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# Designing, Analysing and Simulation of Diffuser in Turbofan Engine by Deflecting Angles

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**ABSTRACT:** Diffusers are extensively used in centrifugal compressors, axial flow compressors, ram jets, combustion chambers, inlet portions of jet engines and etc. The performance of the inlet diffuser can be defined on basis of their geometry and the inlet condition of the diffuser. In this current investigation, we are attempting to obtain the optimal angle of diffuser. Here the analysis is based on static pressure recovery and coefficient of total pressure loss. Simulation is carried out by using the ANSYS FLUENT for the air flow over diffuser for different angles. The diffusers are designed to get the maximum pressure recovery within shortest possible length to overcome the limitations of aircraft engine by designing and developing the inlet diffuser.

**KEYWORDS:** Gas turbine Aircraft engine, Divergence angle, ANSYS FLUENT.

## I. INTRODUCTION

Inlets are very important to the overall jet engine performance & will greatly influence jet engine thrust output. The faster the airplane goes the more critical the inlet duct design becomes. Engine thrust will be high only if the inlet duct supplies the engine with the required airflow at the highest possible pressure.

It must operate from static ground run up to high aircraft Mach number with high duct efficiency at all altitude, attitudes and flight speeds. It should be as straight and smooth as possible and designed in such a way that Boundary layer separation is minimum. It should deliver pressure distribution evenly to the compressor. The purposes of the diffuser or inlet are:-

- i. To bring air smoothly into the engine.
- ii. To slow the fluid and to increase the pressure.
- iii. To deliver a uniform flow to compressor.

## II. RELATED WORK

i. Except at the initial stage of the diffuser the velocity decreases and pressure recovery within the diffuser increases as the flow proceeds.

ii. As the pressure coefficient and the static Pressure follows the same as the flow proceeds, they both increase as the flow proceeds.

iii. At the pressure coefficient on the impact of divergence angles is being clearly noticed.



iv. As the divergence angle increase the pressure coefficient also tends to increases which makes the diffuser a high pressure recovery.

v. On Increasing the divergence by more than 27° leads to no increase in pressure coefficient.

### REFERENCE GEOMETRIC MODEL

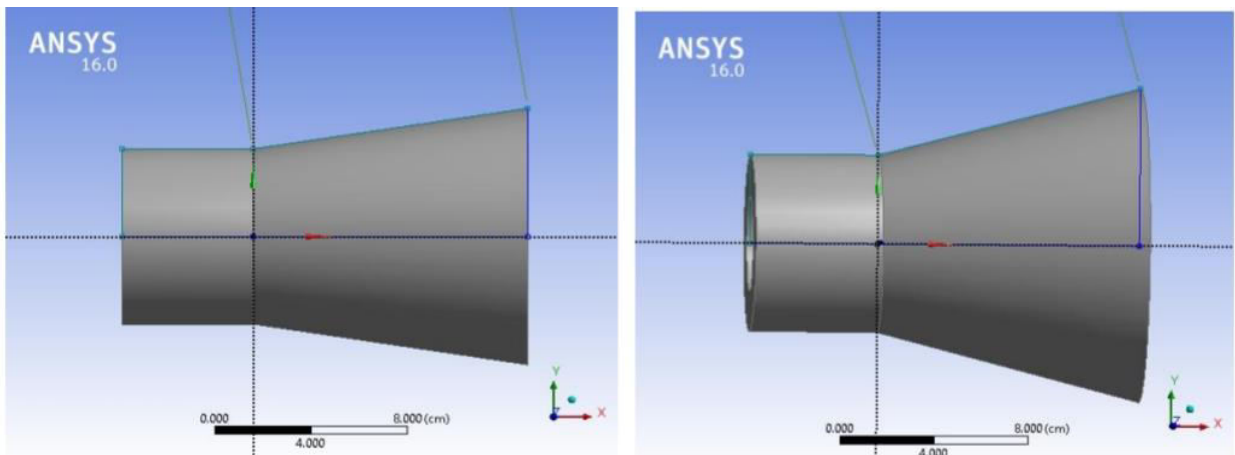


Figure-1: Reference geometry of diffuser with 9° divergence angle    Reference geometry of diffuser with 15° divergence angle

### REFERENCE MESHED MODEL

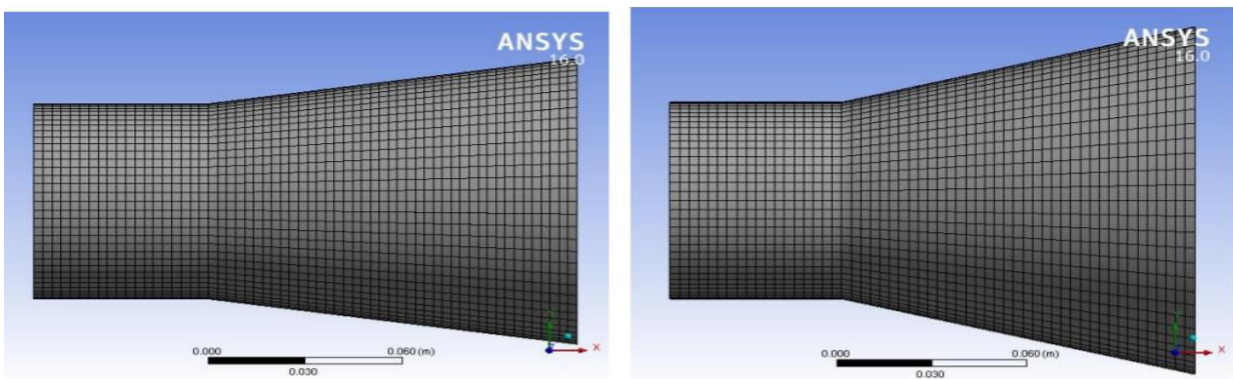


Figure:2- Reference meshed of diffuser with 9° divergence angle    Reference meshed of diffuser with 15° divergence angle



### III. METHODOLOGY

Collection of the basic geometrical data of an diffuser from the literature survey and creation of 3-D model of the diffuser using cad software CATIA.

- i. Boundary Conditions
- ii. CFD modelling (generation of grid)
- iii. Analysis using Ansys Fluent.
- iv. Obtaining flow field results using the CFD solvers.

### IV. CONCLUSION

As the divergence angles increases the pressure coefficient also increases leading to high pressure recovery. Increase in divergence angle more than 22° has no effect on pressure recovery and pressure coefficient.

### REFERENCES

- [1] Jason J. Dunn, 2007, "On the nature of flow in separated annular diffuser", BSAE University of Central Florida, Orlando.
- [2] SN Singh, V Sheshadri, K Saha, KK Vempati and S Bharani, "Effect of inlet swirl on the performance of annular diffuser having same equivalent cone angle", Vol.220, 2005, Journal of Aerospace Engineering, 129-143
- [3] DIFFUSER ANGLE CONTROL TO AVOID FLOW SEPARATION Vinod Chandavari.
- [4] "Effect of Divergence Angle on the Performance and Flow Analysis of 3D Annular Diffuser of an Aircraft Engine using CFD Technique" Sharan Padashetty, Pravin Honguntikar, K. Rajagopal
- [5] Buice, C.U. and Eaton, J.K., "Experimental Investigation of Flow Through an Asymmetric Plane Diffuser," 1997
- [6] Obi, S., Aoki, K., and Masuda, S., "Experimental and Computational Study of Turbulent Separating Flow in an Asymmetric Plane Diffuser," Ninth Symposium on Turbulent Shear Flows, Kyoto, Japan, August-1993
- [7] Reid A. Berdanier., "Turbulent flow through an asymmetric plane diffuser", Purdue University, April-20
- [8] Performance Analysis of a Two-Dimensional Supersonic Diffuser, G Saravanan, Ravichandra Kumar, A Vinoth Kumar
- [9] E.L. Goldsmith and J. Seddon, Practical Intake Aerodynamic design, AIAA Education Series, Virginia, Reston, 1993.
- [10] R.S. Pugazenthi and Andy C. McIntosh, Performance Analysis of a Supersonic Diffuser for Plasma Wind Tunnel, International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering, Vol. 5, No. 8, 2011, pp. 1682-1687.



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