CFD Approach on Throttle Valve Variation on Venturi

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Abstract— CFD analysis on variation of throttle for venturi chamber of floating carburetion system. The computational analysis of flow properties on venturi chamber of their various nozzle angles with throttle variations are 32º, 34º and 38º, 42º respectively. The numerical and flow properties analysis had done to investigate pressure inside venturi as well as velocity and mixing properties of air-fuel ratio to get better atomization properties and thermal, mechanical efficiency. To increase volumetric efficiency of engine, improve design of venturi so we took mentioned angle that to do investigate as cfd analysis to improve its flow properties as well as mixing properties. To improve better system in inside of floating carburetion system to produce better result.

Keywords: Venturi, Investigates Flow Properties on Venturi

I. Introduction

CFD analysis on venturi for C-D types nozzle angle are 32º, 34º and 38º, 42º respectively, so we can do investigate their different flow properties. Cfd process done in CFX software in Ansys so we go for analysis to get acquire result.

II. Geometric Parameter

Geometric dimension of the Carburetor:
Following parameters for design taken below mentioned:-
Total length of carburetor = 130 mm
Inlet diameter = 45 mm
Throat diameter = 30 mm
Outlet diameter = 40 mm
Length of throat = 7 mm
Length of the inlet part = 50 mm
Length of the outlet part = 50 mm
Nozzle inlet diameter = 7 mm
Angle of fuel discharge nozzle with the vertical axis of carburetor = Ɵ

III. Flow Condition & Assumptions and Boundary Conditions

A. At Inlet

Condition	Values
Temperature	296k
Pressure	1 bar
Velocity	40 m/s
Turbulent Intensity	10%
Wall condition	No slip
Flow Direction	Normal to boundary

B. At Outlet

Condition	Values
Temperature	296k
Pressure	0.9 bar
Wall roughness	smooth
Turbulent Intensity	15%

Table 1: Boundary condition for inlet and outlet

IV. Modeling of Geometry

In geometry modeling, we shall see about geometry analysis of Venturi design

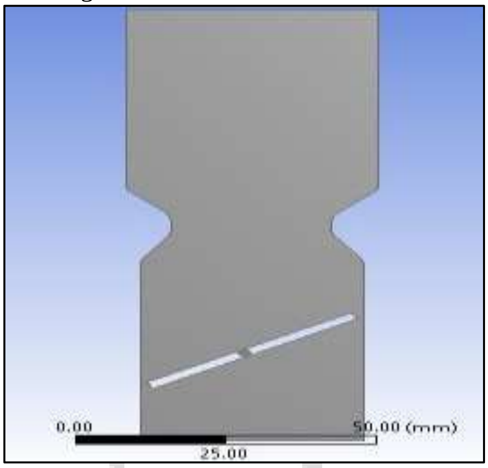

Fig. 4.1: Plane view of Import geometry in ANSYS

V. Meshing Detail of Geometry

In meshing part, as mentioned above and shown geometry like 32º, 34º, 38ºand 42 ºare each meshed as structured Quadrilateral mesh shaped for discharge nozzle angle of venturi of carburetor. So figure of meshing sample as below as follows.

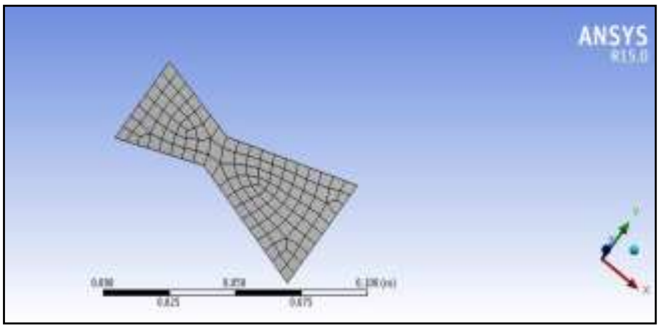

Fig. 6.2: Mesh geometry

VI. Grid Detail:

The three dimensional flow regions along with Venturi of fuel injected float chamber with appropriate nozzle angle were modeled using software CFX. Three dimensional structured grids was generated using Quadrilateral mesh in ANSYS work bench. The grid cells were refined in the critical regions, like Venturi of carburetor inlet and exit, in anticipation of high velocity and pressure gradient. The solutions were predicted by using ANSYS CFX.

Element type	Quadrilateral
Number of nodes	45680

Number of elements	45180
Refinement	Up to 3 degree

Table 6.3: Meshing details of venturi passage

VII. RESULT AND DISCUSSION

In Ansys CFX solver all analysis done for discharge nozzle angle of venturi are 32^o, 34^o and $38^{o,}$ $42^{o.}$ Analysis done with pressure and velocity contour given with respective angles given below one by one. For CFD analysis of Venturi means its geometry as well as analysis of flow like aerodynamics properties inside Venturi of carburetor so analysis in various stages like geometry modeling, meshing of geometry and geometry as well as flow analysis like pre-processing and final post- processing contour are say about design and performance to predict experimental result.

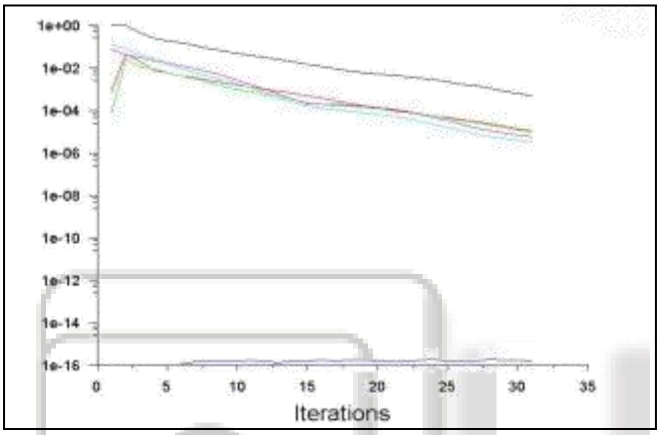

Fig 8: Result graph

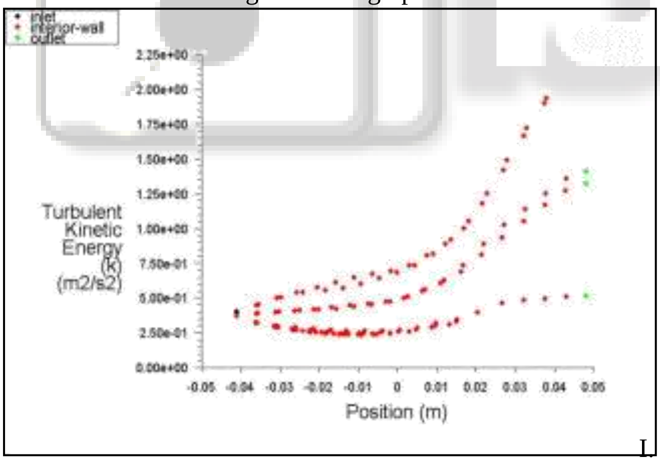

Fig 9: Turbulent contour

VIII. CONCLUSION

Following conclusions are obtained by CFD analysis on simple carburetor for different nozzle angle of venturi of carburetor.

1) It's observed from analysis for fuel discharge nozzle angle of venturi of carburetor is 32^o, it was observed that the pressure distribution inside the body of the carburetor is quite uniform which leads to a better atomization and vaporization of the fuel inside the carburetor body. But in other cases like where the fuel discharge nozzle angle are 34^o, 38^o and $42\ ^0$, the pressure distribution is quite non-uniform inside the body of the carburetor. So it is concluded that for gasoline operated engine the optimum fuel discharge nozzle angle is 32^o. [17]
2) For various throttle plate valve angles such as 30^0,40^0, 50^0, 60^0,70^0,80^0 and 90^0, it was found that the pressure at the throat of the venturi has decreased with the increase in the throttle plate angle. It is due to the fact that with the increase in throttle angle, the air velocity increases with the drop in air pressure at the throat section. The amount of air flowing through the throat section remains same but, more amount of fuel will be sucked into the throat section due to increase in pressure drop. [18]

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