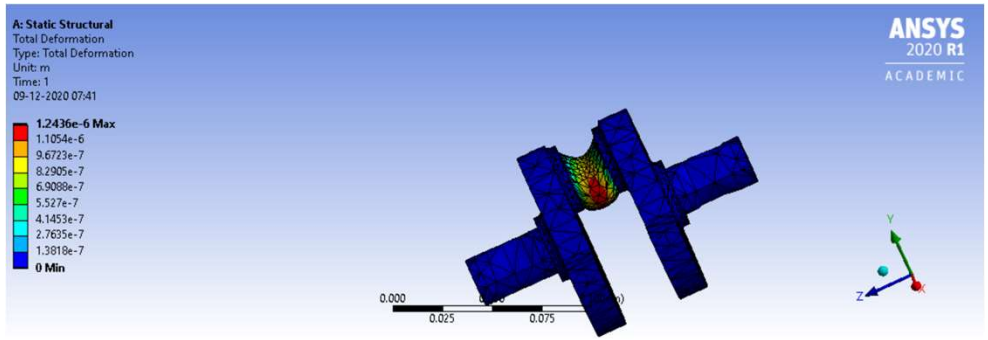




RESULTS-STRUCTURAL STEEL







RESULT COMPARISON FOR DIFFERENT MATERIALS

MATERIAL	EQUIVALENT (VON-MISES) STRESSES (Mpa)	EQUIVALENT ELASTIC STRAIN (m/m)	TOTAL DEFORMATION (mm)	MAXIMUM SHEAR STRESS (Mpa)
ALUMINIUM ALLOY	30.4	0.00047872	0.0043486	16.847
GREY CAST IRON	27	0.00034674	0.002235	15.545
STRUCTURAL STEEL	27.18	0.00018722	0.0012436	15.565

From the selected materials it is preferrable to use structural steel for manufacturing the crankshaft

FUTURE SCOPE

- Conducting transient structural analysis which models the real conditions more accurately.
- Conducting modal analysis wherein the effect of the vibrations of different parts of the I.C Engine on the crankshaft can be analyzed.
- Conducting the aforementioned simulations for the entire multi-piston assembly.

OPTIMISATION

- Introducing chamfer and fillets reduces stresses which increases life of crankshaft.
- Alloys of nickel and chrome like Inconel-x750 are used.
- Forging is preferred over casting.

THANK YOU!!