Abstract—The concern for a clean environment, high oil prices and strict emission standards in research was the driving force behind the internal combustion engine. Popular direct injection engine nutrition with its compact size, low fuel consumption and low emission level. Here is the mathematically using the various statistical methods.

Keywords-IC Engine, Mathematical modeling, Wiebe function, Miyamoto model

Index Terms: About four key words or phrases in alphabetical order, separated by commas.

1. INTRODUCTION

Engine performance prediction and optimization is widely used in automotive industry to minimize design iterations to reduce the product development cycle. Various mathematical simulation tools zero dimensional, one dimensional [5-8], three dimensional are utilized in the initial development stages of an engine to optimize the design parameters. Based on this preliminary design inputs the engine hardware is made and tested and tuned to get the targeted results. Mathematical modeling and simulation has dramatically reduced the product development cost and time. Simulation tools are also combined with other simulation software’s called co-simulation to optimize the final vehicle target[1-4]. (HIL, SIL)

MATHEMATICAL MODELLING

1.1 MODEL STEUP [1], [8], [12]

Mechanical model is constructed by defining entries. The default input contains mechanical and boundary conditions. Therefore, all dimensions of intake and exclusion channels are measured and added. Similarly[9-11], the indices of internal mechanical geometries, the hole, the strokes, the long wire extension, the offset piston pin and the compression ratio are attached to the simulation model. The initial conditions, such as upper temperatures and wall temperatures, were set for the default values provided in the software. Since then, our systems have no tools to measure them. Since actual mechanical measurements are available, they can be replaced with more accuracy.

By using gas law, pressure and temperature and mechanical engineering, the number of cylinders on each crack angle can be determined from the beginning of the compression from the beginning of the injecting of the fuel.

Fig: 1 – Thermodynamic Flowchart of ICE

Models, performance and emissions analysis of these blocks are reasonable, with brief explanations. Performance is generally more effective at controlling flow in the combustion zone. Fast combustion engines provide higher turbulence levels. In terms of more turbulent conditions, the reliability of events, but the thermal efficiency is determined by the heat transfer rate. These models include subsamples to predict some of these trade-offs[12-16].
Optimization Of Four Stroke C.I. Engine Performance By Using Statistical Techniques (Mathematical Method)

Fig: 2 Flowchart of Engine Development Process

Sophisticated thermal driven models of performance are achieved including these submodels. Such models can customize and customize the direction of many major designs. Different designs are applied to the bone exhausting quality, it is believed that some treatments should include useful for realistic models of treatment[22-28].

1.2 HEAT TRANSFER [8]

In-cylinder heat transfer model has been developed for more than 20 years and as a result its focus is very low.

Heat transfer takes place between a cylinder and a thin layer of solid wall gas. This level of heat boundary layer, which shows a major change with the most significant gradient of gas temperature wall. Formally, heat transfer gradients and gases are given by thermal conductivity. However, because the gradient shift to outer boundary level. Depending on the features, it is affected by the transmission speed through the weak flow. The presence of the wall has a profound effect on the distribution of gases, because the average velocity and turmoil will disappear between the walls. Therefore[17-21], heat transfer heat at any place is a function of the boundary layer and the boundary layer of the moment.

1.3 Wiebe function [11]

Using continuous mathematical functions to assess the combustion rate and performance of internal combustion engines provides fast and low cost technology. These functions are usually variable variable's variable distribution derivatives and the most famous Wiebe function[29-34].

Published By: Blue Eyes Intelligence Engineering & Sciences Publication

Retrieval Number: B1007078219©BEIESP
DOI: 10.35940/ijrte.B1007.078219
In an actual combustion system, the internal combustion engine can run parallel to the formation of intermediate types, including chain reactions and independent radicals and atoms. This is called the interactive network of the website. Due to its highly reactive and functional center, chemical chemistry plays an important role in the reaction and is necessary for the way of communication. To start a conversation, you need a special complex active center (the primary center) and you can create it by providing heating or electricity for the center air composite and fuel. During the combustion process, a large number of active centers will be present near the main reactive species molecules. Molecules that burn the final product and more active centers can trigger new reaction cycles. This scheme eliminates blockage of the center of the chain resulting from collision of free radicals or free atoms with a third object (any other group of atoms, atoms or molecules or their walls). As it burns, the concentration of the reagent gradually decreases and the reaction rate correspondingly decreases [35-38].

Graph 1 – Wiebe Burn Characteristics

1.4 Miyamoto model

They tried to establish a relationship between some Wiebe parameters regarding thermodynamic efficiency, noise and smoke discharges. A sample of thermal output rate comprised of two Wiebe functions. They are the amount of energy released in the pre-mixing and spread conditions of their respective fuel. Other parameters are defined by Wiebe, the index associated with the P code and the index d for the spread. Miyamoto and many others. Continuous tests were conducted in direct injection diesel and indirect injections. Engine adjustment parameters such as brake average pressure (b.m.e.p), needle time and ignition time are related to the remaining adjustment parameters.

The figure 6, 7 below shows the data input given in the simulation software where the type of fuel, Fuel system, bore, stroke, etc. are entered.

Fig: 6 – Data Input Window for Fuel system

Fig: 7 – Data Input Window for Engine Geometry

Single zone model assumes the charge as homogeneous and single wiebe heat release model is widely used to model SI combustion. Here we use two wiebe model as we are simulating a Direct Injection Diesel Engine [37-41].

Fig: 8 – Data Input Window for Combustion and Heat Transfer Data
Heat transfer by convection from gas to the cylinder walls or from the cylinder walls to the gas is considered over the entire cycle. Heat transfer by radiation is additionally considered, during combustion as the temperature of burning zone is significant[42-48].

The figures above shows the data input given into the simulation software.

Figure 12 shows the port flow coefficient values for different valve lift values. We have accepted the default values provided for a single cylinder diesel engine, because to measure the actual data, a flow test rig is needed.

Figure 13 shows the valve event display with firing order in the cylinder with its required data. The graph shows the Pressure variance during the cycle of combustion.
The above figure shows the different element status at various stages of combustion, its values and requirements.

The below mentioned figure 17 shows the tool provided in the software to estimate the FMEP values for a single cylinder CI engine. Various methods of obtaining FMEP values based on engine type, configurations are provided in the simulation tool. In the real scenario, the FMEP values needs to be collected by running the engine either in motoring mode and finding out the friction values by means of friction dynamometer.
RESULT AND DISCUSSION

A method has been proposed to obtain a mathematical model of a four-stroke engine for hyle simulation of a motor control system. This technique is used to calculate motor parameters and empirical data functions for motor performance theory in real time.

The four-stroke diesel engine is considered to be a series of interactive elements such as cylinders, repair elbows and exhaust manifolds. Output parameters (angular shaft and rotor angle velocity and turbochef intake and exhaust pressure) are different.

REFERENCES

1. John, B. Heywood- Internal combustion Engines
2. Diesel Engine Reference book
3. Dr.V.Ganesan – Internal combustion engines
4. Dr.V.Ganesan – Computer simulation of Compression Ignition Engines.
11. J.J.Ghool. Review of the development and applications of the Wiebe function: a tribute to the contribution of Ivan Wiebe to engine research. May 2010
21. Srinivasan V.,Analysis of static and dynamic load on hydrostatic bearing with variable viscosity and pressure,Indian Journal of Science and Technology,V-6,1-SUPPL,6,PP 4777-4782,Y-2013


Mr. P. Vignesh, Working as Assistant Professor in the department of Mechanical Engineering in Indira Institute of Engineering and Technology, Pudur, Thiruvallur, Tamil Nadu, India. Completed B.E Mechanical Engineering from Indira Institute of Engineering and Technology, Anna University -2015 and M.Tech Automobile engineering from Bharath Institute of Engineering and Technology – 2018. He had Life Time Membership from IAENG, UAMAE and He is acting as Reviewer and Editor Board member for IEEE and SCI Journals.

Mr. P. Madan, PG Scholar from Bharath Institute of Higher Education and Research Department of Mechanical Engineering. He completed B.E Mechanical Engineering from St. Peter’s College of Engineering and Technology, Anna University -2017.

Mr. D. Mohankumar, Assistant Professor from Bharath Institute of Higher Education and Research Department of Automobile Engineering. He completed M.E (Engineering Design), in G.K.M College Engineering and Technology, Anna University – 2014.

Dr. P. Naveen Chandran, Professor from Bharath Institute of Higher Education and Research Department of Automobile Engineering.

Retrieval Number: B100707821919©BEIESP
DOI: 10.35940/IJRTE.B1007.078219

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication