DESIGNANDANALYSISOFELECTROMAGNETICENGINE

Santosh Kulkarni[1], B. Pradeep[2], B.Pavan Upendra Shiva Kumar[3], K Jayanth[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

Solenoidisthegenerictermforacoilofwireusedasanelectromagnet.Italsoreferstoanydevicethat convertselectricalenergytomechanicalenergyusingasolenoid.Thedevicecreatesamagneticfie ldfromelectriccurrentandusesthemagneticfieldtocreate linear motion. This proposal deals with reducing the use of major fossil fuels and switching to better energy saving for the future using as olenoid engine. The development of an electromagnet-icengineis based on attracting and repelling properties of an electromagnet. The electro- magnet can be operated by using both AC and DC. By using this model, we can reduce pollution and use of fossil fuels, and also we can reduce the cost electric vehicles.

Key words: Electromagnetic engine, Catia, Ansys, Thermal analysis, Heat flux.

1. INTRODUCTION

An American scientist Joseph Henry (1797-1878) constructed a small electromagnet- nitic engine, with a reciprocating beam quoted as a "philosophical toy", and there was certainly no intention of getting useful work out of it. It was first described in the American Journal of Science, 1831, Vol 20 p342. The British journal Philosophical Magazine in 1838, F WatkinsexaminedHenry'sinventionindeta ilanddescribeditasthefirstcyclicelectricmo tor,i.e.,onethatcontinuedworking withoutmanualswitchingorresetting.Since then,continuousresearchhasbeengoingont oimplementthisconceptonalargescale.Inth isresearch,weaspiretode-velop an electromagnetic mover as a derivative of the electric motor and IC engine. This propulsion system is designed based on the principle of electromagnetism and uses a solenoid and Internal Combustion Engine (ICE) working mechanism and thus, this concept is known as Solenoidal Powered Engine(SPE)Ongiftday,wetendtocan'tima gineeachdaywhilenotICengines,thatisonei neveryofthebestinventionofman.TheICen gineisemployedincarstorunit.wewantanau tomobilefor transporting product and to travel. As an increasing population, the requirement for anautomobile is increasing. The IC engine uses gasoline and diesel as fuel. the requirement offuelisincreasingthatofferhikewithinthevalueofafuel.ThisproducesascenariothatbringsupadesiretochangetovarioussuppliesoffueltoprovidetheabilityalmostlikeanICengine.The challenge isn't to create AN engine that operates on AN alternate fuel however even hashigher efficiencies. The succeeding supply of energy that strikes our minds is unquestionablyelectricity. we will use electricity or hybrid that runs on each fossil fuel and electrical energy.toextendthepotencyoftheenginea mixofvariousenergyisused.Thegovernmenthastakenevolution of scientific ways for emission inventory is crucial. Therefore, analysis is finishedon the emissions from numerous vehicles by exploitation IVE model. The quality of air indevelopingcountrieslikeAsiancountries hasreachedahorrifyinglylowlevel.Modalanalysistoestimateaconveyanceemissiontoshowcasethetemporalemissionofvehicles. PistonsandalsothecylindersofatraditionalICEnginearereplacedbythepermanentmagnetpistonsandnon-ferromagneticmaterialsseverallythatLEDtotheinventionofmagneticforcereciprocating engine by Sherman S. Blalock. Multi-cylinder electromechanical engine for theautomotive that consists of the cylinders containing metallic element Co style of magnets inpistons settled at the right angle to the pistons. Growth during this field has LED to theinvention of Maps Engines that are incorporated with numerous equipment and machinerywhoseapplicationareinfieldslikeengine, shipengine,locomotiveengine, andgardentool.Electromagnetism:Leland Gifford mentioned electromagnetically driven ICE in his invention. Reciprocatingpistons square measure slippery mounded during a cylinder and coupled to a mobile rotatingshaft. mounted magnets, preferably of the atomic number 62 metal alloy kind square measuremountedwithinthepistontointermittentlyattractandrepelsequentiallyenergizedelectromagnets that square measure mounted within the cylinder walls. capacitance dischargecircuit used as an influence supply of magnet that is employed for guiding electricity to theelectromagnets. Computerized management means regulates the temporal arrangement ofdischargeofthecapacitanceandsothetemporalarrangementofenergizingtheelectromagnets. Houtman P. Siregar et. al mentioned the materials for the core of magnetismfuel saver square measure created of plain steel and copper. Diameters of the wire winding,thatisemployedwithintheanalysis ,are0.25mmand0.35mm.Speedofengine,a ndavarietyof coils that is voluted during a winding core of the fuel saver square measure chosen as thetestingvariables.Fromthisworkisobtain edthattheperformanceofthemagnetismfue lsaverthat uses copper core is healthier than the magnetism fuel saver. Kannan et al mentionedregarding the Yamaha R15 bike 149.8 cc cylinder are created from Diasil (Die forgedAluminium Silicon) that AN all-aluminium cylinder is created attainable by AN exclusiveYamaha metal forging technology. because it uses a two-hundredth silicon aluminium alloy,it'sglorioustemperaturereductionqua litiesandreducestheengineweightattheide nticaltime.sotheusershouldn'tgettoselecte xpensivemaintenancelikesleevereplacem entswhenridingsays some twenty,000 kilometers. Another advantage of the Deasil cylinder is that the ridergets improved fuel economy. As cylinder, piston and close elements square measure all.Numerous size and weight reduction and performance of enhancement over the work and,notably, secured solid solution permanent magnets, moreover, provides these benefits at anaffordablevalue.Primarilyforthesereaso ns,thesemagnetssquaremeasurecurrentlye mployed in the wide and growing range of peripheral, workplace automation, and shopperelectronicapplicationsandcurrentl yrepresentthefastest-growingsectionofamagnetmarket.The temperature among the magnetism engine cylinder is incredibly low then no engine squaremeasure needed for warmth transfer. These build the cylinder simply manufacturable. Thecylinder is created of unblemished steel, a nonmagnetic material that limits the field of forceamongtheboundaries ofthe cylinder outer boundary.Piston:Thepistonisthattherecipr ocalapartoftheAssociateintheNursingengi ne.Thestaticmagnet hooked up within the piston and the magnet hooked up within the cylinder creates anattractionthat drives therotatingshaft with the assistanceoftherod.

Material properties:

Table 1 material properties Material properties

Material properties	Copper metal	Aluminium metal
Thermal conductivity k [W/mk]	400	237
Specific heat c[j/kgK]	384	887
Density [kg/m3]	8960	2700
Youngs modulus E [GPa]	110	70
Modulus of rigidity G [GPa]	48	26
Melting temperature	1083°c	660.32°c
Coefficient of thermal expansion	16.5μm/[m.K]	23.15μm/[m.K]

2. PROBLEM FORMATION

Problem Formation

"An Electromagnetic Mechanism Which Works Like an Engine". Engine is the main power source of Automobiles, where combustion takes place & produces heat which converts into mechanical energy. We know IC-Engines are used in Automobiles, Aeroplane etc. But the incomplete combustion produces some harmful gasses, which is one main cause of air pollution.Modern Science & Technology has been taken many positive steps for emission control. Like, using CNGs & LPGs instead of petrol & diesel. Now technology brings Electrical bikes, scooters & cars. The battery of electrical vehicle can charge easily like mobile.To Analyse the temperature distribution for engine with different cross-sections and materials, you can use thermal analysis software such as ANSYS. These software packages allow you to simulate heat transfer and temperature distribution in complex geometries, such as engine parts. To begin, you would create a 3D model of the parts in the software and define the material properties of the part and surrounding environment. You would also need to define the heat sources and boundary conditions for the simulation, such as the heat flux at the base of the part and the temperature of the surrounding air.Next, you would run the simulation and analysis the temperature distribution along the length of the engine for different cross-sectional shapes and materials. You could then compare the results to determine which combination of cross-sectional shape and material provides the highest heat transfer rate and the lowest temperature along the engine part. Once you have identified the optimum engine cross section with suitable material, you could use this information to design and manufacture engine that improve the heat transfer rate. This could lead to increased solenoid engine efficiency and a longer lifespan.

Objective

ElectromagneticEnginewithanObjectiveofLoweringPollutionToreducetheusageofHYDROCARBONS.Nowadaystheelectromagneticvehiclehashighinnovativecomparedwith ICEngine.Andthis engine has very cleaner and which is not produce any kind of the smokes.

Themaintenancecostofthetypeofelectromagneticengineisalsolow.The present-day electric vehicle is efficient than petrol/diesel vehicles. They are 97%cleanerthangas-poweredcars.Themaintenancecostofelectriccarsisoptimum.Themainproblemsfacedbyelectricvehiclesareitsinabilitytorunlongdistancesbeforebeingchargedagainandthehighinitialcostoftheelectricvehicles. Most production electric cars about to hit the market can only go about 90 miles. Also,thereisneedforinstallationofchargingstationsastheenergydensitiesofnormalbatteriesislessforvehiclestotraveloverlongdistancesand gettingafullchargetakesaroundeighthours.After studying the above research papers, we concluded that, to perform the thermal analysis of different cross-sections by considering different materials and finding the optimum engine which has better heattransfer rate.

3. METHODOLOGY

By considering the solenoid engine dimensions, 3D parts are modelled in different cross sections using CATIA V5 software.After modelling is done. The file is extracted into ANSYS15.0, subsequent material is added to the component and thermal analysis is performed.Then the temperature distribution is analyzed and from which the heat flux is obtained.After computing heat flux values, the engine cross section with suitable material which has higher heat flux value is considered as optimum part (as it has better heat transfer rate).

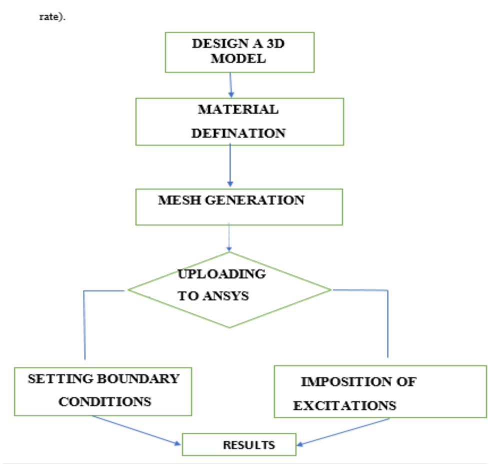

Fig 1 flow diagram.

4. EXPERMINANTION

Copper at 100°C

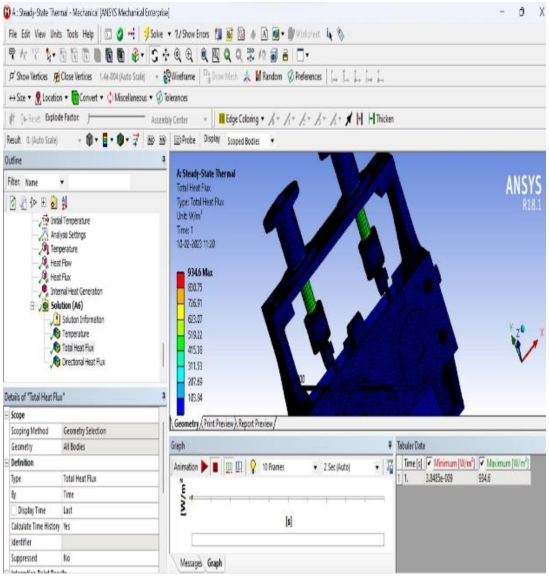

Fig: 2 Total heat flux of copper.

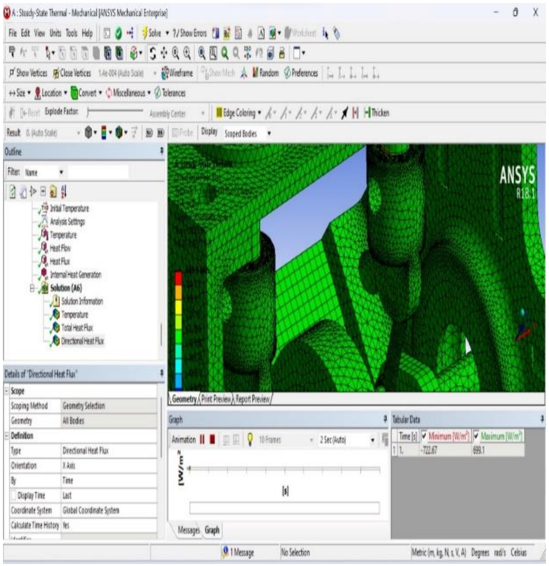

Fig: 3 Directional heat flux.

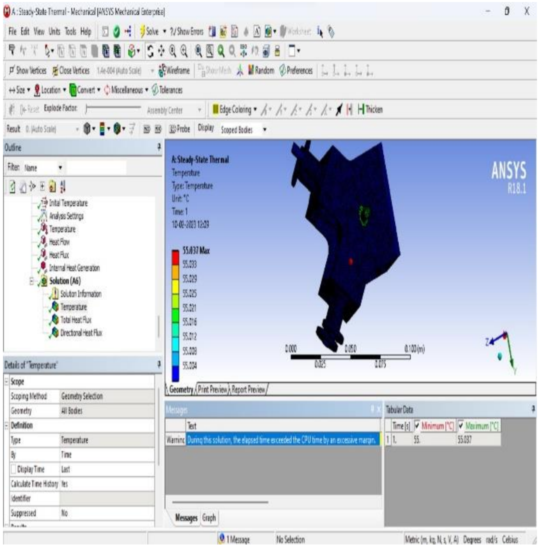

Fig: 4 Temperature details of copper.

Tabulation of Results

After performing the thermal analysis, the results heat flux values obtained are listed below according to material wise.

Iteration 1 60°C

Table 2 Heat Flux, Direction Heat Flux at 60°c

Material	Temperature	Total Heat Flux	Directional Heat Flux
ALUMINIUM ALLOY	55.037	845.82	614.41
COPPER	59.012	934.6	699.1

Iteration 2 100°c

Table 3Heat Flux, Direction Heat Flux at 100°c

Material	Temperature	Total Heat Flux	Directional Heat Flux
ALUMINIUM ALLOY	101.21	1694.07	1224.33
COPPER	109.31	1872.40	1402.3

Iteration 3 130°c

5. RESULTS DISCUSSION

When designing and analyzing a solenoid engine, the choice of materials is animportant consideration. Copper alloy and aluminum alloy are both commonlyused in solenoid construction due to their favorable electrical and thermal properties.Copper alloy has a high electrical conductivity, which allows for efficient transfer of electrical energy to the solenoid coil. It also has good thermal conductivity, which helps to dissipate heat generated by the coil during operation. However, copper alloy can be relatively heavy and expensive compared to other materials.Aluminum alloy, on the other hand, is lightweight and has good thermal conductivity, making it an attractive choice for solenoid construction. It is also less expensive than copper alloy. However, aluminum alloy has a lower electrical conductivity than copper alloy, which can lead to reduced efficiency in the transfer of electrical energy to the solenoid coil.

6. CONCLUSION

When it comes to the construction of solenoid engines, the choice of materials is an important consideration. Aluminum and copper alloys are commonly used in the construction of solenoid engines due to their excellent electrical conductivity and mechanical properties.Aluminum alloys are lightweight and have good thermal conductivity, making them ideal for use in the construction of engine blocks and other components that need to dissipate heat. Copper alloys, on the other hand, have high electrical conductivity, making them suitable for use in the construction of solenoid coils and other electrical components.Design and analysis of solenoid engines with aluminum and copper alloys require a deep understanding of materials science, electromagnetic principles, and mechanical engineering. Proper material selection and careful design and analysis of the engine's components are critical to ensuring the engine's performance, reliability, and efficiency.In conclusion, the use of aluminum and copper alloys in the construction of solenoid engines is a viable option for designing high-performance, efficient, and reliable engines. However, it is crucial to carefully consider the material properties, design, and analysis of the engine's components to ensure optimal performance and reliability.

7. REFERENCES

1. Abil Joseph an electromagnetic engine has various advantages over the internal combustion engines. Vol 03 june-2014
2. K. Athani Very less amount of electric power is required to magnetize the electromagnets and these electromagnets can supply the sufficient amount of power continuously Vol 4 August-2021
3. J. Rithula, J. Jeya shruti, and Y. Anandhi design an electromagnetically reciprocating automobile engine. A four-stroke engine is used in the vehicle. November 2013
4. Shirsendu Das, our main intension is to produce continuous revolution in crank shaft by reciprocating the piston inside the magnetic field. January-2013
5. Aby Eshow Varughese, Arun T.P., Athul T.N. The efficiency and power output of the engine was less than what was expected. The reason for less power and efficiency are the windings of the electromagnet are not perfect. June-2014
6. Balaji, G. Bala Subramanian in this engine there are two magnets, one is permanent magnet and temporary magnet. August -2018
7. Mahima Rathore, Danish Shaik

Proceeding from the mechanical domain, the pistons had obstruction in their movement due to the material of the cylinder.November 2011

8. N.G.Lokhande et al, showed basic information about magnets, laws of magnet and its property also with the working of the electromagnetic engine with repulsive force action by suspending magnet in like pole direction inside the cylinder which is used to move the piston from TDC to BDC, while the energy which is stored in the flywheel help the piston to move from BDC to TDC. Vol 4 March-2017
9. Adarsha. H et al, have taken different types of material for electromagnet like ceramic, iron, steel and the maximum power obtained is from the ceramic material.Vol 2 June-2012
10. Ganesh Bairavan.P et al, modify the I.C engine by providing the precise wounding of the coil on the iron core which can reduce the void between the coil resulting higher magnetic field which increase the efficiency of the engine. Vol 6 July-2014
11. Das, S., Nayak, J., Nayak, S., Dey, S., 2022, Prediction of Life Insurance Premium during Pre-and Post-Covid-19: A Higher-Order Neural Network Approach, Journal of The Institution of Engineers (India): Series B, 10.1007/s40031-022-00771-1
12. Pittala, C.S., Vallabhuni, R.R., Vijay, V., Anam, U.R., Chaitanya, K., 2022, Numerical analysis of various plasmonic MIM/MDM slot waveguide structures, International Journal of System Assurance Engineering and Management, 10.1007/s13198-022-01664-8
13. Ahmad, N., Yadav, K.S., Ahmed, M., Hussain Laskar, R., Hossain, A., 2022, An integrated approach for eye centre localization using deep networks and rectangular-intensity-gradient technique, Journal of King Saud University - Computer and Information Sciences, 10.1016/j.jksuci.2022.02.015
14. Velliangiri, S., Pandiaraj, S., Iwin Thanakumar Joseph, S., Muthubalaji, S., 2022, Multiclass recognition of AD neurological diseases using a bag of deep reduced features coupled with gradient descent optimized twin support vector machine classifier for early diagnosis, Concurrency and Computation: Practice and Experience, 10.1002/cpe.7099
15. Muthubalaji, S., Devadasu, G., Srinivasan, S., Soundiraraj, N., 2022, Development and validation of enhanced fuzzy logic controller and boost converter topologies for a single phase grid system, Electrical Engineering and Electromechanics, 10.20998/2074-272X.2022.5.10