

Electronically Operated Valve System – Review

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Abstract: - The project provides a method for electronically operated valve system in internal combustion engine. This method for camshaft operation looks at utilizing the expected charge of 12v standard in motor vehicle. it also provide simplified model detailing how this principle works .the advantage of electronically operated valve system is that it improves the mechanical efficiency of the internal combustion engine .basically we are implementing drive by wire technique for this project .drive by wire is technique by which mechanical component and linkage are replaced by electronic system. With the use of Arduino and give it to the DC motor which give drive to camshaft .camshaft rotates at half speed of crankshaft which are connected by timing chain .main objective of this project is to incorporate drive by wire technique and improve the mechanical efficiency of internal combustion engine.

Keywords - camshaft, photodiode sensor, DC motor, Arduino, IC engine, Drive by wire.

1. Introduction

There are many loads acting on crankshaft.in addition to running the vehicle there are many loads acting on it like driven camshaft, driving oil pump, driven compressor of AC. etc. Due to this load on engine increases and mechanical efficiency reduces. The mechanical efficiency of engine is around 60-70% in internal combustion engine. Aim of our project is to increase the mechanical efficiency. There are, many ways by which mechanical efficiency can be increased like driven oil pump by DC motor, driving compressor of AC by DC motor, driven camshaft by motor. From this we choose to drive camshaft by DC motor i.e. electronically operated valve system. Basically we are incorporating drive by wire phenomenon in our project. Drive by wire is phenomenon by which mechanical systems are replaced by electronic systems.by drive by wire we can decrease the load on crankshaft hence we can definitely increase mechanical efficiency.in conventional engines camshaft was driven by crankshaft through timing chain both the shaft having sprockets on them. Camshaft rotates at half speed of crankshaft as teeth's on both the shaft are in ratio 1:2. we did some modification in our project. We coupled the motor to camshaft .we have used single phase DC motor. We are using optical and IR (infra-red) sensor which give input to Arduino. We have programmed Arduino in such a way that it drive the DC motor at half speed of crankshaft speed. There are three ways of controlling speed of motor 1) voltage control 2) armature rheostat control 3) flux control.

From above types we found voltage control is easy so we implemented the voltage control. Voltage on motor is varied as per the input given by sensor to it. For various rpm

various voltage is applied on DC motor. The IR sensor acts as a transmitter which transmits the light, the light is reflected by some medium. Reflected light incident on optical sensor and it gives pulse to Arduino. We have programmed the Arduino in such a way that it calibrates the data and give desirable voltage so that motor can run on desired speed. Arduino is faced with the motor driver to control speed of motor. At start we use breadboard, number of wires and power source due to which circuit become so complicated. So we convert circuit into PCB (printed circuit board).due to this our setup becomes so compact. If this project is implemented in modern vehicles the mechanical efficiency can definitely increases by some amount and fuel economy of engine also increases.

2. Analysis

Andrew jay grey [1] we found that this research paper is so relevant with our topic. Most of the emphasis is on the increasing fuel efficacy of IC engine by varying valve timing. Instead of using single valve timing for engine they have used 3-4 valve timings by varying design of cam for single valve. At high speed interval for which inlet and exhaust valve open changes and it's not constant. This will also have effect on emission of engine. Mechanical systems does not give chance to optimize performance of engine but by using electronic system performance can be optimise.by using different cam profiles they have explain how this system works . They have also explain how conventional system works and compared both the systems. This helps in studying overlap timing of valves. This system is known as VVT (variable valve timing).as mentioned earlier they have used2-3 cams and solenoid also used. Solenoid is main component they are using .solenoid is used to change the

cam as per requirement .driver manually changes the cam as per requirement. This system also can be used in multi cylinder engines when not needed we can shutoff cylinder when needed by third way we can increase efficiency.

L.C.Litchy.[2] This book contain all the information regarding the internal combustion engine it is having detail working of internal combustion engine. We found this book so relevant with our topic because it provides solid information about how the actual engine design works and detail explanation about valve timing relation between crankshaft and camshaft speed different load acting on engine and various efficiency of engine this parameters are very important while studying of IC engine it helps us to calculate the load which acting on crank shaft due to cam shaft by using different theory and formulas we can easily found forces acting in addition to this information it also provide different ways to increase the engine efficiency.

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[3] Dc motor plays very important role in their project. Dc motor is very simple to understand and it is very economical speed of dc motor can be controlled in three ways
1-voltage control 2-rheostat armature control. 3-flux control. In this research paper they have employed voltage control method .Control system is interconnection of different component to achieve desired output. Control on dc motor is provided by using Arduino hardware which provide interface between computer and motor. The primary function of Arduino is to digitalize the signal coming to it so that computer can interpret them. It is done to achieve prior aim of controlling speed of dc motor. PID controller (Proportional integrated derivative) is use to find error while giving various signals. PID finds effect of various errors on systems and tries to minimize the error. They have use PID along with the Arduino to have desired output.

Yihui Qiu, David J. Perreault, John G. Kassakian, Thomas A. Keim [4] In this research paper they have to design whole new cam for internal combustion engine. This cam is called as a disc cam. Along with the disc cam they have used VVT (Variable valve timing mechanism) the disc cam is first mounted in a DC motor. The speed of dc motor

is control by required circuit. Disc cam helps in improving performance of engine on the other hand VVT increases fuel economy of engine. The system incorporates electromechanical system. This system is totally independent on crank shaft the cams are operated as per the required performance basically they are two options one is by electronic actuators but it finds difficulty with soft landing of valve while landing gives acoustic noise . So the develop the disc cam and it fits in the engine head.

Conclusion

After studying all these papers we come up with some conclusion which have been noted down as follows:

- Mechanical efficiency of engine increases.
- Drive by wire phenomenon can be implemented successfully.
- Improved fuel efficiency of engine.
- System can be more reliable.
- Due to replacement of mechanical system by electronic system wear reduces.

References

- [1] Electronic valve actuation by Andrew jay grey [1]
- [2] internal combustion engine, Mc Graw Hill by L.C.Litchy.[2]
- [3] Real Time DC Motor Speed Control using PID Controller in LabVIEW Pratap Vikhe1, Neelam Punjabi1, Chandrakant Kadu2 Assistant Professor, Department of Instrumentation Engineering, Pravara Rural College of Engineering, Ahmednagar, India 1 Lecturer, Department of Biomedical Engineering, Vidyalkar Institute of Technology, Mumbai, India 1 Assistant Professor, Department of Instrumentation Engineering, Pravara
- [4] Rural College of Engineering, Ahmednagar, India 2
- [5] A custom designed limited angle actuator for an electromechanical valve drive part 1 conceptual design by Yihui Qiu, Devid J. Perrpeault, John G. Kassakian, Thomas A. Keim.