STRESS ANALYSIS OF CONNECTING ROD

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Abstract*—The connecting rod is one of important part of engine assembly. Its function is to convert reciprocating motion into rotary motion. This paper gives analysis of I.C. engine connecting rod under different loading conditions with the help of NX9 advance simulation tool. In this paper loads are applied to big end and its corresponding results are evaluated. The parameters like von misses stress, Maximum and Minimum principle stress were obtained from NASTRAN software.

***Keywords*—Connecting rod, NASTRAN, FEA**

I. INTRODUCTION (HEADING 1)

Automobile internal combustion engine connecting rod is a critical component. It connects reciprocating piston to rotating crankshaft, thus transmitting the thrust of piston to the crankshaft, and is subjected to complex loading. It undergoes high cyclic loads of the order of 108 –109 cycles, which range from high compressive loads because of combustion, to high tensile loads because of inertia.

Inertia load is a time-varying quantity and can refer to inertia load of the connecting rod or of the piston assembly. Connecting rod is undergo both compressive and tensile loading during its operation. The axial compressive load is greater than that of tensile load. Therefore the design is analyzed for compressive loads.

The main aim is to determine the Von Mises stresses, Maximum and minimum principle stresses, deformation. For this a three dimensional model is prepared in Sioemens NX9 software with dimensions taken as from actual model of 100 cm^3 Hero Honda Splendour.

II. LITERATURE REVIEW

Webster et al. (1983) performed three dimensional finite element analysis of a high-speed diesel engine connecting rod. [1]For this analysis he used maximum compressive load which was measured experimentally, and maximum tensile load which is essentially the inertia load of the piston assembly mass. G.M Sayeed Ahmed et al. presented design, fabrication and analysis of a connecting rod with aluminum alloys and carbon fiber.[2] In this connecting rod of LML Freedom is modeled in PRO/Engineer and analysis is done different materials. Puran Singh et al. in his research work fatigue and structural analysis of connecting rod’s material due to (C.I) using FEA gives analysis results of connecting rod made up of structural steel.[3] Abhinav Gautam et. Al in his paper static stress analysis of connecting rod using FEA gives stress analysis results of Cummins NTA 885 BC engine.[4]

III. STRUCTURAL ANALYSIS RESULTS

The below figure shows half view of connecting rod. Connecting rod has two ends. At one end small section is to hold it into piston and big end is to fix with crank shaft. In this paper the big end is kept as fixed end and load is applied to small end. Material used for analysis are Epoxy resins. The below model is prepared in NX9 and analyzed in NASTRAN.

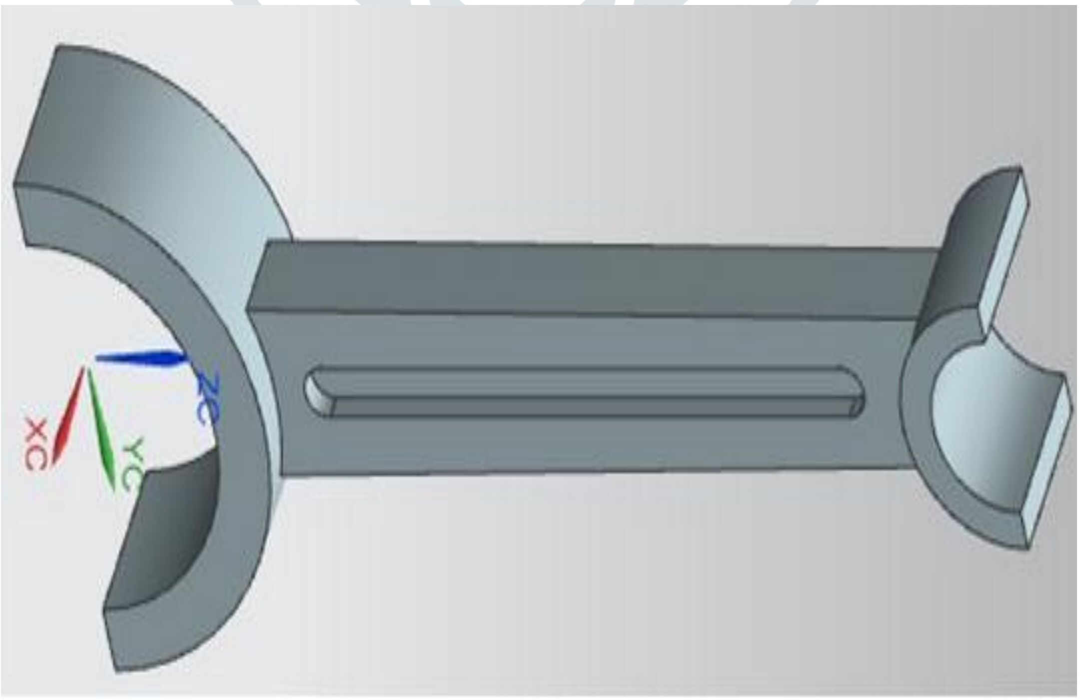

Figure 1: Half model of the connecting rod.

The nodal distribution is shown in figure below.

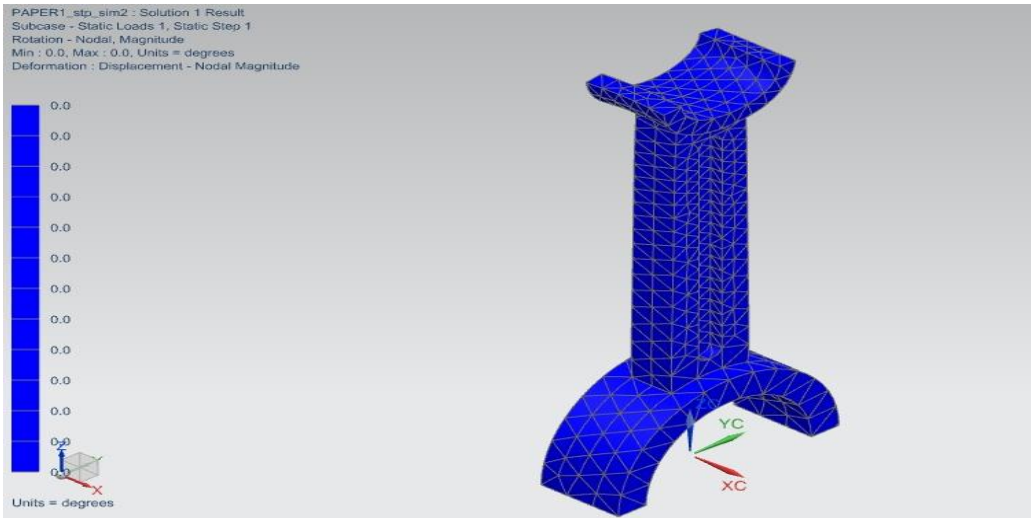

Figure 2: Nodal distribution of connecting rod

The nodal displacement is shown below. It is the deformation along vertical axis.

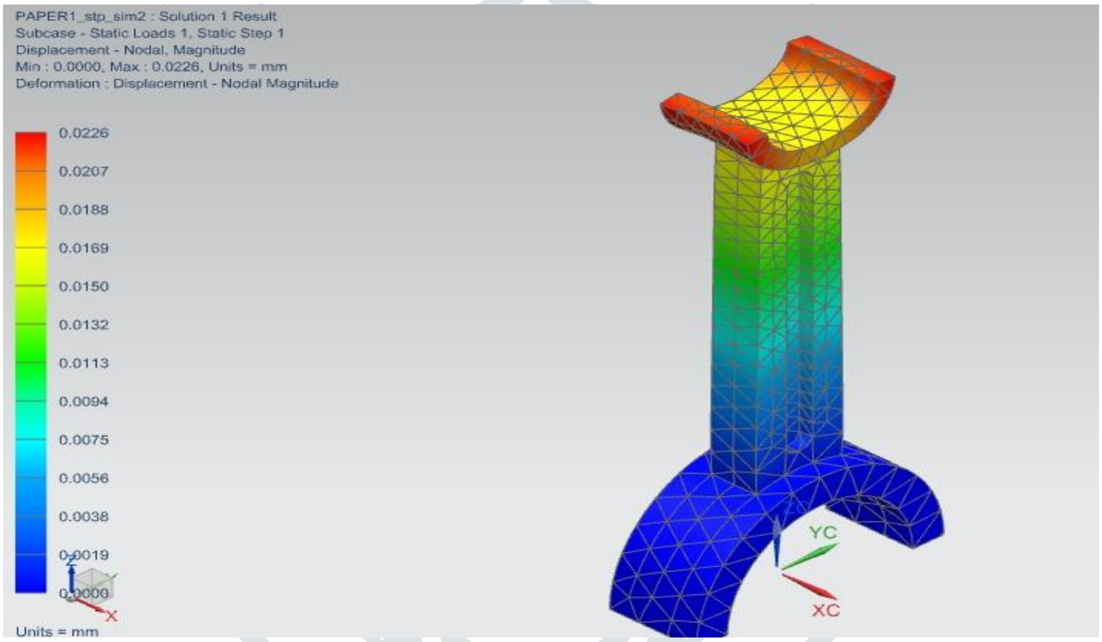

Figure 3: Nodal displacement

The following figure shows the static load distribution under loading

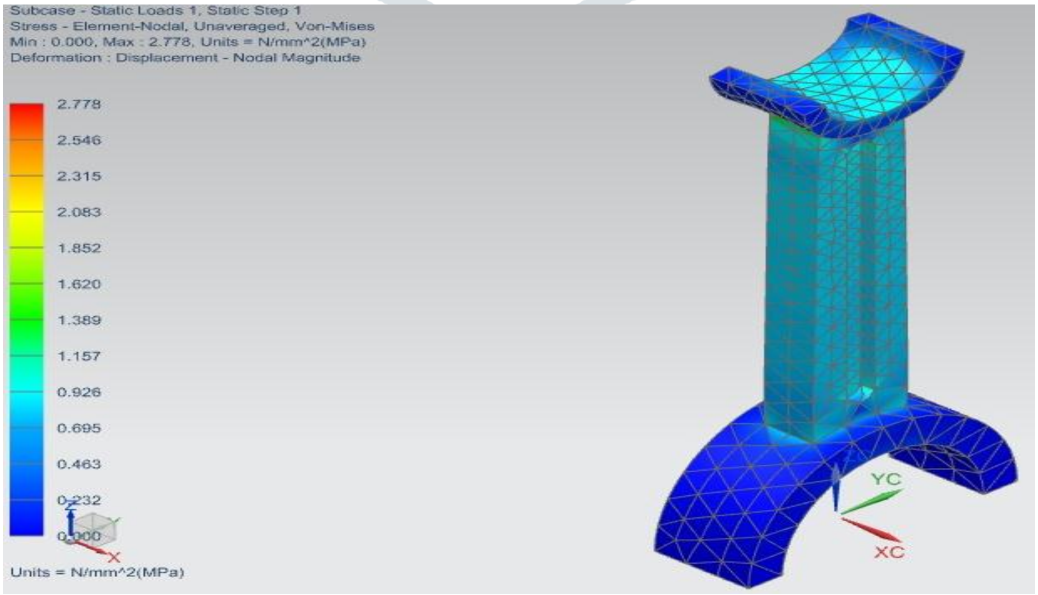

Figure 4: Static load distribution

The below figure shows deformatioon under reactiom forces.

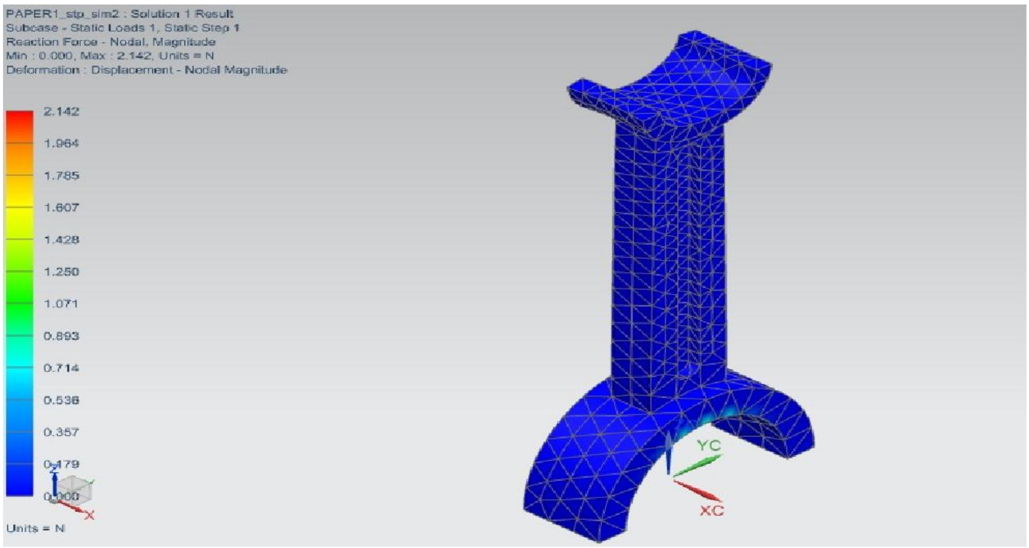

Figure 5: Deformation under reaction force

The below figure shows Von Mises stress distribution under load of 1, 1.5, 2, 3, 5 Kg. load.

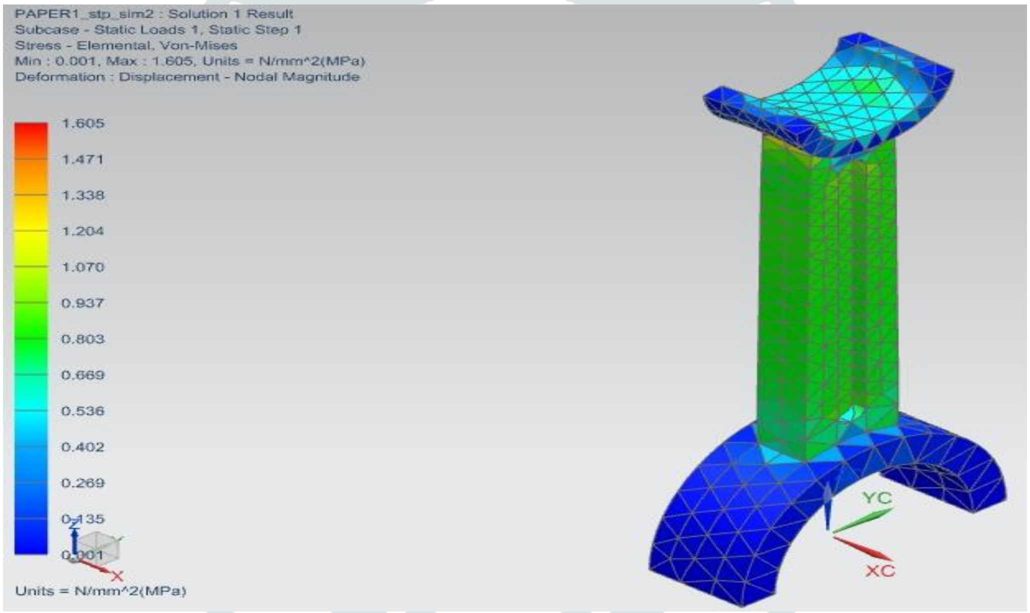

Figure 6: Von-Mises stress distribution

The below graph is showing load applied from 1 to 5 kg and corresponding changes in Minimum principle stress values from 0.00012 Mpa to 0.984 Mpa.

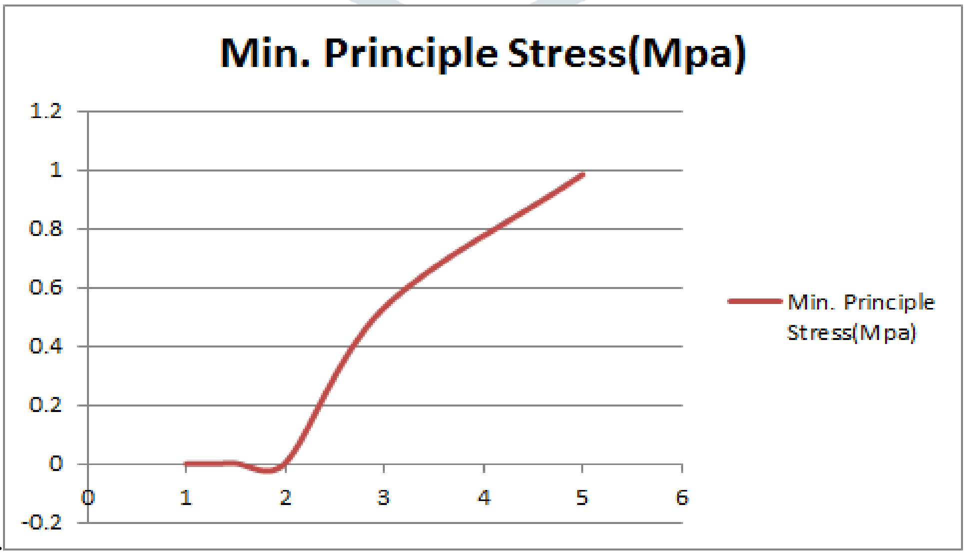

Figure 7: Variation of Min. principal stress under loading.

The below graph is showing load applied from 1 to 5 kg and corresponding changes in Maximum principle stress values from 0.079 Mpa to 1.052 Mpa.

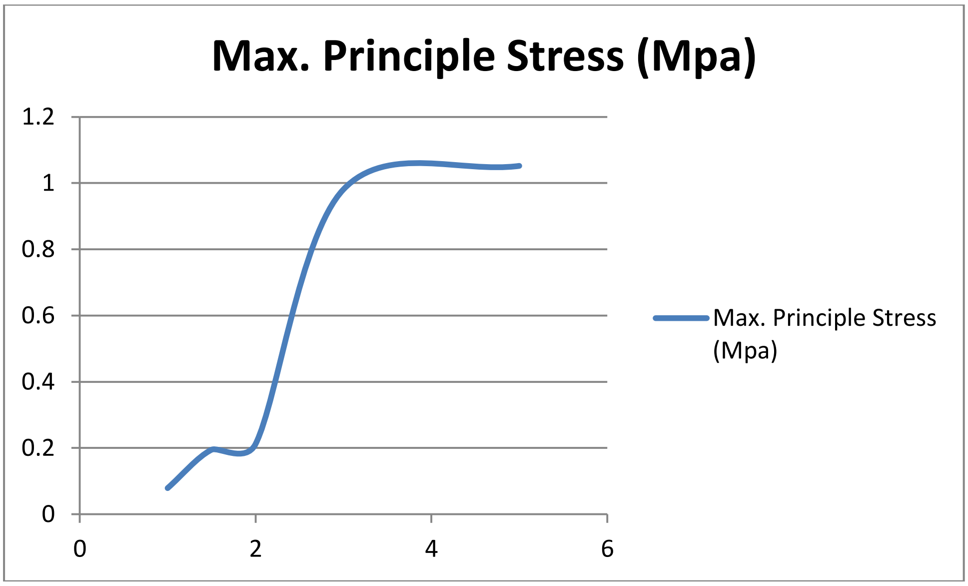

Figure 8: Variation of Max. principal stress under loading.

The below graph is showing load applied from 1 to 5 kg and corresponding changes in Von Mises stress values from 0.268 Mpa to 3.598 Mpa.

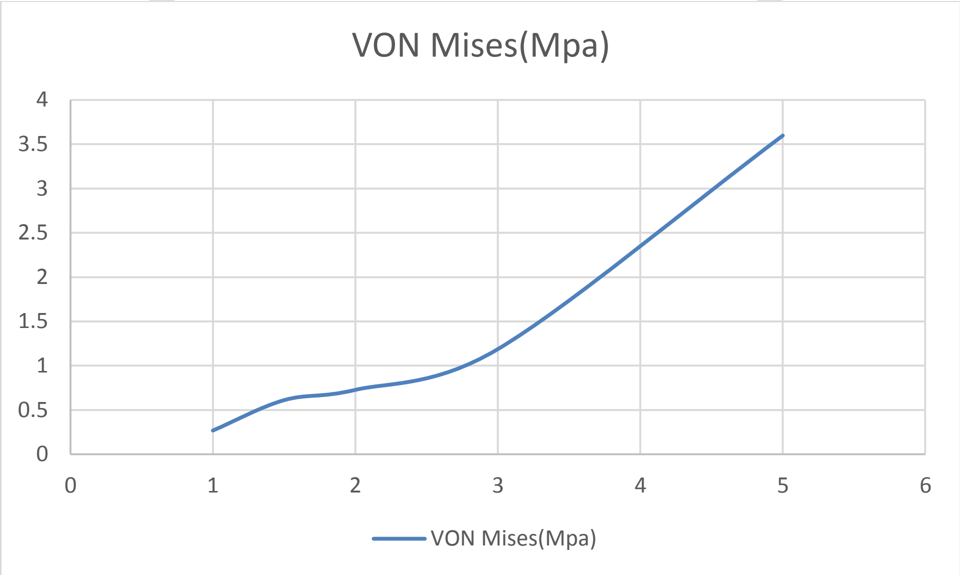

Figure 9: Variation of Von Mises stress under loading.

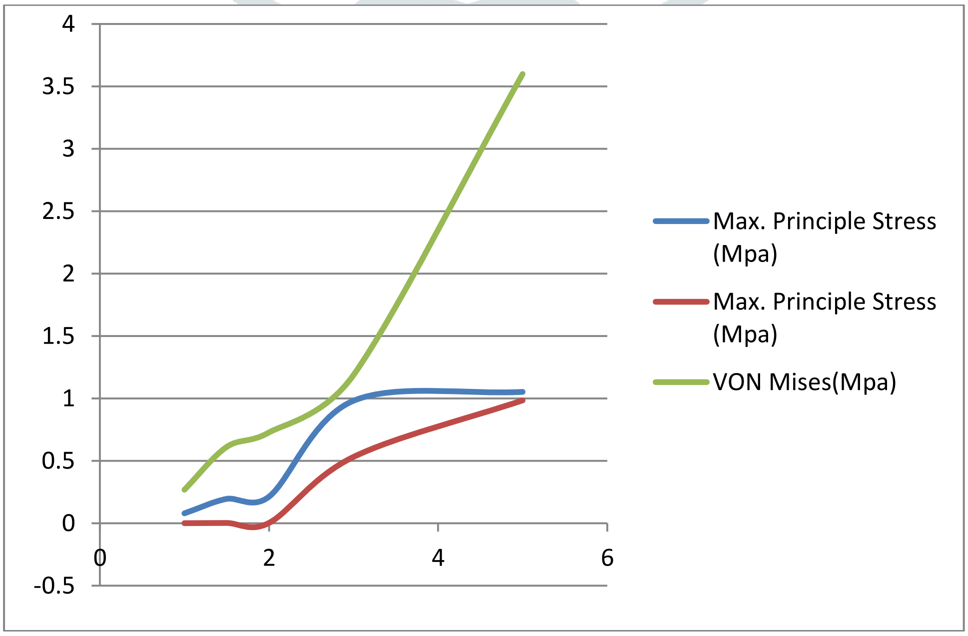

Figure 10: Variation of Von Mises stress, Maximum Principal stress and Minimum principal stress under loading.

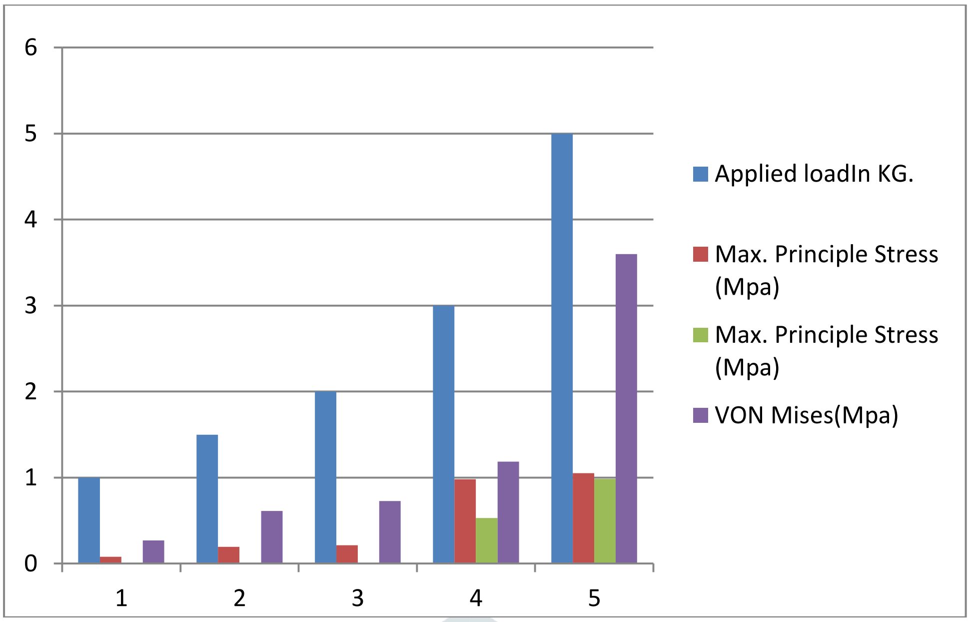

Figure 11: Result Chart

Table 1 Experimental data Result

Applied load in Kg	*Applied load in Newton*	*Max. Principle stress (Mpa)*	*Min. Principle stress (Mpa)*	*Von Mises Stress (Mpa)*
1	9.81	0.079	0.00012	0.268
1.5	14.715	0.195	0.00173	0.611
2	19.62	0.212	0.002	0.727
3	29.43	0.981	0.531	1.187
5	49.05	1.052	0.984	3.598

IV. CONCLUSION

As the load applied changes from 1 kg to 5 Kg on large end of connecting rod corresponding Von Mises stress increases from 0.268 to 3.598 Mpa but rise of Maximum principle stress is comparatively less, starting from 0.079 Mpa to 1.052 Mpa. The minimum principle stress values also changes but not as that of Von Mises stress values.

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