ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Modelling of S.I Engine Single Crank Shaft with Different Materials Subjected To Thermal Analysis

Telaprolu Manoj Kumar
V.K.R,V.N.B & A.G.K College of Engineering,
Eluru Road, Krishna District,
Gudivada, Andhra Pradesh.

G.V.N.B.Prabhakar, M.Tech (Ph.D)
V.K.R,V.N.B & A.G.K College of Engineering,
Eluru Road, Krishna District,
Gudivada, Andhra Pradesh.

ABSTRACT

Crankshaft is a component in an engine which converts the reciprocating motion of the piston to the rotary motion. Whereas in a reciprocating compressor, it converts the rotational motion into reciprocating motion. In order to do the conversion between two motions, the crankshaft has "crank throws" or "crankpins", additional bearing surfaces whose axis is offset from that of the crank, to which the "big ends" of the connecting rods from each cylinder attach.

In this project to compare the optimization of crank shaft with thermal conditions and two different materials(aluminum &steel alloy) .The results are taken and evaluated with the given thermal conditions and following heat flux are shown.

Key words ; model , catia, analysis , heat transfer.

INTRODUCTION TO CRANKSHAFT

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 crankset or a brace and bit drill. In this case a person's arm or leg serves as the connecting rod, applying reciprocating force to the crank. There is usually a bar perpendicular to the other end of the arm, often with a freely rotatable handle or pedal attached.

Today's automotive industries are faced with a number of issues, which require them to be responsive in order to be competitive. To be competitive, one has to produce components with low cost and high quality. The advent of high performance computers, CAD tools and Optimization techniques has helped realize the demand of global market. With the help of Optimization techniques and numerical methods, one can design a component, create a solid model using CAD tools, simulate the operating conditions and find out if the component meets the expectations and feasibility before starting the actual production, thereby saving time and resources

LITERATURE REVIEW

Crank Materials and Construction

Essentially, the range of crankshaft materials runs as follows: billet steel, steel forgings, cast steel, nodular iron, malleable steel or (in some cases) cast iron. If we were to produce one crankshaft design and reproduce it in all these materials, the order of strength would approximately follow this same list. While cast cranks are typically less expensive than forgings, they can be produced in shapes not available with forgings. But dollar for dollar, forged cranks tend to be the better method of manufacture, certainly with respect to high output durability.

Often a subject of discussion and frequently believed to be critical in the design, modification and service

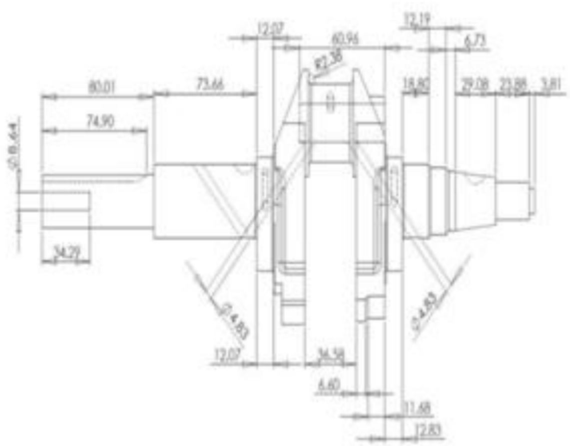
ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

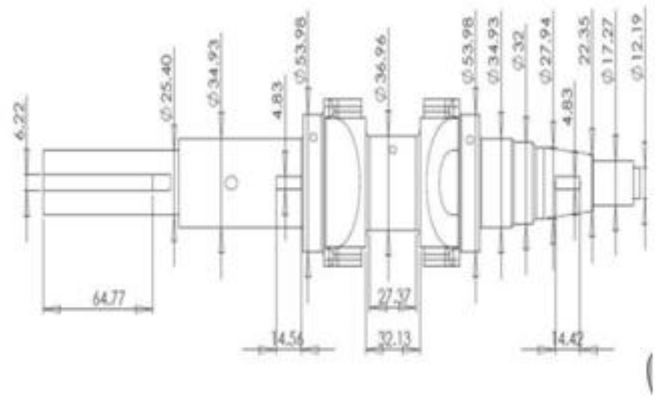
life of a crankshaft, is how fillet radii are configured. If we were to perform a stress analysis test that included all other design features and conditions of a given crankshaft, fillet radii could be considered the most critical factor in overall design and/or modification procedure. There is belief among crankshaft manufacturers that the use of fillets of non-constant radius sometimes called non-circular contours is preferred over those of constant radius. Worst case, this is an area worth discussing with your engine builder or crankshaft manufacturer of choice.

CRANKSHAFT DESIGN ISSUES

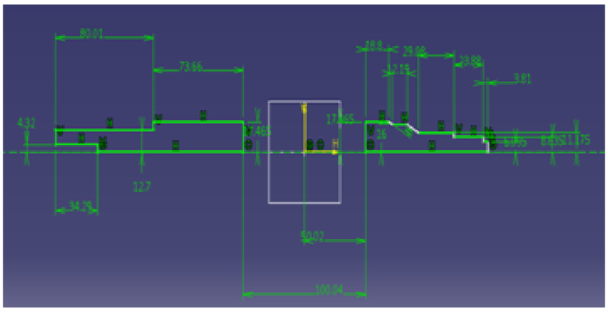
In the world of component design, there are competing criteria, which require the engineers to achieve a perceived optimal compromise to satisfy the requirements of their particular efforts. Discussions with various recognized experts in the crankshaft field make it abundantly clear that there is no 'right' answer, and opinions about the priorities of design criteria vary considerably. In contemporary racing crankshaft design, the requirements for bending and torsional stiffness (see the Stiffness vs. Strength sidebar) compete with the need for low mass moment of inertia (MMOI). Several crankshaft experts emphasized the fact that exotic metallurgy is no substitute for proper design, and there's little point in switching to exotics if there is no fatigue problem to be solved.

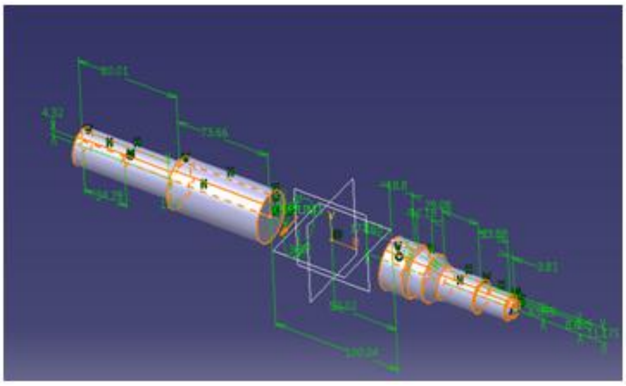
Dimensions of crank shaft:



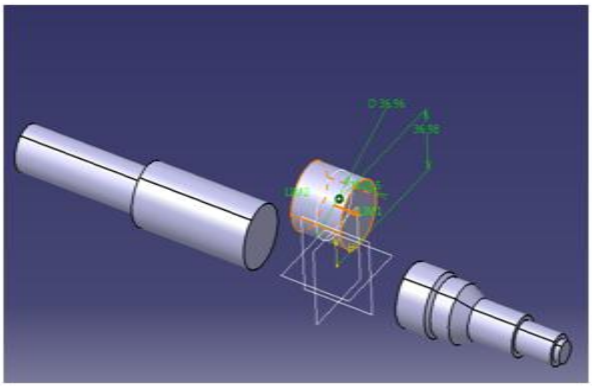


HOW TO DRAW CRANK SHAFT IN CATIA

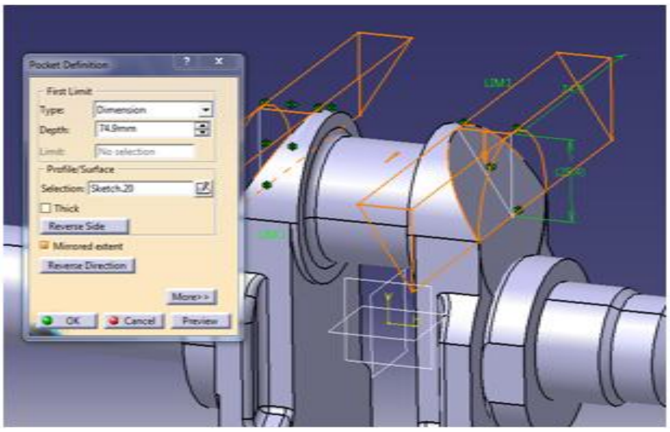




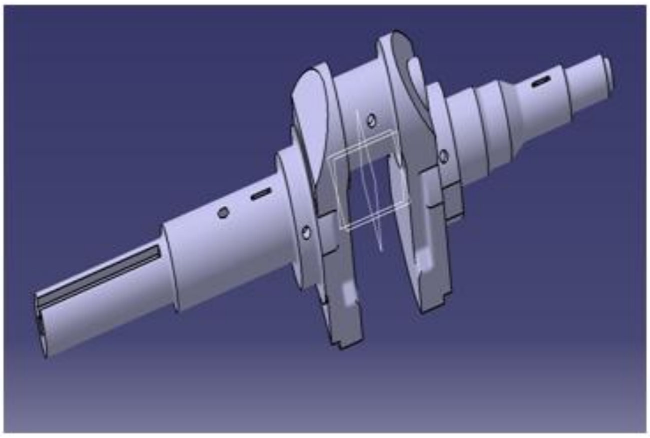
SKETCH 2



ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal



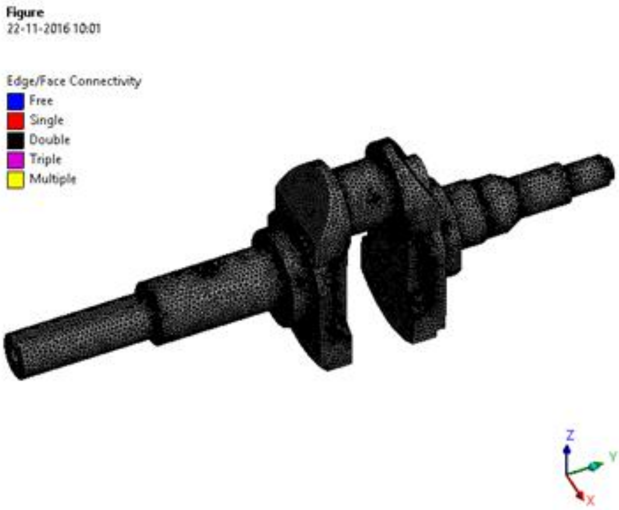
Final Crank shaft



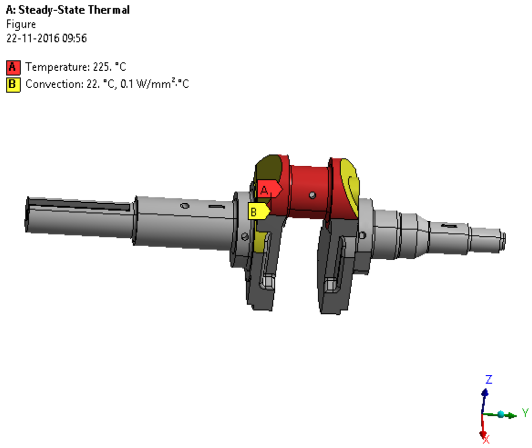
1st MATERIAL ANALYSIS

Steady-State Thermal

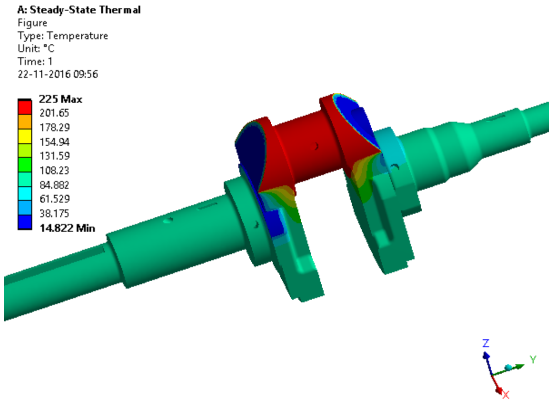
Steel 1008



Model (A4) > Steady-State Thermal (A5) > Figure

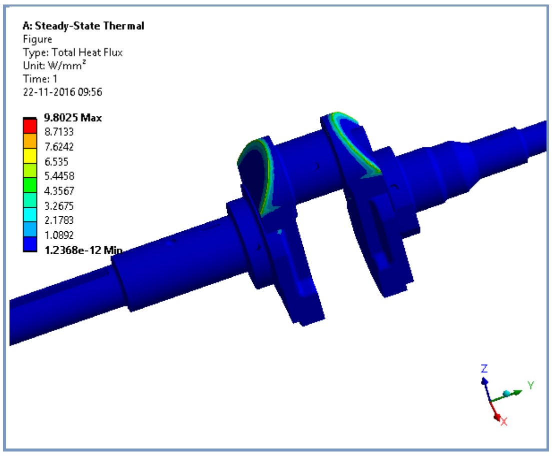


Model (A4) > Steady-State Thermal (A5) > Solution (A6) > Temperature



Model (A4) > Steady-State Thermal (A5) > Solution (A6) > Total Heat Flux

Minimum [W/mm²]	Maximum [W/mm²]
1.2368e-012	9.8025



ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Material Data
Steel 1008

Steel 1008 > Constants

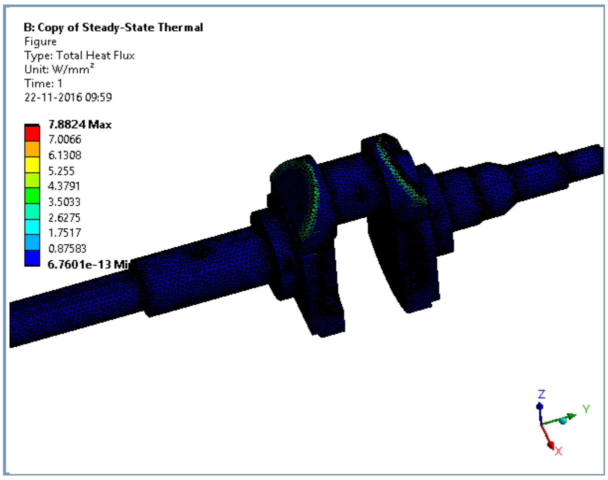
Thermal Conductivity	4.5e-002 W mm^-1 C^-1
Density	7.872e-006 kg mm^-3
Specific Heat	4.81e+005 mJ kg^-1 C^-1

2ND MATERIAL ANALAYSIS Aluminum Oxide

Model (B4) > Steady-State Thermal (B5) > Solution (B6) > Total Heat Flux

Minimum [W/mm²]	Maximum [W/mm²]
6.7601e-013	7.8824

Total Heat Flux > Figure



Material Data
Aluminum Oxide

Aluminum Oxide > Constants

Thermal Conductivity	3.5e-002 W mm^-1 C^-1
Density	3.96e-006 kg mm^-3
Specific Heat	8.5e+005 mJ kg^-1 C^-1

Conclusion

In this project to compare the optimization of crank shaft with thermal conditions and two different materials(steel alloy & aluminum oxide) .The results are taken and evaluated with the given thermal conditions and following heat flux are shown.

	Steel alloy	Aluminum oxide
temperature	225degree max	225 degree max
Total heat flux	9.8025 W/MM2 MAX	7.8824 W/MM2 MAX

According to the thermal analysis of two materials we will consider the heat transfer rate so steel alloy is a good material to manufacture the crank shaft in future.

REFERENCES

1.Hall, Bert S. (1979), The Technological Illustrations of the So-Called “Anonymous of the Hussite Wars”. Codex Latinus Monacensis 197, Part 1, Wiesbaden: Dr. Ludwig Reichert Verlag, ISBN 3-920153-93-6 .

2.al-Hassan, Ahmad Y.; Hill, Donald R. (1992), Islamic Technology. An Illustrated History, Cambridge Univer-sity Press, ISBN 0-521-42239-6 .

3.Laur-Belart, Rudolf (1988), Führer durch Augusta Raurica (5th ed.), August .

4.Mangartz, Fritz (2010), Die byzantinische Steinsäge von Ephesos. Baubefund, Rekonstruktion, Architektur-teile, Monographs of the RGZM 86, Mainz: Römisch Germanisches Zentralmuseum, ISBN 978-3-88467-149-8

5.Sprules, E. (2000). The biomechanical effects of crank arm length on cycling mechanics. Retrieved July 17, 2009, from SPORTDiscus database.

6.Morris, D., & Londeree, B. (1997, October). The ef-fects of bicycle crank arm length on oxygen consump-tion. Canadian Journal of Applied Physiology, 22(5), 429-438. Retrieved July 17, 2009, from SPORTDiscus database.

7.Gonzalez, H., & Hull, M. L. (1989). Multivariable op-timization of cycling biomechanics. Journal Of Biome-chanics, 22(11-12), 1151-1161.

8.Too, D., & Landwer, G. (2000, March). The effect of pedal crank arm length on joint angle and power pro-duction in upright cycle ergometry. Journal of Sports Sciences, 18(3), 153-161.