Journal of Engineering and Applied Sciences 13 (Special Issue 5): 4827-4829, 2018
ISSN: 1816-949X

Design and Thermal Analysis of a Cam Shaft Using Various Materials

A.R. Sivaram
Department of Mechanical Engineering, AMET University, Chennai, India

Abstract: Cam shaft is used for controlling the opening and closing of inlet and exhaust valves. A camshaft is designed with a new material and is compared with that of the existing material. The properties of the designed camshaft are compared with the properties of the existing camshaft.

Key words: Camshaft, properties, inlet and exhaust valves, controlling, material, camshaft

INTRODUCTION

Camshaft has been modeled and the properties of the modeled camshaft is examined in detail (Dhavale and Muttagi, 2012; Mali *et al*., 2012; Bayrakceken *et al*., 2006; Paradorn, 2007; Cho and Hedrick, 1988). The properties of various materials which are used in making the camshaft are examined in detail (Koser, 2009; Mangai *et al*., 2016; Rajesh *et al*., 2017). In this study a camshaft made up of billet steel is designed and analysed in this study.

MATERIALS AND METHODS

Existing material: Camshafts can be made out of several different types of material. The materials used for the camshaft depends on the quality and type of engine being manufactured.

Existing material: Chilled press castings: This is a decent decision for high volume generation. A chilled press camshaft has a resistance against wear. When making chilled press castings, different components are added to the iron before throwing to make the material more appropriate for its application. Chills can be made of numerous materials including iron, copper, bronze and aluminum, graphite and silicon carbide. Other sand materials with higher densities, warm conductivity or warm limit can likewise be utilized as a chill. For instance, chromate sand or zircon sand can be utilized when forming with silica sand.

Proposed material: Alloy Steel Alloy steels are steels containing elements such as chromium, cobalt, nickel, etc. Alloy steels comprise a wide range of steels having compositions that exceed the limitations of Si, Va, Cr, Ni, Mo, Mn, B and C allocated for carbon steels with which camshaft is to be designed is given Table 1.

Create a 3D Model of the cam shaft assembly using parametric software SOLIDWORKS. Convert the surface model into Para solid file and import the model into ANSYS workbench to do analysis. Perform static analysis on the cam shaft assembly for thermal loads. Perform harmonic analysis on the existing model.

The camshaft with billet steel is designed and analysed. The analysed camshaft is shown in Fig. 1 and 2a, b.

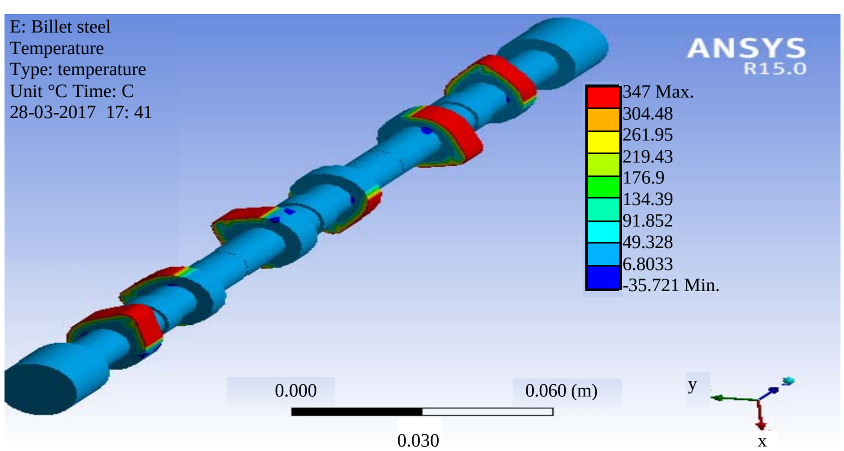

Fig. 1: Analysed camshaft (in terms of temperature)

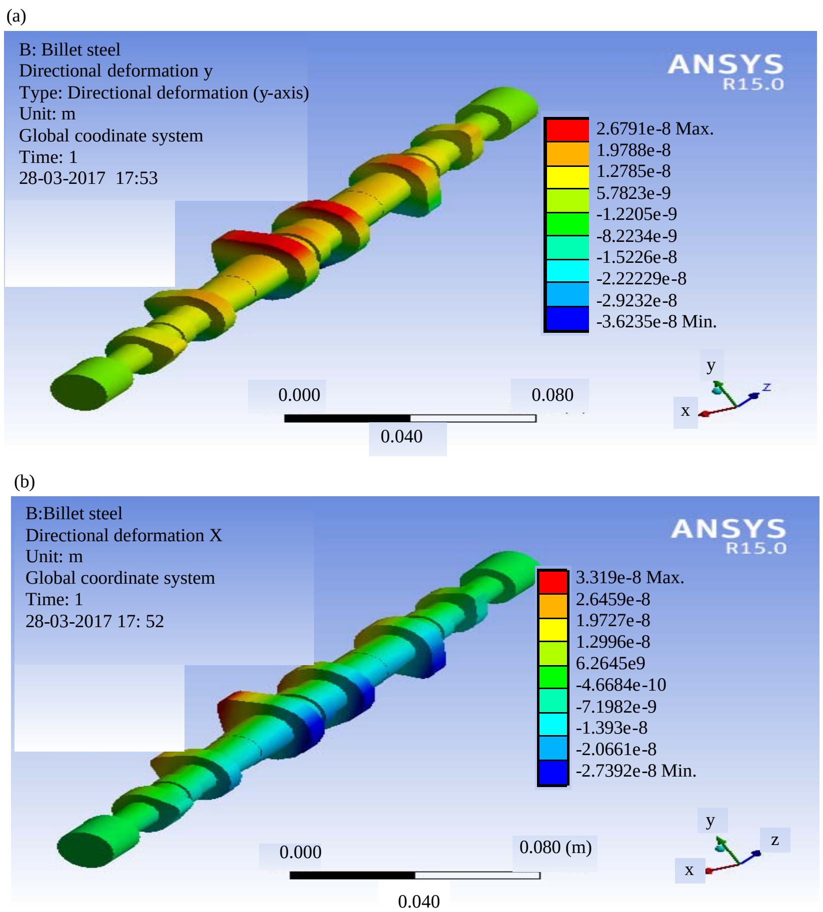

Fig. 2: a) Directional deformation of the camshaft and b) Directional deformation of the camshaft

Table 1: The properties of billet steel

Variables	Values
Material	Steel 1258
Density	10.14-2.08 g/cm^3
Melting point	1584°C
Elastic modulus	182-215 GPa
Poisson's ratio	0.12
Tensile strength	442- 642 MPa
Thermal conductivity	48 W/m-k

Table 2: Comparison of the existing camshaft and proposed camshaft

Materials	Frequency (Hz)	Max. deformation
Billet steel	12.21	20.12
Cast iron	45.21	29.20

RESULTS AND DISCUSSION

The comparison of existing camshaft and the camshaft with the new proposed material is given in Table 2. The existing material cast iron has 45.21 Hz frequency and its maximum deformation is 20.12. The proposed material Billet steel has 12.21 Hz and its maximum deformation is 20.12. From the above discussion new proposed material is safer than then existing material.

CONCLUSION

From the thermal analysis , it can be concluded that the camshaft with billet steel could exhibit better properties than the camshaft made with cast iron.

REFERENCES

Bayrakceken, H., I. Ucun and S. Tasgetiren, 2006. Fracture analysis of a camshaft made from nodular cast iron. Eng. Failure Anal., 13: 1240-1245.

Cho, D. and J.K. Hedrick, 1988. A nonlinear controller design method for fuel-injected automotive engines. J. Eng. Gas Turbines Power, 110: 313-320.

Dhavale, A.S. and V.R. Muttagi, 2012. Study of modeling and fracture analysis of camshaft. A. Balan., 100: 3-42.

Koser, K., 2009. A cam mechanism for gravity-balancing. Mech. Res. Commun., 36: 523-530.

Mali, M.R., P.D. Maskar, S.H. Gawande and J.S. Bagi, 2012. Design optimization of cam and follower mechanism of an internal combustion engine for improving the engine efficiency. Mod. Mech. Eng., 2: 114-119.

Mangai, K.A., K.T. Selvi, M. Priya, M. Rathnakumari and P. Sureshkumar et al., 2016. Structural and optical absorption studies of cobalt substituted strontium ferrites, SrCoxFe12- xO19 (x= 0.1, 0.2 and 0.3). J. Mater. Sci. Mater. Electron, 2: 1238-1246.

Paradorn, V., 2007. An impact model for the industrial cam-follower system: Simulation and experiment. MSc Thesis, Worcester Polytechnic Institute, Worcester, Massachusetts.

Rajesh, S., Bhaskar, R. Subash, K. Pazhanivel and S.S. Sagadevan, 2017. [Optimizing the design of composite sheet springs using the composite leaf spring design methodology using response surface methodology (In Romanian)]. Romanian J. Mater., 47: 98-105.