



THEORITICAL INVESTIGATION ON SIGNIFICANCE OF IGNITION TIMING ON PERFORMANCE OF SPARK IGNITION ENGINE A RIVIEW

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ABSTRACT

The performance of spark ignition engines is a function of many factors but ignition timing is one of the important factor for improving performance of the spark ignition engine. Correct ignition timing lead to improve efficiency and reduces emission from the SI engine. If the ignition timing gets too advance the net work, power and thermal efficiency of the SI engine decrease so for the high performance of an SI engine optimum value of ignition timing should be determined. This paper is focused on investigate the significance of ignition timing on performance of the SI engine.

Keywords : Ignition timing, combustion, internal combustion engine.

I. INTRODUCTION

In the development of Spark Ignition(SI) engine power and reliability of the engine was main focus by the designer in the early years but to maximize the performance of the SI engine today's engine design is focused on ignition timing.[6,7]

Performance of the SI engine depends on ignition strategy, in SI engine just before end of compression stroke due to ignition spark combustion of the air and fuel mixture in the combustion chamber occurs which moves piston from top dead centre (TDC) to bottom dead centre (BDC). Depending on the engine design and operating conditions ignition spark must be supplied with advancement by changing the spark timing. The best spark timing produces maximum peak cylinder pressure and maximum brake torque. So at best timing engine produced more power and reduce engine emission.

Combustion inside the engine is highly depends on ignition strategy. Improper ignition leads to incomplete combustion which reduces efficiency of the Internal combustion engine and increased emissions. So poor ignition system affects the engine performance reduces its efficiency and increased emissions.

When the compressed mixture inside a cylinder is ignited it takes time for the flame front to reach the piston and for the expanding gases to start pushing it down. The time taken for the mixture to fully ignite depends on engine speed, compression ratio, strength of the mixture and combustion chamber shape. For high speed engine time available to burn the mixture is less so to start burning of mixture ignition advancement is required.

So ignition timing is very important for effective performance of the engine and emissions of the spark ignition engine. By the setting of ignition timing an ignition will occur in the combustion chamber just before end of compression stroke. By setting the ignition timing ignition inside the engine cylinder will be optimized with reference to piston position. The distribution of spark depends on ignition timing.

Proper spark timing also lead to increase efficiency of the internal combustion engine. Ignition timing affects fuel economy and particular spark timing gives maximum torque which improve power output of the engine and ignition timing also

affect engine emissions.[3]

II. LITRATURE SURVEY.

Zhu retarded ignition value and investigate in-cylinder gas temperature by varying spark timing.[1]

Soylu[2] developed a two zone thermodynamic model to evaluate effects of ignition timing and its composition. By the study flame propagation period and different engine operating condition was analyzed.

Performance of the internal combustion affects by advancing and retarding the ignition timing, the best timing engine produced more power and reduces engine emission. So by advancing and retarding the spark timing engine performance affects i.e. by retarding the timing burning temperature reduces and exhaust gas temperature increases. [3]

Rangkuti[4] Investigate Fuel consumption and emissions for spark ignition engine with different ignition timing. By retarding the ignition for lean mixture yielded poor fuel consumption, the poor combustion increased CO emissions and reduces UHC. In the test optimum ignition timing with richest mixture was used to achieve maximum best torque(MBT). By retarding the ignition timing results in poor combustion increased unburnt hydrocarbon(UHC).

Kakaee, Shojaeefard and Zareei[5] Investigate the performance of a spark ignition engine under different values of ignition advance. A Wiebe modeling result of two-zone in-cylinder combustion is compared with experimental result where ignition timing was varied. Power, torque, thermal efficiency, pressure, and heat release are obtained and compared at variable timing. The results show that optimal power and torque are achieved at 31°CA before top dead center and performance is decreased if this ignition timing is changed. It is also shown that the maximum thermal efficiency is achieved when peak pressure occurs between 5 and 15°CA after top dead center.

Chan and Zhu[6] By modeling of in-cylinder thermodynamics and by retarding the ignition timing investigate the performance of spark ignition engines. Effects of varying the spark timing on cylinder pressure distribution, in-cylinder gas temperature and

trapped mass inside the cylinder were evaluated.

Soylu and Van Gerpen[7] Developed a two-zone thermodynamic model to investigate the effects of ignition timing, fuel composition, and equivalence ratio on the burning rate and cylinder pressure for a natural gas engine. Burning rate analysis was carried out to determine the flame initiation period and the flame propagation period at different engine operating conditions [7].

Hassan [8] Investigate the effect of variation in injection timing on exhaust emission concentrations in a CNG fuelled direct injection engine and observed a decrease in HC concentration with advancement in injection timing as well as retardation in injection timing resulted in increment of NOx

Zuohua[9] Ignition timing has a large influence on the combustion, emissions and engine performance for a direct injection engine. Ignition timing played an important role in the improvement of the engine performance.

M. K Hassan, I. Aris, S. Mahmud, R. Sidek [10] Investigate the performance of high compression engine at various ignition and injection timing. Ignition timing is important factor for combustion, emission and obtaining the high performance of the IC engine. Advancing the ignition timing increased the exhaust temperature of gas it also increase the CO emission so optimum timing is required for better performance of the engine.

Golcu, Sekmen ,Salman [11] By artificial neural network modeling for variable spark timing conclude that engine performance of spark ignition engine depends on ignition timing and it is one of the most important factors for high efficiency and reduce emissions for the engine.

III. CONCLUSION.

- Combustion inside the engine is highly depends on ignition strategy, improper ignition leads to incomplete combustion which reduces efficiency of the Internal combustion engine and increased emissions.
- If the ignition timing gets too advance, most of the air fuel mixture burns before the piston rises which reduce the network power and thermal efficiency of the engine.\
- Ignition timing for SI engine should not be advanced or retarded but it should be optimized to improve performance of the SI engine. So by advancing and retarding the spark timing engine performance affects i.e. by retarding the timing burning temperature reduces and exhaust gas temperature increases.
- The performance of an SI engine highly depends on ignition timing, and its optimum value should be determined for each SI engine.
- Ignition timing has a large influence on the combustion, emissions and engine performance for a direct injection engine. Ignition timing played an important role in the improvement of the engine performance.

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