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Optimization of Intake Valve of IC Engine Using Finite Element Analysis

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ABSTRACT

Internal combustion engine valves are precision engine components. The valve should be optimally designed so as to avoid an abnormal valve movement, such as valve jumping or bounce up to the maximum engine speed. There are different types of valves used by the manufactures; some common types of valves being poppet valves, slide valves, rotary valves and sleeve valve. This work considered the stress induced in a valve due to high pressure inside the combustion chamber, spring force and cam force for the optimization of fillet radius of inlet valve. For modelling CATIA V5 R21 is to be used and to analyze the valve ANSYS 14.0 is used as the tool. Static Structural analysis are to be performed on the different valve materials and on the different fillet radius of the inlet valve. A static analysis calculates the effect of steady loading condition on a structure.

Keywords : *- Inlet valve ,CatiaV5, Ansys*

1. Heading *This work considered the stress induced in a valve due to high pressure inside the combustion chamber, spring force and cam force for the optimization of fillet radius of inlet valve.*

1.1 Sub-headings

Poppet valves are used in most piston engines to open and close the intake and exhaust ports in the cylinder head. The valve is usually a flat disk of metal with a long rod known as the valve stem attached to one side of valve and this portion fillet is given . Following fig.1 shows the fillet portion of the inlet valve

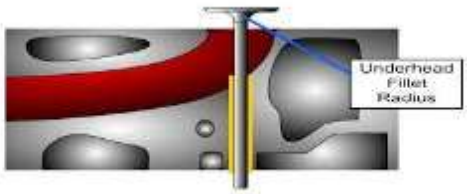

Fig. I Fillet

Design of this valve is depends on many parameters like behaviour of material at high temperature, vibrations, oxidization characteristics of valve material and exhaust gas, fatigue strength of valve material, configuration of the cylinder head, coolant flow and the shape of the port. The basic nomenclature used for valves is as shown in Fig.2 Out of these valve poppet valve is selected for optimization because of the following advantages:

1. Simplicity of construction
2. Self centering
3. Free to rotate about stem to the new position.
4. Maintening of sealing efficiency is relatively easier.

Inlet valves are larger than the exhaust valves because the velocity of incoming charge is less than the velocity of exhaust gases which leave under pressure.

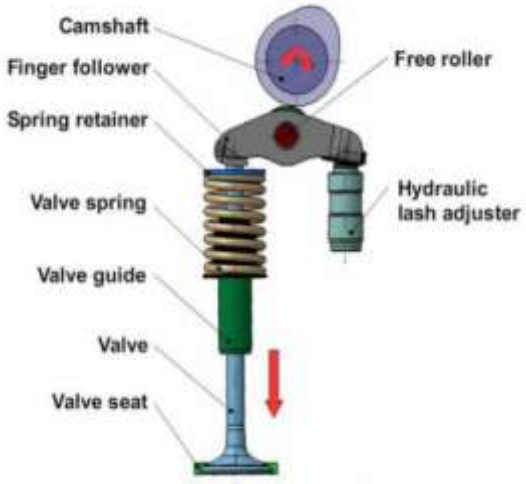

Fig. 2: Engine valve mechanism [5]

2. Conclusion

1. The results obtained through Static structural analysis suggest that the optimized value of fillet radius is 14 mm shows safe results and is selected for further work that is for material optimization.
2. Results for selected valve radius are showing good improvement compare to allowable stresses.
3. Material AISI 1541 shows less stress (23.74 %) compare to 21-2N with higher allowable stress and hence finally suggested for Valve improvement.

3. ACKNOWLEDGEMENT

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