Cfd Analysis of Air Swirl in Cylinder of Ci Engine by Modification of Cylinder Head

Mahesh G, Hiregoudar Yerrennagoudar, Somanath Swamy R H M

***Abstract:** Work is based on the impact of air swirl in the cylinder chamber by cfd analysis of a one cylinder 4s CI engine is presented. So as to accomplish the swirl, tumble and kinetic energy intensities in the combustion chamber. The cylinder head is modified to increase the turbulence in the chamber. This increases the air motion, is done by removing material and protrusion on the cylinder head. Depending upon on the design configurations of Diesel engine i.e. in the order to exaggerate the air motion and to provide homogenous mixture in the cylinder and its effects on the emission and performance.*

***Keywords:** CI engine head modification, Combustion chamber and performance.*

I. INTRODUCTION

In generally all automobile parts will have an analysis, researcher are trying to create flow pattern on standard flow. Two types of flow in the cylinder, flow on cylinder axis and tumble flow in diesel engines. Air flow types, on the basis of cylinder axis to flow will be different motion. In the case of swirl flow, the air flow axis is parallel to axis of the cylinder. Performance of CI engine will increases with Air flow entering into the Combustion chamber and have ability of controlling the air-fuel mixture in CI engines. Combustion, emission and performance parameters depend upon the mixture of Air-fuel. Air flow in the cylinder is depending on the inlet manifold, profile of valves and CC geometry.

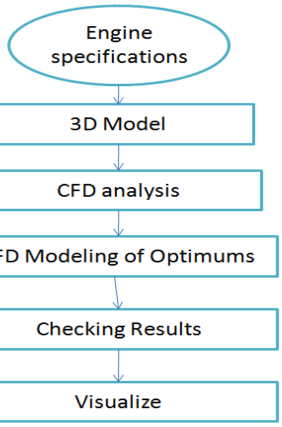
II. LITERATURE SURVEY

Jinou Song et al [1] have conducted an experiment based on the different CC geometry used in cylinder DI engine and calculated the three-dimensional flow. Bowl type pistons are used to find the determinant factors for the growth and formation of the flow field in cylinder. Piston geometry plays very important role to have swirl ratio on profiles and vital impact on the distribution at the cross section.

Gyeung Ho Choi et al [2] have conducted an experimental analysis on swirl chamber effects on the characteristics of combustion in CI engine. It depends upon the geometry of hole , angle of inclination and area occupied by the jet spray. Due to interblend, effect on the parameters of CI engine varies which helps to influence for the generation of TKE.

Pavlos Dimitriou et al [3] have conducted an experimental analysis on angle of jet spray and various geometries of the piston are used to analyze the quality of fuel air mixture and compared with the quantitative measuring factors on CI engine. A higher swirl value is obtained in the cylinder which helps to increase of fuel air mixture. The best output value is obtained with the piston having narrow entry and steep combustion chamber.

III. METHODOLOGY



IV. EXPERIMENTAL DETAILS

Water cooled, single cylinder, 4-stroke diesel engine	
Engine make	Kirloskar
Model	TV1
Power	5.2 KW
Bore Diameter	87.5 mm
Stroke length	110 mm
Speed	1500rpm
Compression ratio	17.5:1
Swept volume	661.45cc

V. 3D MODEL DESIGN

3D model of CI engine head is created based on availability of conventional engine head. By using CATIA V-5 R18 software.

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Conventional engine head.

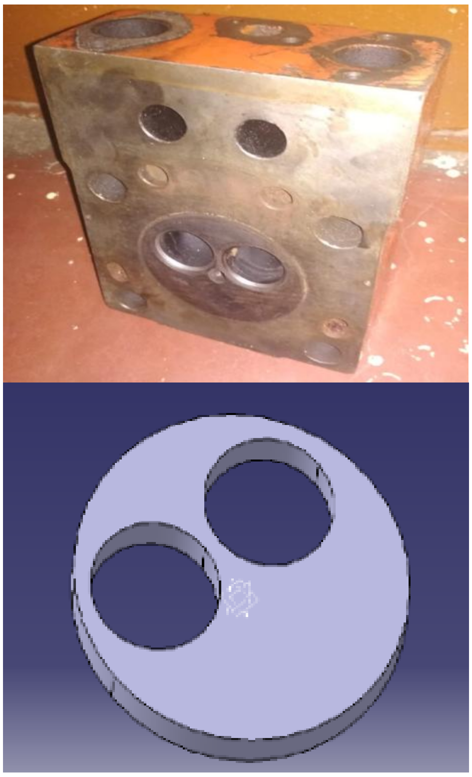


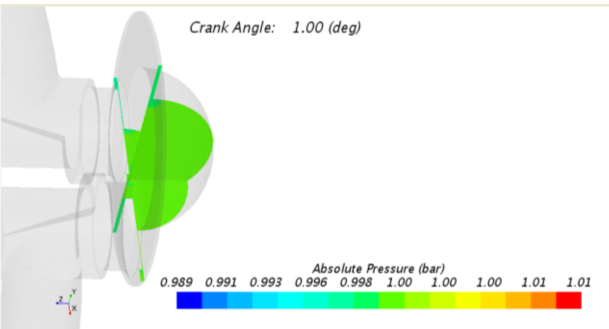
Fig. 1: Conventional engine head.

Modified engine head

Fig. 2: Modified engine head.

VI. RESULT AND DISCUSSION

Pressure distribution:



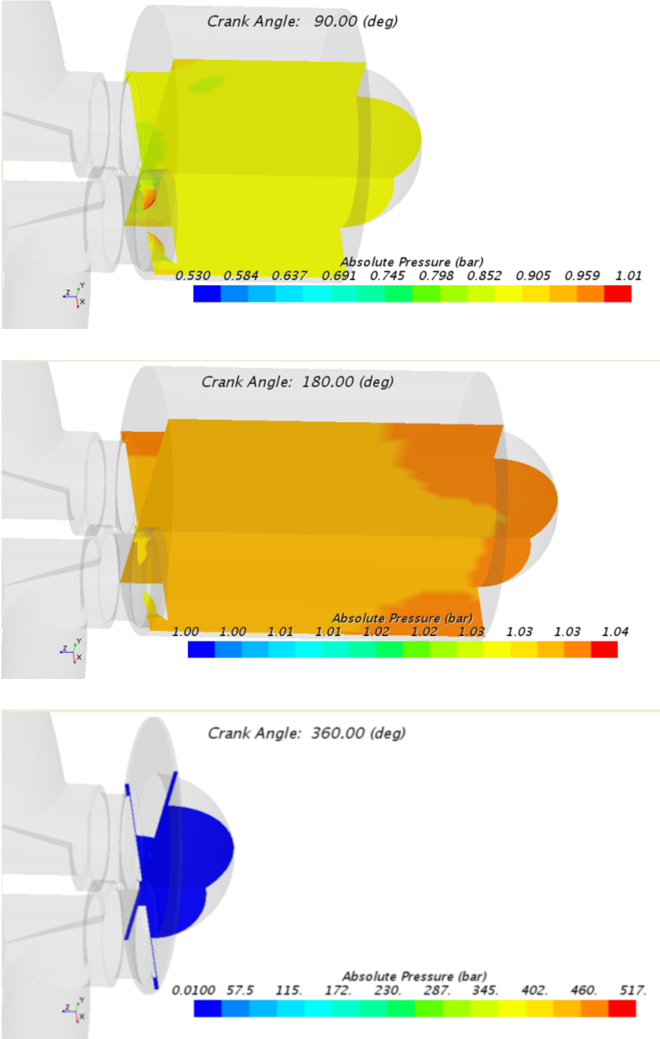
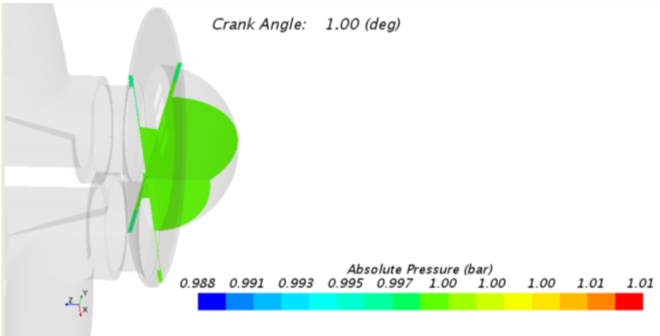
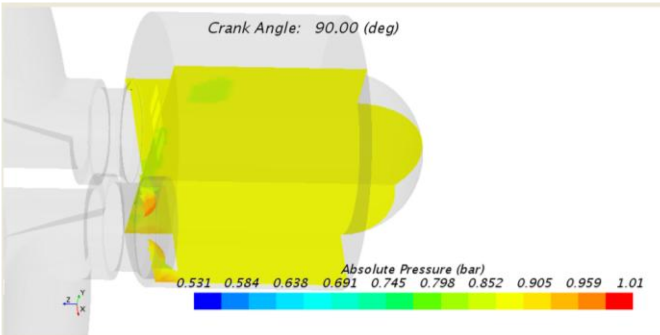


Fig. 3: Pressure distribution for Conventional cylinder head at different angles.





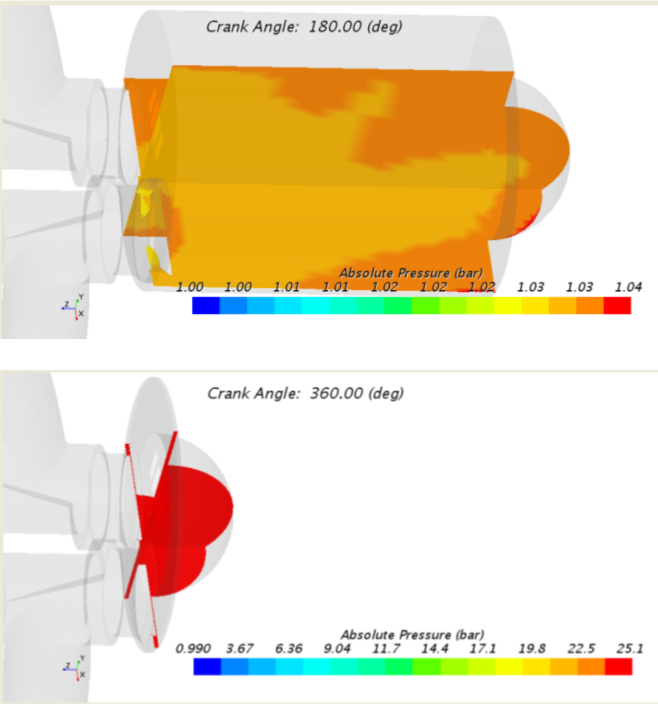
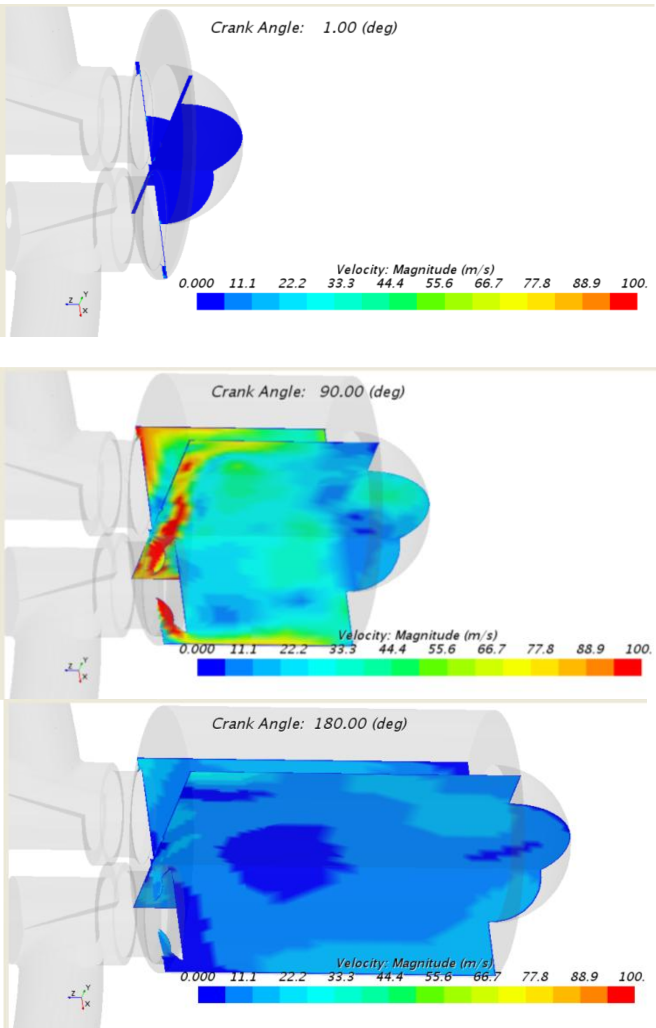


Fig. 4: Pressure distribution for Modified cylinder head at different angle.

Velocity distribution:



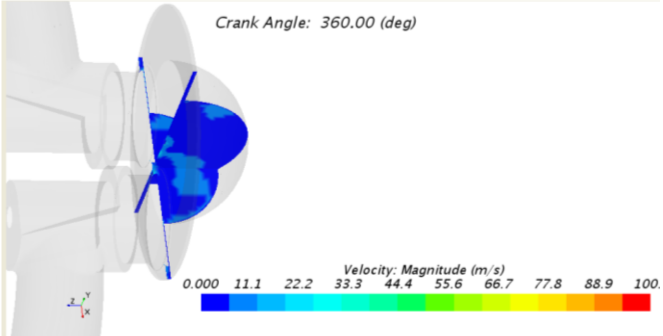


Fig. 5: Velocity distribution for Conventional cylinder head at different angles.

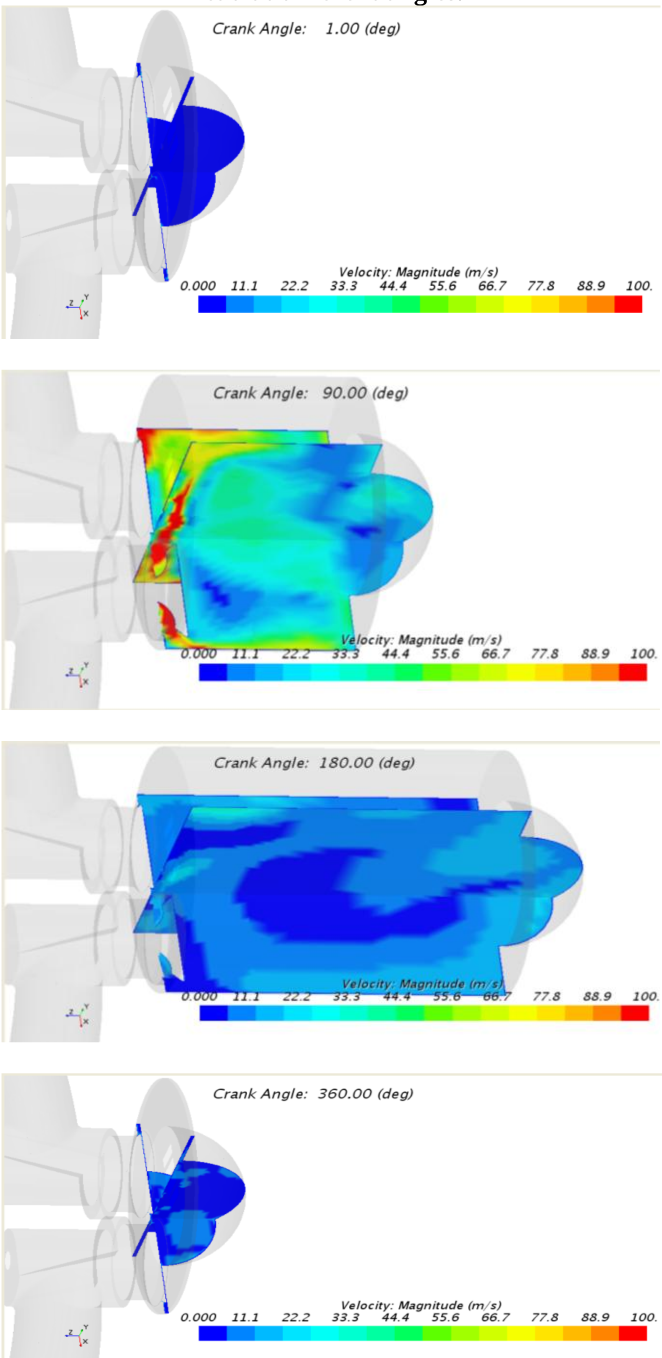


Fig. 6: Velocity distribution for Modified cylinder head at different angles.

Temperature distribution:

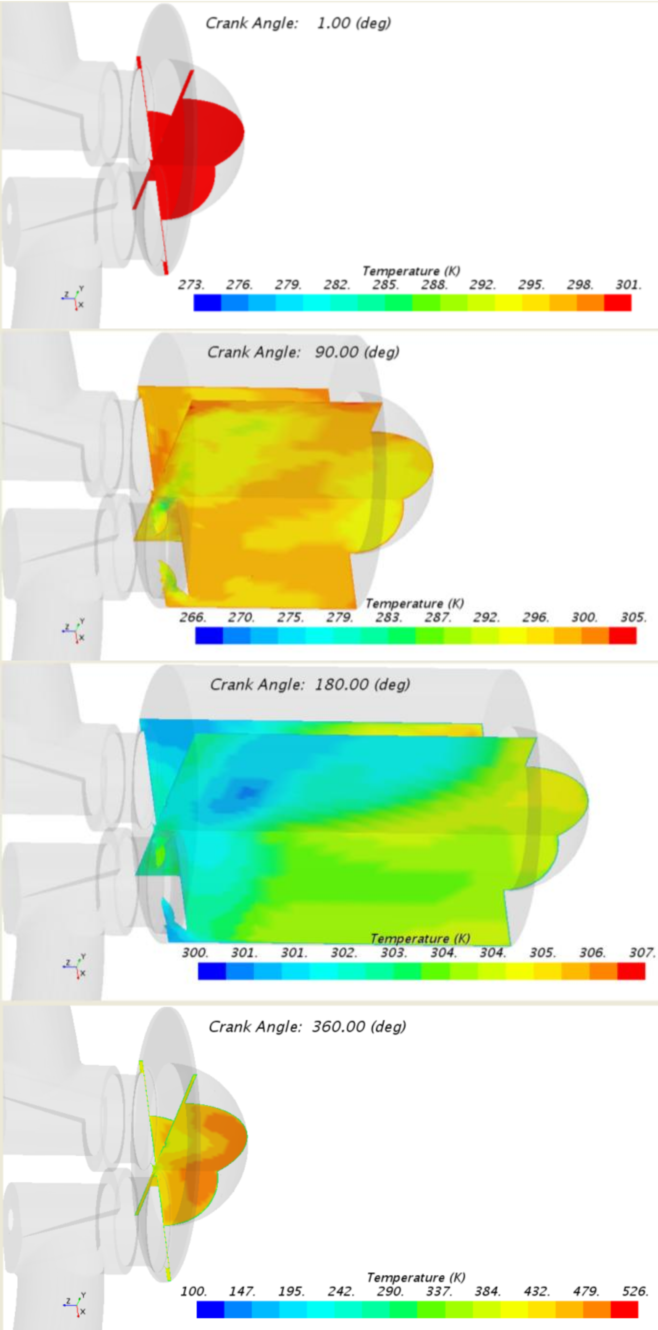
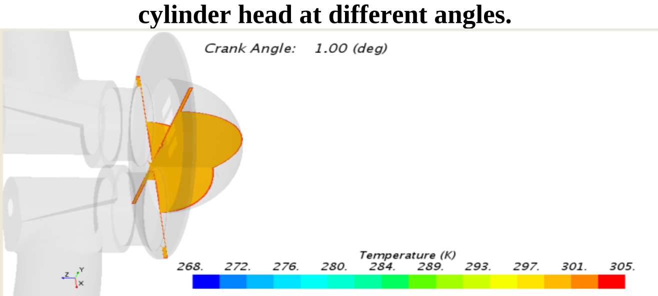


Fig. 7: Temperature distribution for Conventional cylinder head at different angles.



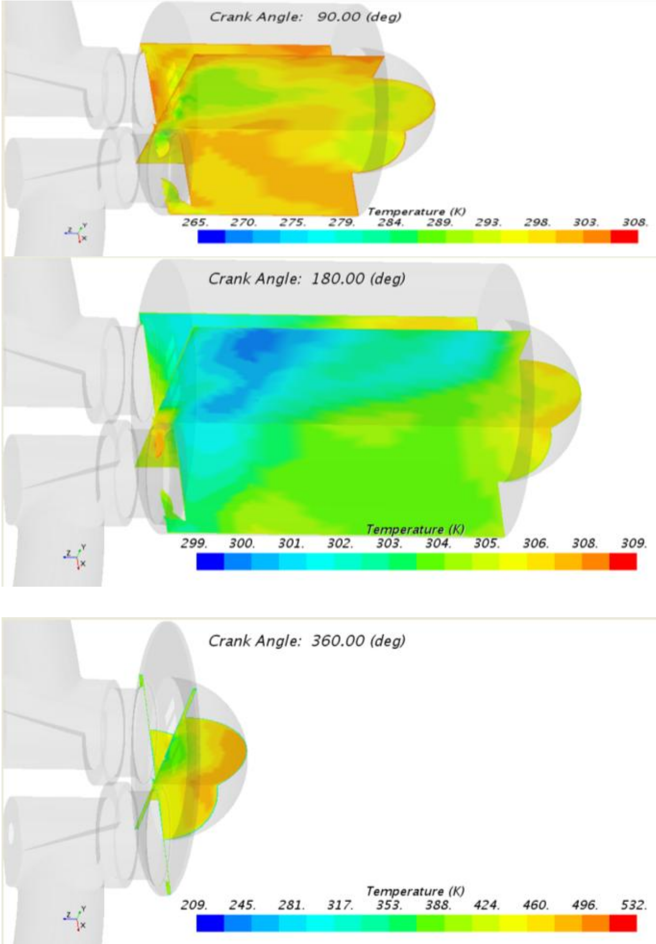


Fig. 8: Temperature distribution for Modified cylinder head at different angles.

Swirl Ratio - X

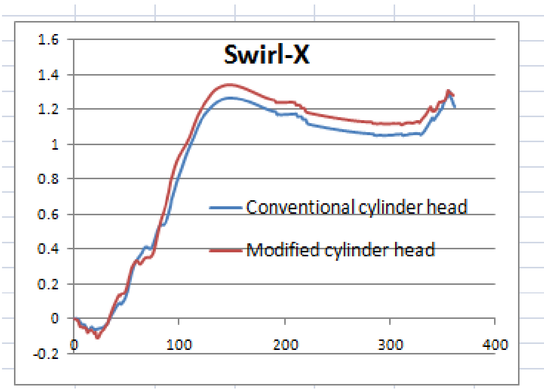


Fig. 9: CA v/s Swirl ratio.

Tumble Ratio - X

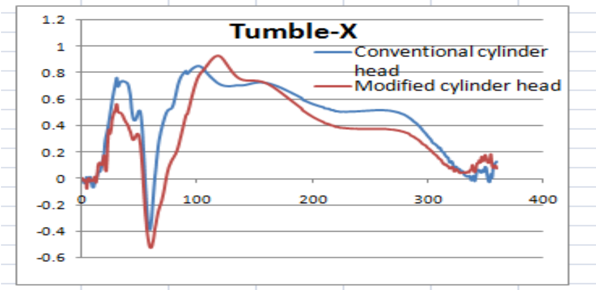


Fig. 10: CA v/s Tumble ratio –X.

Tumble Ratio – Y

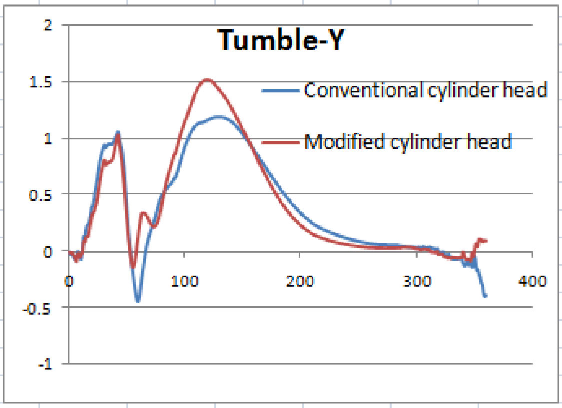


Fig. 11: CA v/s Tumble ratio –Y.

Turbulence kinetic energy

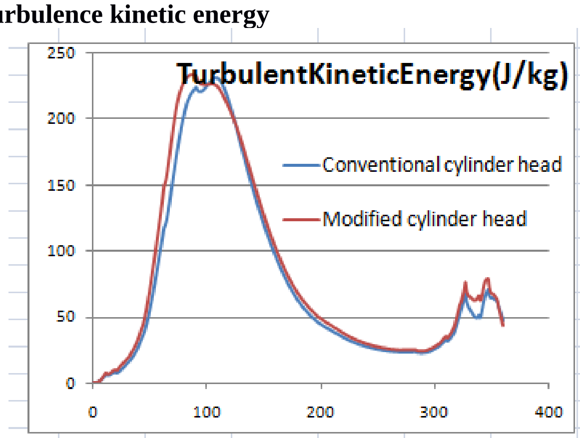


Fig. 12: Crank angle v/s Turbulence kinetic energy.

VII. CONCLUSION

1. Swirl X-axis: Swirl in modified cylinder head is exhibiting a improvement as compared to conventional cylinder head.
2. Tumble X-axis: Tumble in modified cylinder head is improved as compared to conventional cylinder head at an angle more than 100^0 and 300^0.
3. Tumble Y-axis: Tumble in modified cylinder head is improved as compared to conventional cylinder head at an angle more than 100^0 and 320^0.
4. Turbulence Kinetic Energy: Turbulence Kinetic Energy in modified cylinder head is improved as compared to conventional cylinder head at an angle less than $100^0$and more than 180^0.
5. Pressure distribution for Modified cylinder head is increased at an angle at 1800 compared to conventional cylinder head.

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