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Modelling and Analysis of Connecting Rod

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Abstract: ***Connecting rod is one among the foremost necessary half in automotive engine. Connecting rod is that the link between piston and crankshaft. Which it converts reciprocatory motion of piston into motion of crankshaft. In internal engines connecting rod is mainly made of steel and aluminium alloys (for light weight and absorb high impact loads) or titanium (for higher performance engines and for higher cost). As a connecting rod is rigid, it may transmit either a push or apull and then the rod could rotate the crank through each halves of a revolution, i.e. Piston pushing and piston pulling. Earlier mechanisms, such as chains, could only pull. In a few two-stroke engines, the connecting rod is only required to push. In which it undergoes structural deformations. Thus in this project we are modelling a connecting rod in catia V5R20 design software and doing static structural analysis in ansys work bench 17.0 software.***

I. INTRODUCTION

Connecting rods are widely used variety of engine. The perform of rod is to transmit the thrust of the piston to the crankshaft, and as the result the reciprocating motion of the piston is translated into rotational motion of the crankshaft. It consist of a pin –end. A shank section, and crank end .Pin end and crank end pin holes are machined to permit accurate fitting of bearings. One finish of the rod is connected to the piston by the piston pin. The other end is assembled to crankshaft. Connecting rods area unit subjected to forces generated by mass and fuel combustion .Theses two forces results in axial load and bending stresses. A rod should be capable of transmission axial tension, axial compression, and bending stress caused by the thrust and full of the piston and by centrifugal force. Finite component (FEM) Modal may be a trendy manner for fatigue analysis and estimation of the element. The prestigious element factors area unit able to modification like material cross section conditions etc. In trendy automotive combustion engine, the connecting rods area unit most commonly made from steel for production engine. But is made from aluminium or atomic number 22 for prime performance of engines of forged iron for application like motor scooters. They are not bolt mounted at either finish, so that the angle between the connecting rod and piston will modification because the rod moves up and down and rotates round the crankshaft. The big finish connects to the bearings journal on the throw rod is underneath tremendous stress from the reciprocator load diagrammatical by the piston, actually stretching and being compressed with each rotation, and the load increases to the third power with increasing engine speed .Connecting rod for automotive applications ar generally factory-made by formation from either formed steel or powder metal. Schematic diagram for rod as shown in figure.

Fig.1 Connecting rod

II. SOFTWARES USED CATIA

CATIA was started byFrench air craft manufacturer Avian Marcel Dassault system Initially CATIA name is AN abbreviation for laptop motor-assisted 3 Dimensional Interactive Application. The French assault systems is the parent company and IBM participates in the software's and marketing, and catia is used in broad industrial sectors. Catiais basically a modelling software which is adopted by many small and large industries to make a critical designs. Most of the people works on now is CATIA V5 or fifth version which is rewriting and revision of the fourth edition. For the fifth version there area unit versions from one to twenty. For example CATIA V5 R17 it means that catia fifth edition version seventeenth wherever as years system was adopted in sixth edition. For example CATIA V6 2011 means that catia sixth edition version ofyear 2011.

A. CADD (Computer AIDED Design and Drafting)

CAD (Computer power-assisted Design) is that the use of laptop software package style|to style} and document a product's design method. Engineering drawing entails the employment of graphical symbols like points, lines, curves, planes and shapes. Essentially, it offers elaborated description regarding any element during a graphical form.

B. CAE (Computer AIDED Engineering)

CAD (Computer power-assisted Design) is that the use of laptop software package style to style} and document a product's design method. Engineering drawing entails the employment of graphical symbols like points, lines, curves, planes and shapes. Essentially, it offers elaborated description regarding any element during a graphical form. Associate in Nursing acceptable mathematical formulation of the underlying physics. In the post-processing part, the results are presented to the engineer for review.

C. ANSYS

ANSYS Workbench, developed by ANSYS Inc., USA is a Computer Aided Finite Element Modeling (FEM) and Finite Element Analysis (FEA) tool. In the Graphical program (GUI) of ANSYS work bench, the user can generate 3-dimensional (30) and FEA models, perform analysis and generate results of analysis. ANSYS Workbench enables you to combine the stand-alone analysis system into a project and to manage the project workflow. The ANSYS work bench platform is that the frame work upon that the industry's broadest and suite of advanced engineering simulation technology is built. An innovative project schematic view ties together the whole simulation method, guiding the user through even complex multi physics analysis with drag-and-drop simplicity. With bi-directional CAD connectivity, powerful highly-automated meshing, a project-level update mechanism, pervasive parameter management and integrated improvement tools, the ANSYS work bench platform delivers unprecedented productivity, facultative Simulation Driven Product Development.

III. METHODOLOGY

To design the connecting rod for a diesel engine so as to determine the section thickness of connecting rod.
To geometrically model the rod as per the scale generated from the method of style procedure followed.
To analyse the transient total deformation and thermal stress which is acting on material of connecting rod. To analyse the transient total deformation and thermal stress using FEA approach on material selected for study.
To plot the results for transient total deformation and thermal stress actiong on the connecting rod. Sources

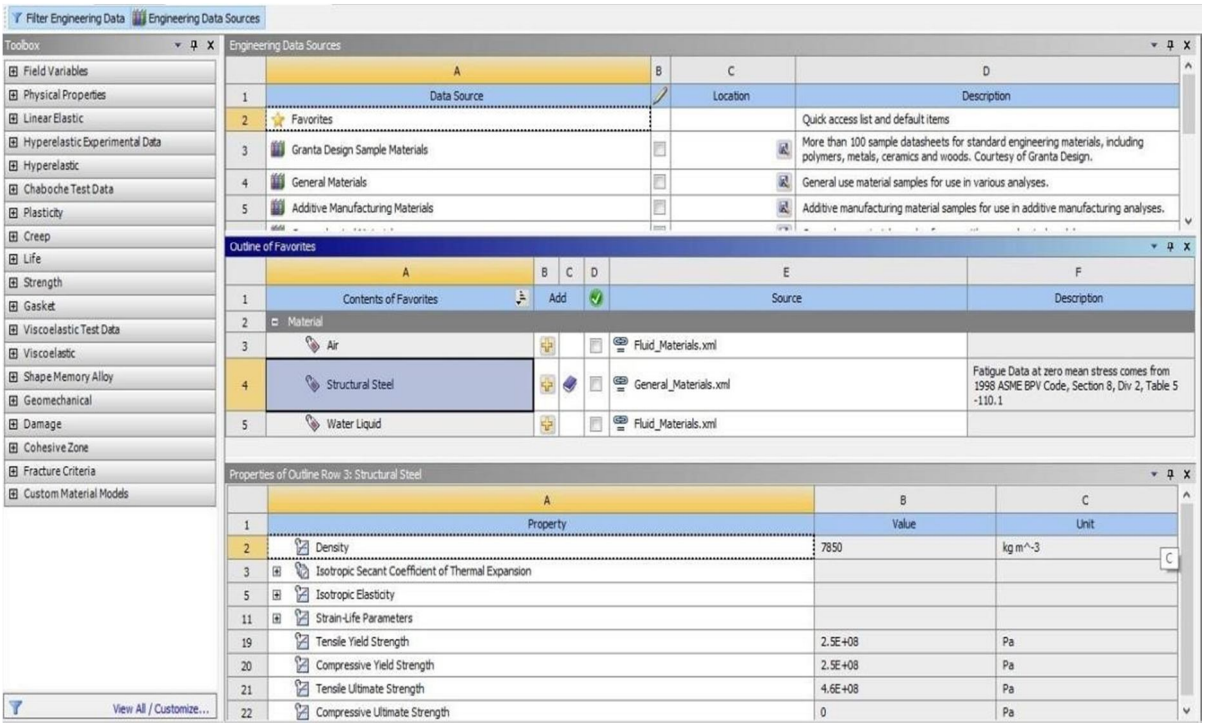

Fig: 2 Material library window

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Next double click on geometry and import the stp format connecting rod assembly and click on generate.

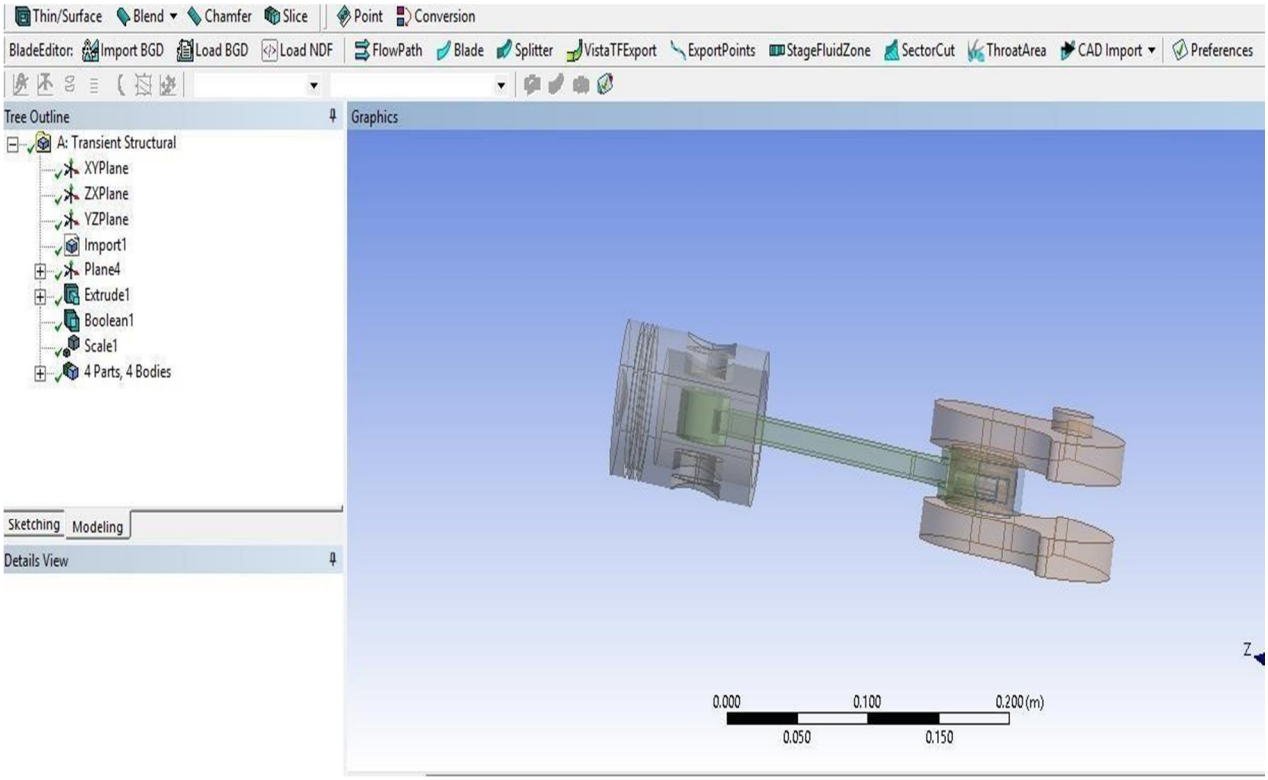

Fig: 3 Design modular window

IV. RESULTS AND DISCUSSIONS

A. Total Deformation

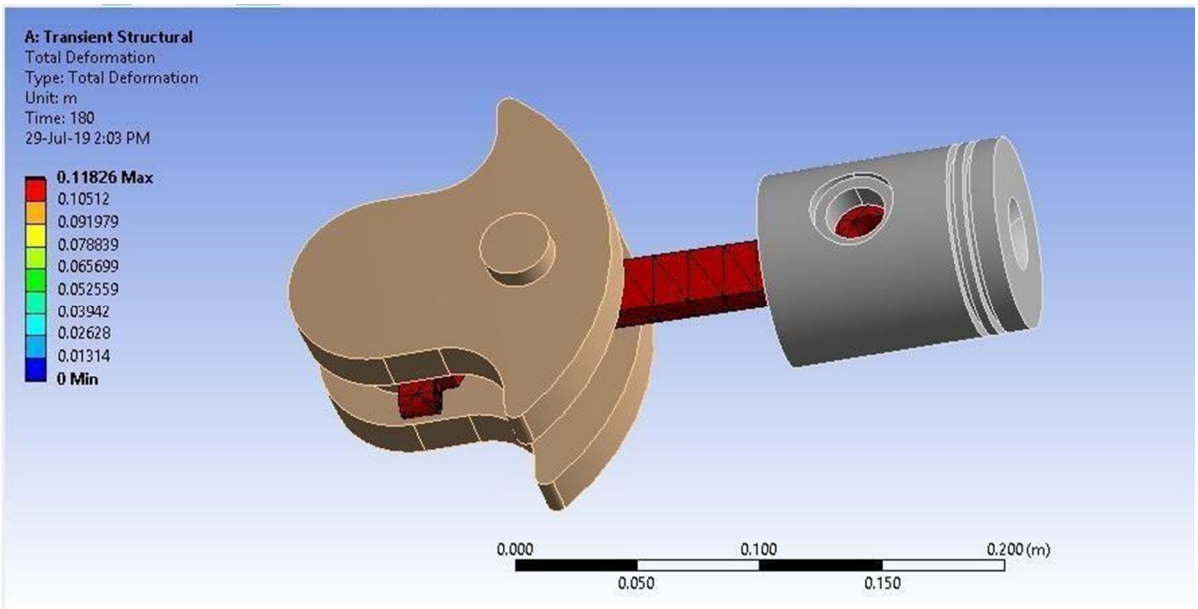

Fig:4 Total deformation

From the analysis of a connection rod , the result obtained is indicating maximum deformation takes place in a connecting rod of a structural steel material (Total deformation = 0.11826 m).

Model (A4) > Transient (A5) > Solution (A6) > Total Deformation

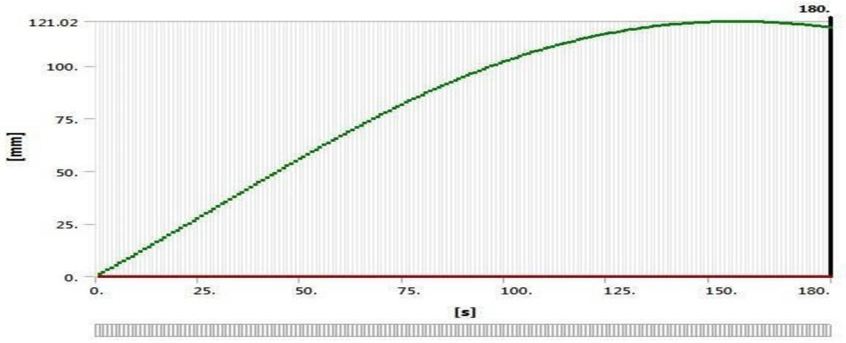

Fig: 5 Total deformation graph

From the above graph, we can see that according to the time the deformation in the connecting rod is gradually increased.

B. Equivalent Strain

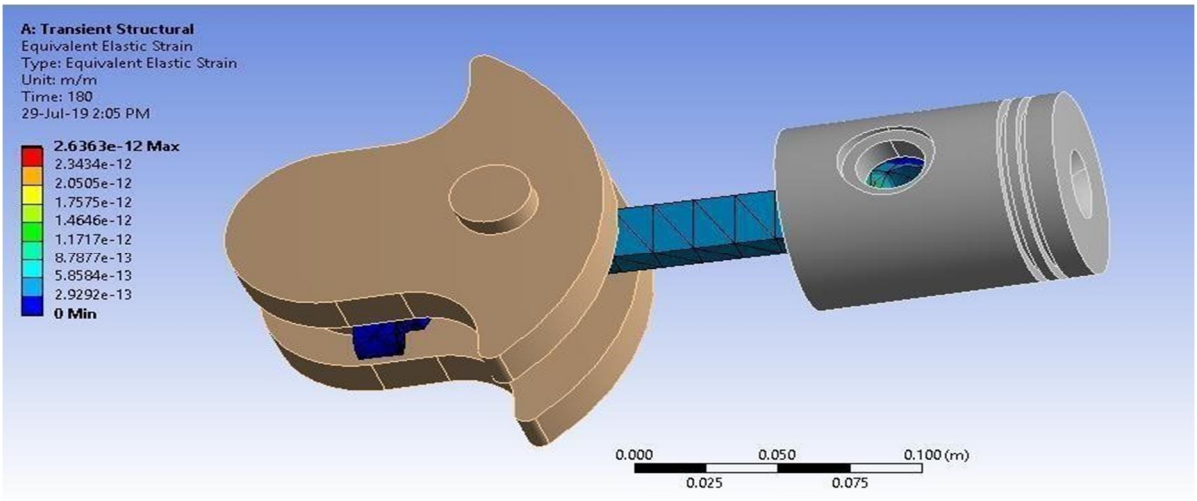

Fig:6 Strain

From the analysis of a connection rod the result obtained is indicating minimum equivalent strain takes place in a connecting rod of a structural steel material (Equivalent strain = 2.9292e-13).

Model (A4) > Transient (A5) > Solution (A6) > Equivalent Elastic Strain

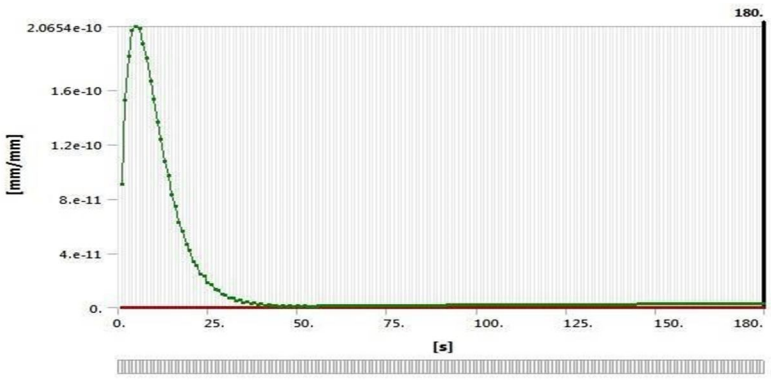

Fig:7 Strain graph

From the above graph, we can see that there is increasing in strain up to some interval of time (10 sec) and then it decreases suddenly and become zero. This indicates that, the connecting rod having minimum strain.

C. Equivalent Stress

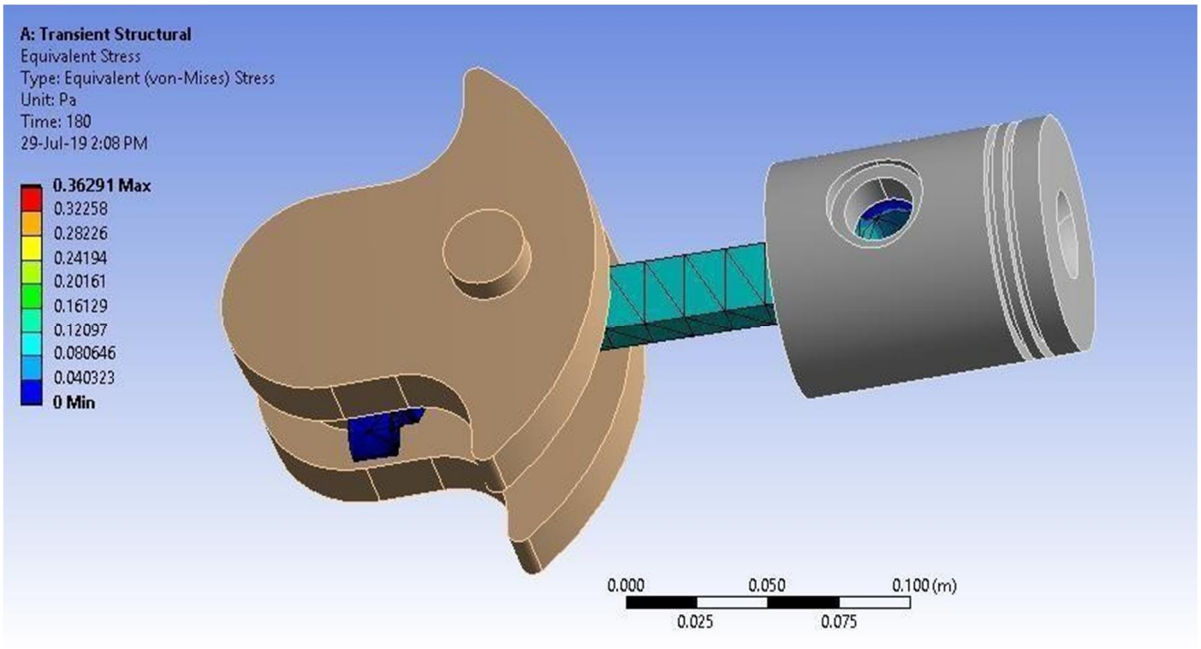

Fig:8 Stress

From the analysis of a connection rod the result obtained is indicating minimum equivalent stress takes place in a connecting rod of a structural steel material (Equivalent stress = 0.12097).

Model (A4) > Transient (A5) > Solution (A6) > Equivalent Stress

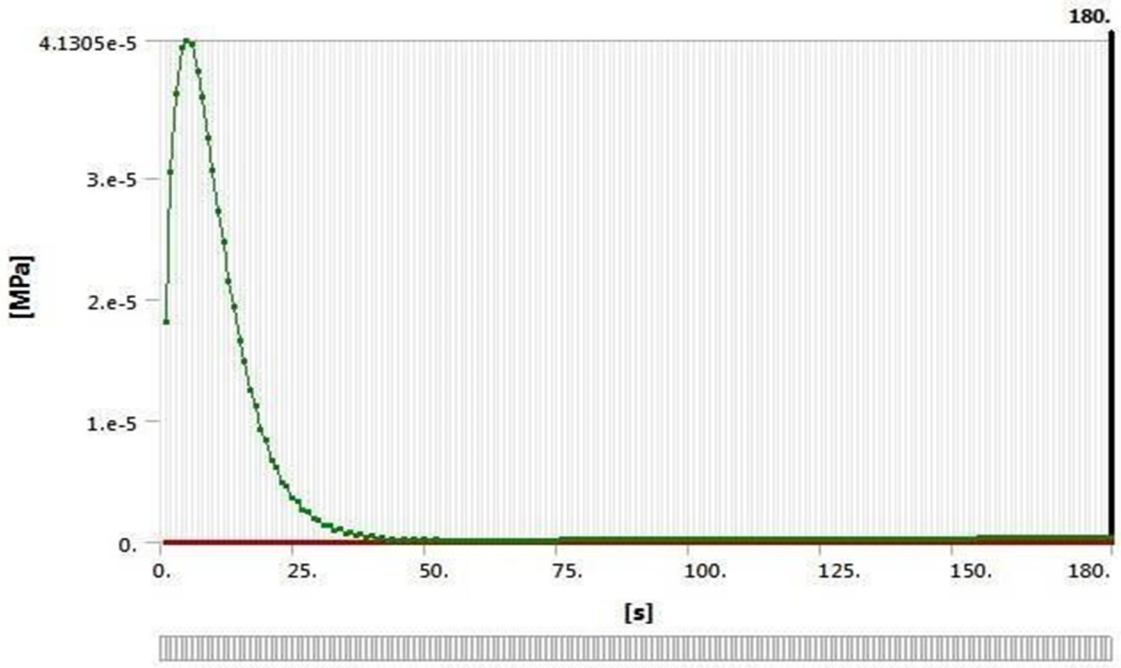

Fig:9 Stress graph

From the above graph, we can see that there is increasing in stress up to some interval of time (10 sec) and then it decreases suddenly and become zero. This indicates that, the connecting rod having minimum stress.

D. Thermal Analysis

Steady State Thermal Analysis

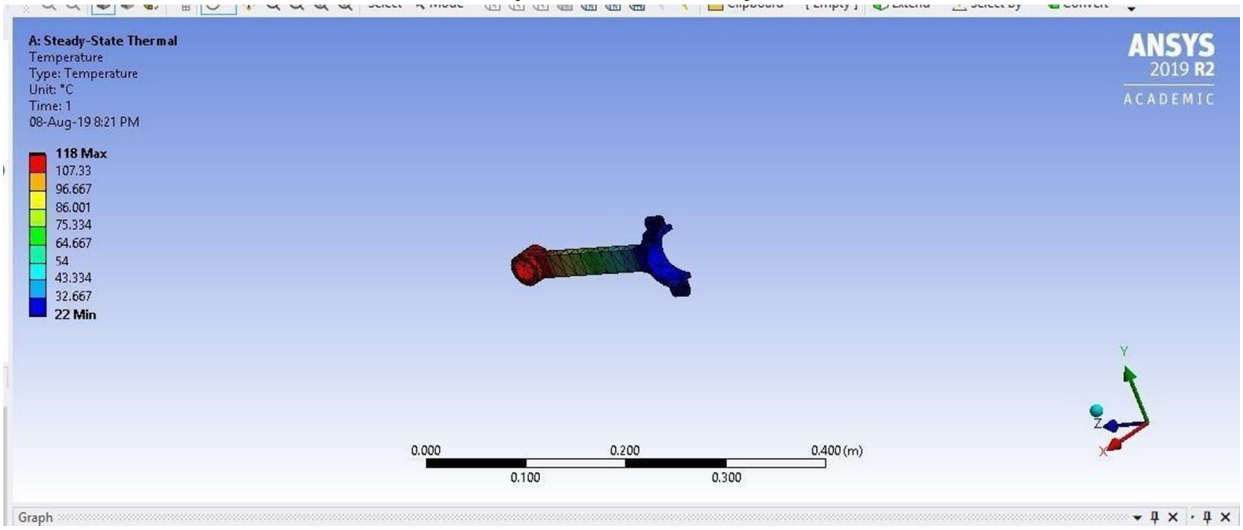

Fig:10 Steady state thermal

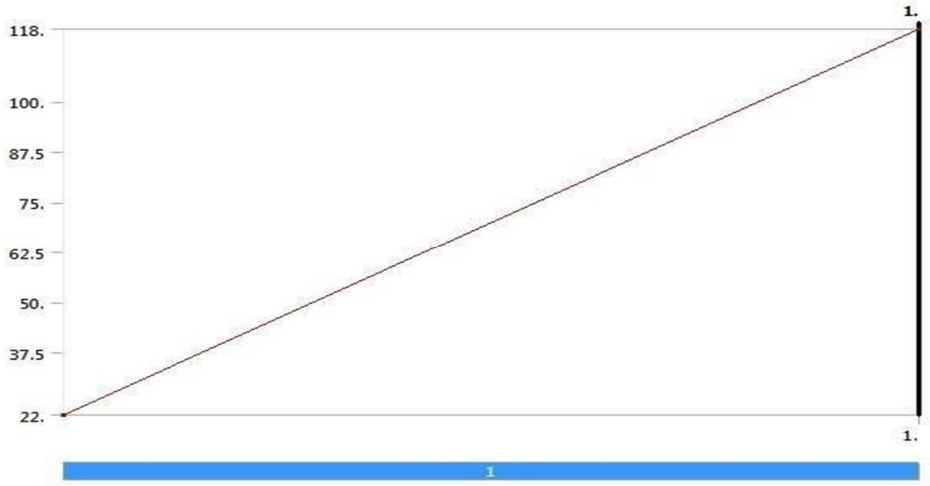

Fig: 11 Study state thermal

E. Total Heat Flux

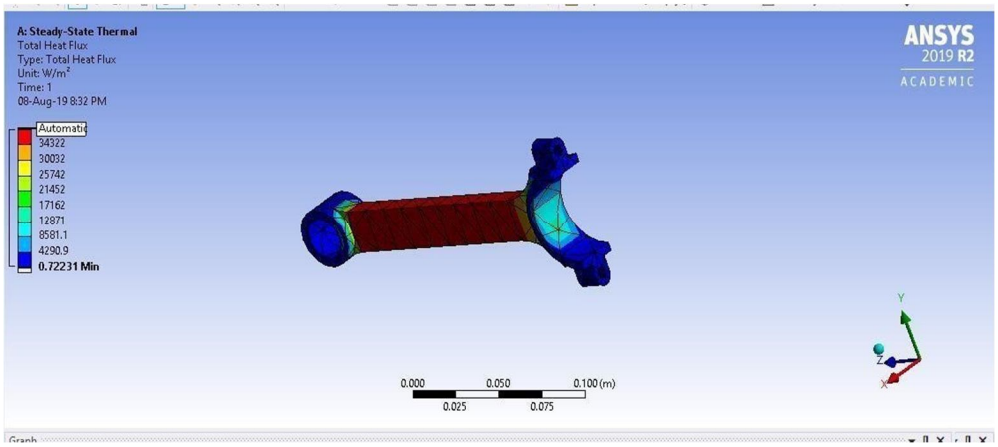

Fig: 12 Total heat flux

V. CONCLUSIONS

This study will be focus on the finite element modeling and analysis. From this project we conclude that the results obtained under transient load and temperature are as follows

Total deformation=0.11826m

Equivalent strain=2.6363e-12 Equivalent stress=0.36291pa

Steady state thermal=118°C

Heat flux=34322w/m2

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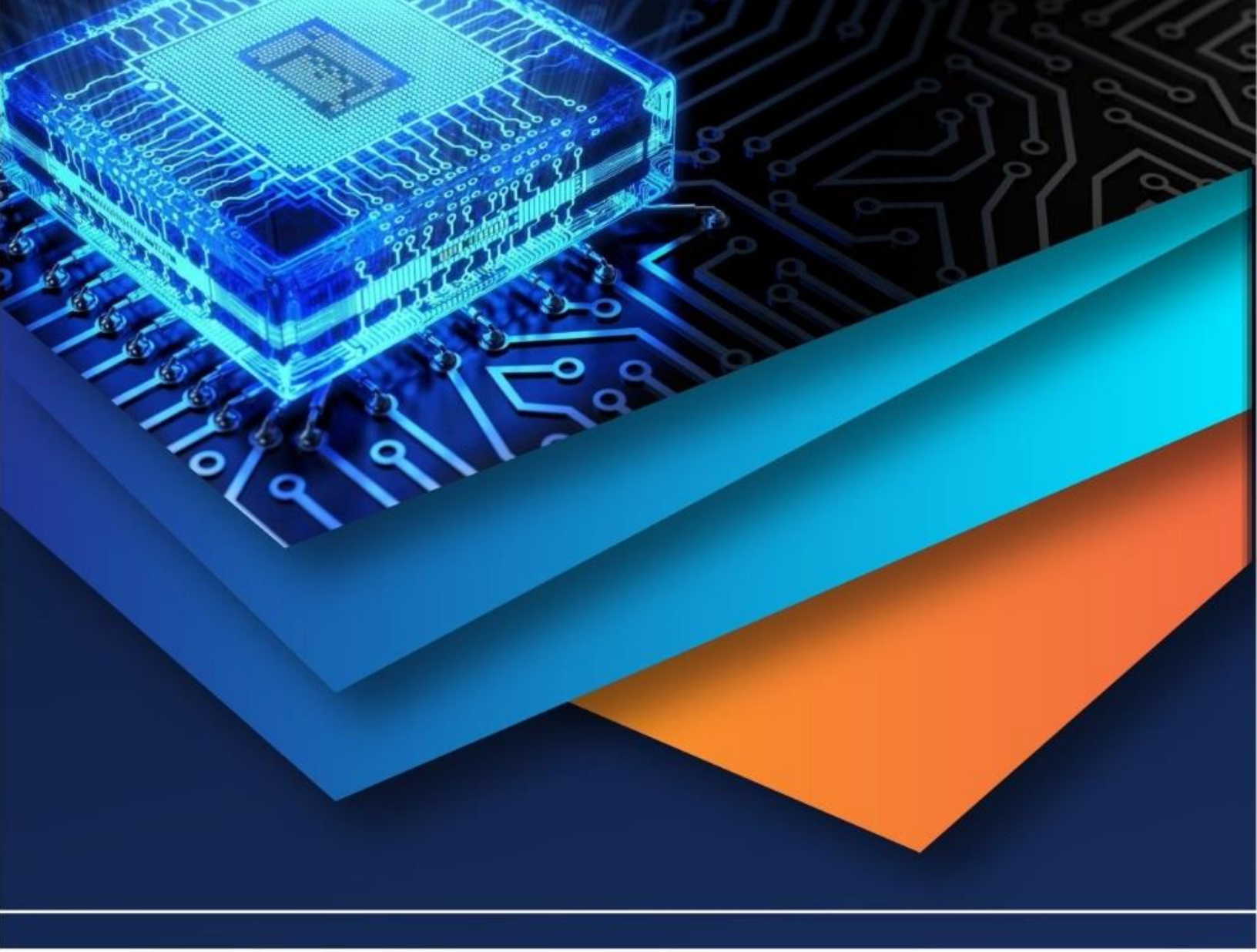

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