International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 9 Issue 12, December-2020

Electronically Controlled Variable Compression System: A Review

Shriyansh Arjaria
M.Tech. Scholar, Research Enthusiast
Department of Mechanical Engineering

***Abstract* — Earning the extruded compression ratio a flexible parameter is regarded as the final residual significant technical measure into combustion-engine optimization. A number of prototype motors with varying compression ratio (VCR) had been tested and designed. The execution of VCR engineering escalates the energy conversion efficacy within stoichiometric spark ignition (SI) motors including 3 to 8 percent based upon the driving cycle, so the more gas along with the level of turbo-charging. The procedure for the connecting rod having a flexible span, a therefore termed VCR linking rod, is thought of as a promising remedy as it might be put into place in virtually every concentric engine regardless of the sort (in line, V or fighter motor) having no less than changes to present engine design. 1 design method of a VCR linking rod is composed in an eccentrically piston pin suspension together using 2 hydraulic cylinders trying to keep the bizarre at a desired rotational place. As a way to improve the plan of the VCR linking rod related to robustness, pounds and production outlays, the lively behavior and some other originating happenings needs to be understood and known. The goal with this task was supposed to explore this lively behavior with search engine optimization. For this intention, a VCR linking rod was instrumented with detectors and also the quantified data has been obtained synchronously into the twist angle. Over those evaluations, usable parameters like engine load and speed and also the oil nourish flow requirements were evaluated to the 2 compression boosters phases and throughout the adjustments in you to the next compression percentage.**

Keywords — Variable compression spark ignition engine, Fuel Efficiency, Mechanical redesigning

I. INTRODUCTION

The efficiency of energy transformation in internal combustion engines will always play an important role regardless in the event the motor is steered through a power engine as detected in hybridized powertrains or independently, and whatever type of gas utilized. The geometric compression ratio clearly affects this electricity conversion efficiency. With fuel--air compressors that are air, the relation between signaled fuel conversion efficacy and geometric compression ratio may also be researched theoretically. The research results show a monotonic increase in efficacy in the direction of increased compression ratio. From the consequences, the compression ratio of an engine should be picked as high as you possibly can. In real engine processes in SI engines untoward phenomena such as rapping and pre-ignition can take place, which result into severe engine outcomes. Knocking is considered being a self-ignition going on within the end-gas after the discharge even though pre-ignition is believed to be a self-ignition occurring prior to the spark. The occurrence of rapping was profoundly researched and released, while the pre-ignition occurrence is still topic of existing investigation. . The compression ratio affects the warmth of the fee throughout the compression stroke. The higher the compression ratio is chosen, the lower is that the strain in which the engine starts knocking. To work the motor over this knock limit, the spark has to become retarded producing a decrease efficacy. In load sweeps had been performed out at a turbocharged direct injection (DI) motor using two separate compression ratio. Out of those experiments the engine operation map may be broken to two different areas. At the decrease area and operation in large compression ratio offers higher efficiencies while in the top map field that the effect of spark retardation gets paramount, thus a reduce compression ratio is so needed. At an important portion of the lower map area brake specific fuel consumption (BSFC) discounts of 5% were got if operating the motor at a compression ratio of 12.11 as an alternative of 9.56 at elevated loading. In the event the compression ratio is also corrected, since it's the case in an varying compression ratio engine, then this reduction potential could be manipulated. The entirely varying variable compression ratio methods offer the highest versatility and so that the greatest thermodynamic advantage. On the opposite hand many of the approaches require a completely new engine architecture causing high spend money on brand new manufacturing lines. NISSAN Car collaboration has Just launched a new engine featuring a completely changeable compression program to get their next generation motors

II. LITERATURE REVIW

Rakopoulos CD et. Al. Second law availability analysis performed in a variable compression ratio spark ignition test engine showed that although the compression work increases with the compression ratio, such losses are more than compensated by the expansion work gains and decrease on energy availability on exhaust gases [1].

Kutlar OA et. Al. As a consequence, the relationship between net to gross IMEP increases due to the need of lower intake pressure to maintain the same load. Thus, to fully exploit the benefits of variable compression ratio at part load it would be desirable to reduce the increase on pumping losses through VVT or lean burn [2].

Feng D et. Al. It has also been shown that the increase on compression ratio increases the engine tolerance to EGR [3]

Shelby MH et. Al. Experimental results obtained from a V6 GTDI engine tested with different fix geometry pistons and connecting rod to adjust different CRs are published in [4].

Kleeberg H et. Al. The tests were performed with RON 91 gasoline. Secondary effects such as friction or parasitic loss increase to be expected in a VCR engine were not taken into account. A fuel consumption improvement of 5–7% was

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 9 Issue 12, December-2020

estimated by cycle simulations exemplarily carried out for a 2.0 L DI TC engine installed into a large passenger car, reported in [5].

Wittek K et. Al. The VCR connecting rods were applied to a PFI TC engine and this engine was installed into a sports car with which chassis dyno tests were carried out. A fuel consumption reduction of 5% was measured [6].

Hoeltgebaum T, et. Al. The Over the years many approaches have been followed to vary the CR either in two steps or even continuously. An extensive classification of VCR systems was obtained based on possible kinematic chains by analysing more than 1000 patents and more than 100 VCR engine designs published in [7].

III. METHODOLOGY

This Theoretical explanation mentioned was carried on a single cylinder spark ignited engine designed using 2-stage varying compression procedure. The cornerstone of this evaluation engine is just a succession production 0.1 engine optimization. The engine structure comes with a 2-valve implanted into the roofing combustion room which we also known as a piston head with a side-mounted in spark ignition engines, In which one is exhaust and two for air-fuel mixture intake, So now we have 2 valve 3 cam profile arrangements in which two profiles to get conditioned air fuel mixture inside combustion chamber and the another valve and a for exhaust gases. In such whole structures the device valve closing and opening is divided to two parts:

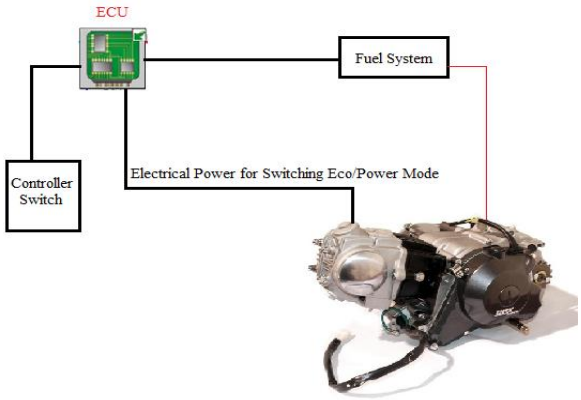
1. Fully Mechanical (Exhaust valve)
2.. Electric – Mechanical arrangements (Air intake Valve)

Fully Mechanical (Exhaust valve) :- In this section there is any changes in its own opening and shutting valve. It's only designed to be simply opening and closing with simple rocker arm agreements according to the size of the engine.

Electric Mechanical Arrangements (Air intake valve) :- In this section two types of arrangement's are there just to increase or decrease the compression ratio inside the combustion chamber. This dual cam profile for air intake manifold is arranged in such a way so that we can easy switch from one profile to another by just emerging the electrically controlled valve by just a press of a button. The switches are directly attached to coil that's triggered by a switch which coil gets energized allow to operate the cam in mean time.

This methodology allows achieving consistent results in terms of fuel consumption and emissions analysis

Main Engine Specifications		
Configuration	Low CR	High CR
Number of cylinder 1	-	-
Bore and Stroke length	50mm/59.5mm	-
Compression ratio	7.7:1	9.9:1
Maximum tested BMEP	0.47MPa	0.5 MPa
Maximum power in KW @ 7000 rpm	4.6	5.89



It's a completely different unit which is used to controlled the two cams provide for increasing or decreasing the compression ratio inside the combustions chamber without investing much in its production and due to its simplicity and elegant design provides a great reliability and economy at the same time. It electronically controlled electrical controllers hydraulic valves very less components and effective power output with great performance at the same time. A reduction of up to 5% in fuel consumption could be reached on the proposed conditions with the ideal instantaneous switching VCR system. Finally, it can be said that the transient switching system evaluation provided more reliable results for the evaluation, optimization, and development of variable length connecting rod VCR engines.

This section describes the main characteristics of the test cell used in this study, focusing on the engine unit and the different systems of which is equipped, with a particular focus on the VCR system. Moreover, some considerations about the methodology followed during the experimental tests are provided.

IV. CONCLUSION

While investigating on this rescerch we found a great potential of a ECVC system. This is the state-of-the-art technology in SI engine that will we used in our present passenger car or others utility vehicles available in all over the world. The transition times between the two different compression ratios were used as an input information to the activator relay in every cycle during cimpression ignition power cycle just to achive the maximum fuel efficiency with respect to a achive macimum power during the real ECVC operation with respect to an instantaneous system. The following conclusions can be extracted from this study.

V. FUTURE SCOPE

The sub-model presented in this study to account for the transient penalties of a two-stage ECVC system can be further applied in studies of control strategy optimization or on parametric studies with other systems. The sub-model can also be applied in combination with the transition behavior of other engine systems, such as turbocharger response modeling, spark advance control, among others, to account for the whole system dynamics and result

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 9 Issue 12, December-2020

REFERENCES

[1] Rakopoulos CD. Evaluation of a spark ignition engine cycle using first and second law analysis techniques. Energy Convers Manage 1993;34:1299–314. https://doi.org/10.1016/0196-8904(93)90126-U.J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[2] Kutlar OA, Arslan H, Calik AT. Methods to improve efficiency of four stroke, spark ignition engines at part load. Energy Convers Manage 2005;46:3202–20. https://doi.org/10.1016/j.enconman.2005.03.008.

[3] Feng D, Wei H, Pan M. Comparative study on combined effects of cooled EGR with intake boosting and variable compression ratios on combustion and emissions improvement in a SI engine. Appl Therm Eng 2018;131:192–200. https://doi.org/10.1016/j.applthermaleng.2017.11.110.

[4] Shelby MH, Leone TG, Byrd KD, Wong FK. Fuel Economy potential of variable compression ratio for light duty vehicles. SAE Tech Pap 2017. https://doi.org/10.4271/2017-01-0639.

[5] Kleeberg H, Tomazic D, Wittek K, Dohmen J, Balazs A. Increasing efficiency in gasoline powertrains with a two-stage variable compression ratio (VCR) system.SAE Tech Pap 2013. https://doi.org/10.4271/2013-01-0288.

[6] Wittek K, Geiger F, Andert J, Martins ME, Oliveira M. An overview of VCR technology and its effects on a turbocharged DI engine fueled with ethanol and gasoline. SAE Tech Pap 2017. 2017-36-0357.

[7] Hoeltgebaum T, Simoni R, Martins D. Reconfigurability of engines: a kinematic approach to variable compression ratio engines. Mech Mach Theory2016;96:308–22. https://doi.org/10.1016/j.mechmachtheory.2015.10.003.

[8] Asthana S. A comparative study of recent advancements in the field of variable compression ratio engine technology. SAE Tech Pap 2016. https://doi.org/10.4271/2016-01-0669.

[9] Shaik A, Moorthi NSV, Rudramoorthy R. Variable compression ratio engine: a futurepower plant for automobiles – an overview. J Automob Eng 2007. https://doi.org/10.1243/09544070

[10] Weinowski R, Wittek K, Haake B, Dieterich C, Seibel J, Schwaderlapp M, et al. CO2-potential of a two-stage VCR system in combination with future gasoline powertrains. 33rd Int Vienna Engine Symp. 2012.

[11] Rau E, Kohler H, Karl G, Fieweger K, Betsch J, Krutzsch B. Variabilities on gasoline engines and their future potentials. 35th Int. Vienna Engine Symp.. 2014.

[12] Moteki K, Aoyama S, Ushijima K, Hiyoshi R, Takemura S, Fujimoto H, et al. A study of a variable compression ratio system with a multi-link mechanism. SAE Tech Pap 2003. 2003-01-0921.

[13] Rabhi V. Study of a gear-based variable compression ratio engine. SAE Tech Pap 2004. 2004-01-2931.

[14] Bergsten L, Drangel H. Der neue Saab SVC Motor – Ein Zusammenspiel zur Verbrauchsreduzierung von variabler Verdichtung, Hochaufladung und Downsizing. 9th Aachen Colloq Automob Engine Technol. 2000.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)