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MODELLINGANDANALYSISOFCYLINDERCRANKSHAFT

E. Sammaiah[1], Sheelamsai Kumar Reddy[2], Rapolu Rakesh[3]. RikkabuSathyaJithin Sagar[4]
[1]Assistant Professor, Department of Mechanical Engineering, CMR College of Engineering & Technology, Hyderabad, India
[2,3,4] Student, Department of Mechanical Engineering, CMR College of Engineering & Technology, Hyderabad, India

ABSTRACT

The static simulation is conducted on a crankshaft from a single cylinder 4- strokediesel engine. A three-dimension model of diesel engine crankshaft is created usingCATIA V5 software. Static structural analysis is performed to obtain the stressmagnitude at critical locations of crankshaft in. The static analysis is done usingSoftware ANSYS 2021R1 whichresulted in the stresses, deformation and elasticstrain. This boundary conditions are applied at bearings**.**Crankshafts find manyapplicationsinvariousbranchesofengineering.Theyareusedwheneverthereistheneedtotranslatereciprocatinglinearmotionintorotationorvice-versa.Intheirmorevaried configurations, crankshafts are usually used in internal combustion enginesbut also in piston steam engines. It lays on the former the vaster and varied range ofapplications of crankshafts. The internal combustion engines cover various fields ofuses,from small scale model planes tolargemaritimeengines.

INTRODUCTION

Crankshaft is an extensive segment with a perplexing (complex) geometry in the engine,which changes over the reciprocating displacement of the piston into a rotating movementwith a four-link mechanism. In a reciprocating engine, it translatesreciprocating motion ofthe piston into rotational motion; whereas in reciprocating, it converts the rotational motioninto reciprocating motion. In order to do the conversion between two motions, the crankshafthas "crank throws" or "crankpins", additional bearing surfaces whose axis is offset from thatof the crank, to which the "big ends" of the connecting rods from each cylinder attach. It istypically connected to a flywheel to reduce the pulsation characteristic of the four-strokecycle,andsometimesatorsionorvibrationdamperattheopposite end,toreducethetensional vibrations often caused along the length of the crankshaft by the cylinder's farthestfromtheoutputend actingonthetensionalelasticityof themetal.Crankshaftsfindmanyap plicationsinvariousbranchesofeng ineering.Theyareusedwhenever there is the need to translate reciprocating linear motion into rotation or vice-versa.Intheir more variedconfigurations,crankshaftsa reusuallyusedininternalcombustio nengines but also in piston steam engines. It lays on the former the vaster and varied range ofapplicationsofcrankshafts.Thein ternalcombustionenginescovervar iousfieldsofuses,from small scale model planes to large maritime engines. So, crankshafts produced by thevariousmethodsapplyto:e.g.,en ginesforroad,railandmaritimetrans port,portablemachinery, electrical generators, agricultural and industrial machinery. Crankshafts are alsoused in driven machinery such as air compressors and reciprocating pumps. The industrialpotential for a new crankshaft manufacturing process is huge, as the existing and commonmethods,forging; casting and machiningareverycostly. Theformertwo

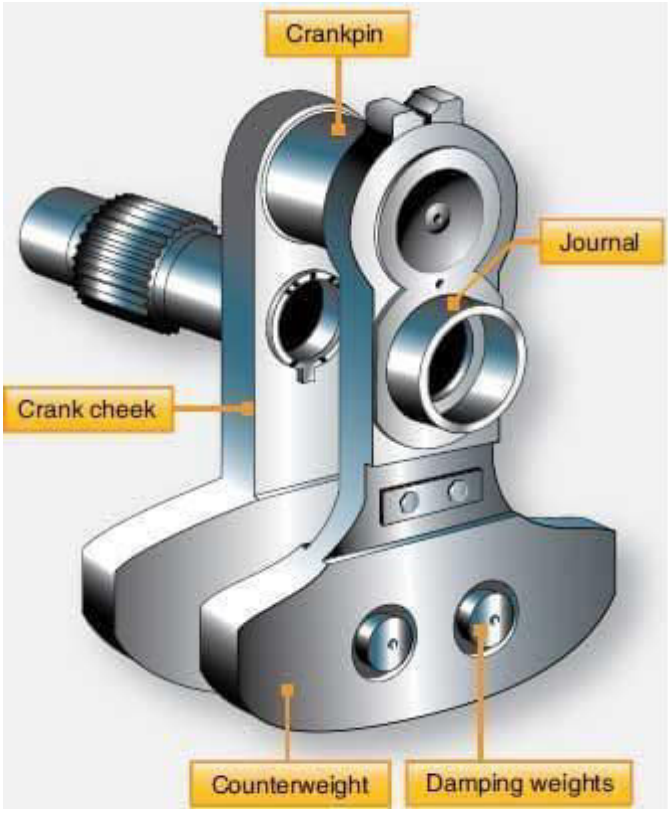

Fig1 Nomenclatureof Crankshaft

demandhighvolumeproductiontobecosteffec tive,astheinvestmentintoolsandmachineryis huge.

MATERIA OF CONSTRUCTION

ALUMINIUM7075 ALLOY:

ChemicalComposition:

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Table-3.1chemical composition ofAl7075

Chemical composition	Al7075
Si	0.62
Fe	0.23
Cu	0.22
Mn	0.03
Mg	0.84
Cr	0.22
Zn	0.10
Ti	0.1
Al	Bal

MechanicalProperties:

Table-3.2mechanicalpropertiesofAl7075

Properties	Al 7075
Elastic Modulus (Gpa)	70-80
Density (g/cc)	2.81
Poisson's Ratio	0.33
Hardness (HB500)	60
Tensile Strength (T) (Mpa)	220

APPLICATION:

The uses of Al 7075 are Aircraft fittings, gears and shafts, fuse parts, meter shafts and gears,missile parts, regulating valve parts, worm gears, keys, aerospace and defenceapplications;bike frames, all-terrain vehicle (ATV) sprockets. It possesses high heat dissipation capacitydue to its high thermal conductivity and is suitable for high strength and high temperatureapplicationsas well.

The world's first mass production usage of the 7075 aluminium alloy was for the MitsubishiA6M Zero fighter. Theaircraft was known for its excellent manoeuvrabilitywhichwasfacilitatedbythehigherstrength of 7075compared to formeraluminiumalloys.

7000 series alloys such as 7075 are often used in transport applications due to their highSpecificstrength,includingmarine,automotiveandaviation.These samepropertiesleadtoits use in rock climbing equipment, bicycle components, inline skating-frames andhangglider airframes are commonly made from 7075 aluminium alloy. Hobby grade RC modelscommonly use 7075 and 6061 for chassis plates. 7075 is used in the manufacturing of M16rifles for the American military as well as AR-15 style rifles for the civilian market. Inparticular high quality M16 rifle lower and upper receivers as well as extension tubes aretypically made from 7075-T6

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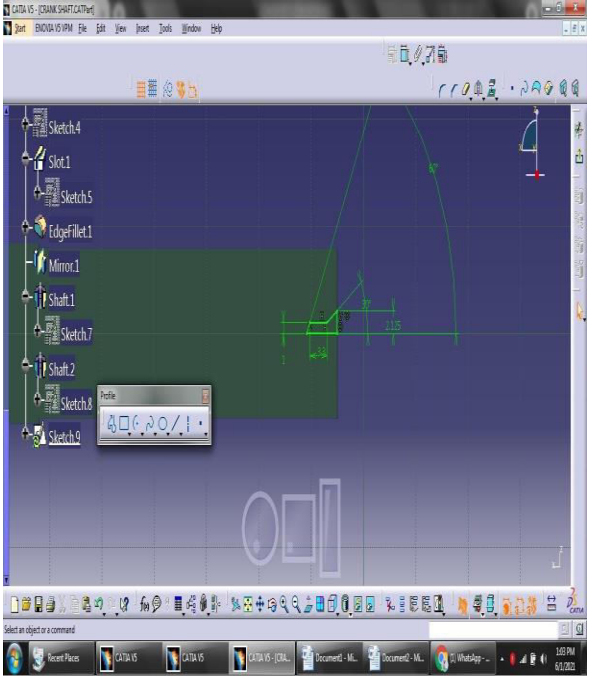
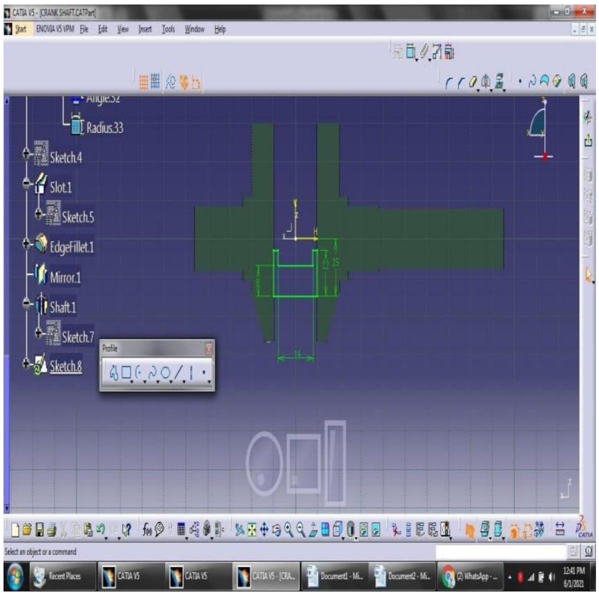


alloy. Desert Tactical Arms, SIG Sauer, and French armamentcompanyPGMuseitfortheirprecisionrifles.Itisalsocommonlyusedinshaftsforlacrossesticks, such as the STX sabre, and camping knife and fork sets. It is a common material usedincompetitionyo-yos as well. Due to its high strength, low density, thermal properties, and its ability to be highly polished,7075 is widely used in mould tool manufacturing. This alloy has been further refined intoother7000 seriesalloys for thisapplication,namely7050 and 7020.

Fig4.5MirrorimageinCatia

Fig Design oftheshaftinCatia



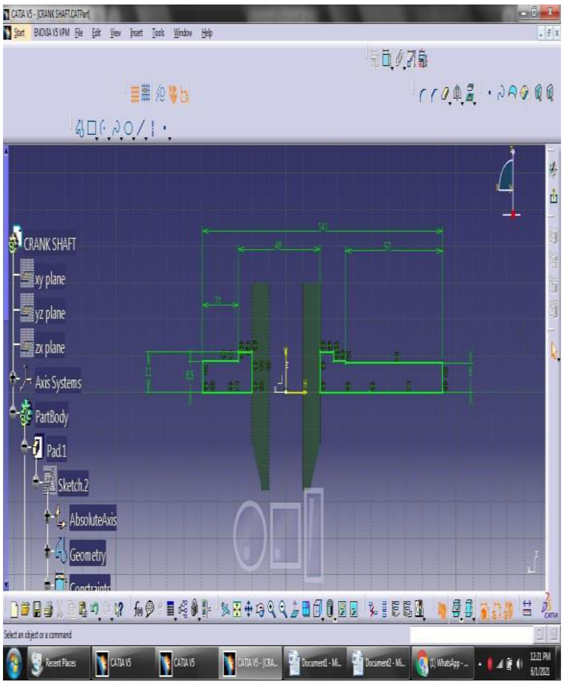


Fig Design ofcrankpininCatia

ISSN- 2394-5125 VOL 10, ISSUE 03, 2023

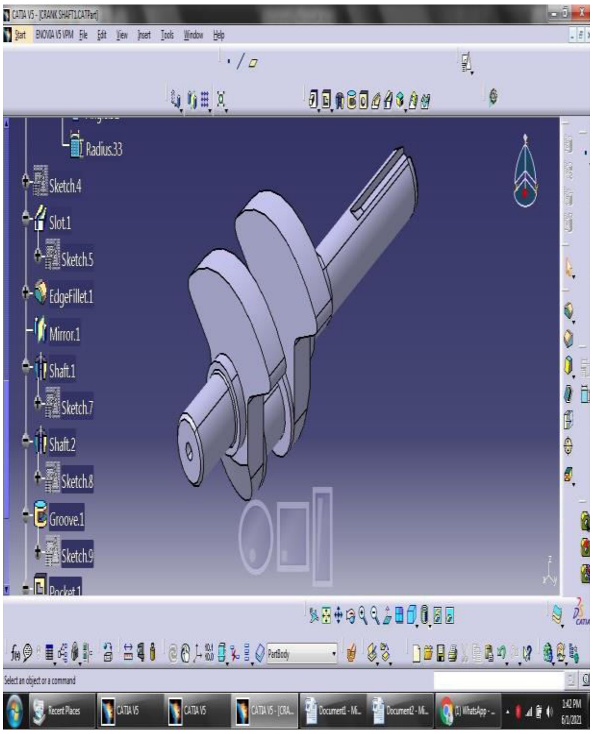
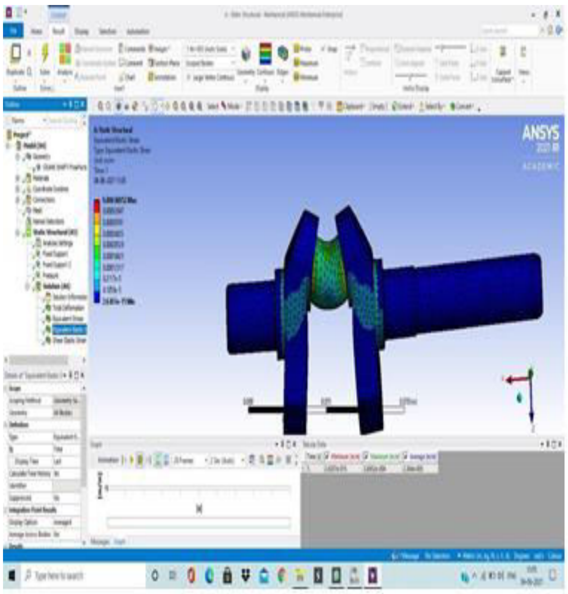


Fig CrankshaftmodelinCatia

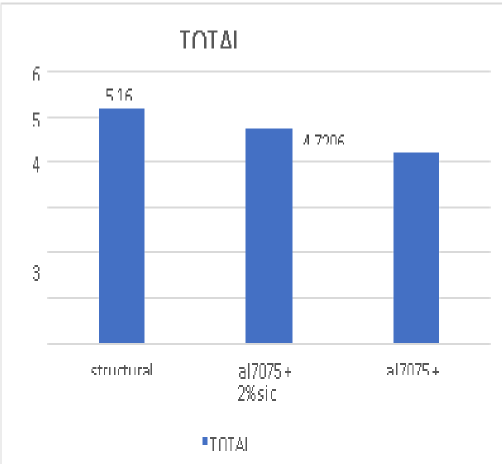
FigEquivalentElastic Strain



RESULTS AND DISCUSSION

Table5.1Theobtainedparameters aretabulated in thebelowtable:

S.NO	MATERIAL	TOTAL DEFORMATION (m)	EQUIVALENT (VON-MISES) STRESS (Pa)
1	Steel	5.1669×10^-6	3.1852×10^8
2	Al7075+2%SiC	4.7206×10^-6	3.1492×10^7
3	Al7075+5%SiC	4.2035×10^-6	3.1492×10^7



CONCLUSION

Crankshaft is designed with three different materials from those three differentdesigns it is concluded that it is very much useful to use Al7075+5%Sic rather thanAl7075+2%Sicand structural steel.Al7075+5%SicandAl7075+ 2%Sichasgotbetterequivalent stress.The Al7075+5%Sic has shown less deformation and elastic strain when comparedwithstructural steel andAl7075+2%Sic.ThisAl7075+ 5%Sichasgotlessequivalentstresst hanstructuralsteel.SoAl7075+5% Sicisbestandconvenientcomposite tobeused.

FUTURESCOPE

Fatigue analysis, vibration analysis and dynamic analysis are to carried outon four strokesinglecylinderdieselengine

REFERENCES

1. C.M.Balamurugan.,R.Krishnaraj.,Dr.M.Sakthive.l, K.Kanthave.l,DeepanMarudachalamM.G.,R.Palani.,2011"Computer Aided Modeling and Optimization of Crankshaft,''International Journal ofScientific&Engineering.
2. Yu Ding and Xiaobo Li.,2011, " Crankshaft Strength Analysis of a Diesel EngineUsingFinite

ISSN- 2394-5125 VOL 10, ISSUE 03, 2023

Element Method,”

3. JianMeng., Yongqi Liu., Ruixiang Liu.,2011,“Finite Element Analysis of 4-CylinderDieselCrankshaft,” I.J.Image,GraphicsandSignalProcessing, 5,22-29.
4. MENG Jian., LIU Yong-qi., LIU Rui-xiang., and ZHENG Bin.,2011,“Intension Analysis of 3-D Finite Element Analysis on 380 diesel crankshaft,” InternationalConferenceon Computational andInformationSciences.
5. Yu Gongzh.i, Yu Hongliang.,DuanShulin., 2011, “Crankshaft Dynamic StrengthAnalysis for Marine Diesel Engine,” Third International Conference on MeasuringTechnology and Mechatronics Automation.
6. GuYingkui, Zhou Zhibo.,2011,“Strength Analysis of Diesel Engine CrankshaftBased on PRO/E and ANSYS,” Third International Conference on MeasuringTechnologyand Mechatronics Automation.
7. Xiaorong Zhou., GanweiCai., Zhuan Zhang. Zhongqing Cheng., 2009, “Analysis onDynamicCharacteristicsofInternalCombustion EngineCrankshaftSystem,”InternationalConferenceonMeasuringTechnologyandMechatronicsAutomation.
8. FatiguePerformance Comparison And Life Prediction Of Forged Steel And

DuctileCastIronCrankshafts,"Published in Proceeding of the 27th Forging IndustryTechnicalConferenceinFt.Worth,Texas.

9. Shenoy, P. S. and Fatemi, A., 2006, "Dynamic analysis of loads and stresses inconnecting rods,"IMechE, Journal of Mechanical Engineering Science, Vol. 220, No.5, pp. 615-624.

10. Zoroufi, M. and Fatemi, A.,2005, "A Literature Review on Durability Evaluation ofCrankshafts Including Comparisons of Competing Manufacturing Processes and CostAnalysis", 26th ForgingIndustryTechnicalConference,Chicago.

1. Bhavani, M., Narayana, V.A., Sreevani, G., "A Novel Approach for Detecting Near-Duplicate Web Documents by Considering Images, Text, Size of the Document and Domain", Lecture Notes in Electrical Engineering, 2021, Vol. 398, Issue, PP-1355-1366.
2. Gogineni, S., Pimpalshende, A., Goddumarri, S., "Eye disease detection using yolo and ensembledgooglenet", Lecture Notes on Data Engineering and Communications Technologies, 2021, Vol. 53, Issue, PP-465-482.
3. Nayak S.C., Misra B.B, "Extreme learning with chemical reaction optimization for stock volatility prediction", Financial Innovation, Vol. 6-Issue 1..
4. Skandha S.S., Gupta S.K., Saba L., Koppula V.K., Johri A.M., Khanna N.N., Mavrogeni S., Laird J.R., Pareek G., Miner M., Sfikakis P.P., Protogerou A., Misra D.P., Agarwal V., Sharma A.M., Viswanathan V., Rathore V.S., Turk M., Kolluri R., Viskovic K., Cuadrado-Godia E., Kitas G.D., Nicolaides A., Suri J.S., "3-D optimized classification and characterization artificial intelligence paradigm for cardiovascular/stroke risk stratification using carotid ultrasound-based delineated plaque: Atheromaticâ„¢ 2.0", Computers in Biology and Medicine, 2020, Vol. 125-Issue.
5. Gautam P., Ansari M.D., Sharma S.K., "Enhanced security for electronic health care information using obfuscation and RSA algorithm in cloud computing", International Journal of Information Security and Privacy, 2019, Vol. 13-Issue 1.
6. Nayak S.C., Misra B.B., "Estimating stock closing indices using a GA-weighted condensed polynomial neural network", Financial Innovation, 2018, Vol. 4-Issue 1.
7. Mahender K., Kumar T.A., Ramesh K.S., "Analysis of multipath channel fading techniques in wireless communication systems", AIP Conference Proceedings, 2018, Vol. 1952-Issue.