# Optimization, Design and Analysis of Axial Flow Compressor in Jet Engine

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**Abstract-This project deals with the optimization of an axial flow compressor by taking various parameters such as inlet velocity, inlet pressure, blade angle, mean diameter, number of blades and mass flow rate which are taken into the account for increasing the outlet pressure of the compressor blade. By Investigating such required literature modules there parameter are different for achieving outlet pressure from that we done many theoretical calculations by changing the values of those parameters we drawn a graph which contains the varied values of our calculation from that we are concluding our final best optimized design module. And it is drawn using CATIA V5R20 and analyzed it by using ANSYS Fluent software.**

## I. Introduction

An axial compressor is a compressor that can continuously pressurise gases. It is a rotating, aerofoil-based compressor in which the gas or working fluid principally flows parallel to the axis of rotation, or axially. This differs from other rotating compressors such as centrifugal compressors, axial compressors and mixed-flow compressors where the fluid flow will include a "radial component" through the compressor. The energy level of the fluid increases as it flows through the compressor due to the action of the rotor blades which exert a torque on the fluid. The stationary blades slow the fluid, converting the circumferential component of flow into pressure. Compressors are typically driven by an electric motor or a steam or a gas turbine.

Axial flow compressors produce a continuous flow of compressed gas, and have the benefits of high efficiency and large mass flow rate, particularly in relation to their size and cross-section. They do, however, require several rows of aerofoils to achieve a large pressure rise, making them complex and expensive relative to other designs (e.g. centrifugal compressors).

Axial compressors are integral to the design of large gas turbines such as jet engines, high speed ship engines, and small scale power stations. They are also used in industrial applications such as large volume air separation plants, blast furnace air, fluid catalytic cracking air, and propane dehydrogenation. Due to high performance, high reliability and flexible operation during the flight envelope, they are also used in aerospace engines.

## II. Numerical Calculation Result

| Parameters | Design |
|---|---|
| Mass flow rate | **12** |
| RPM | **25000** |
| Inlet pressure | **101.3 kpa** |
| Inlet temperature | **288 k** |
| Number of blades | **35** |
| Blade angle | **-8** |

## III. Software Calculation

### 3.1 Software used

CATIA V5R20 and ANSYS Fluent

### 3.2 Process

Design of a model is making on CATIA and its stimulation performed on ANSYS 12. ANSYS system of steady state Thermal analysis provides a convective transport of energy and the conductivity in solids.

Creating Geometry in CATIA
(2D & 3D) and converted into IGS format

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Importing the geometry in ANSYS workbench
(ANSYS fluent)

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Generating the design model

↓

Meshing method (coarse &fine)

↓

Initialise the input &boundary conditions

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Control and monitor the solver to achieve a solution

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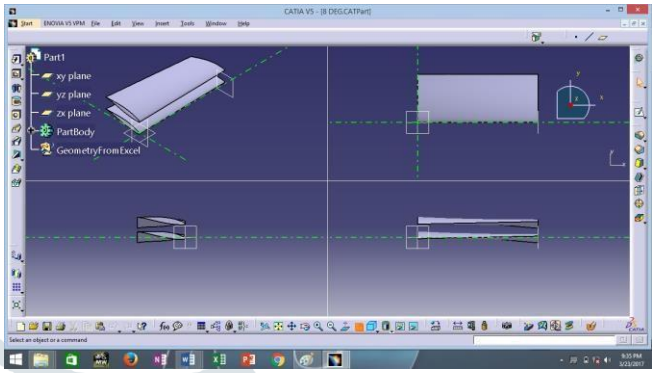
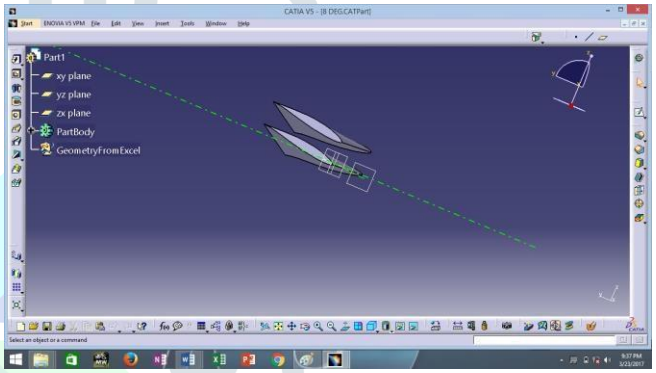
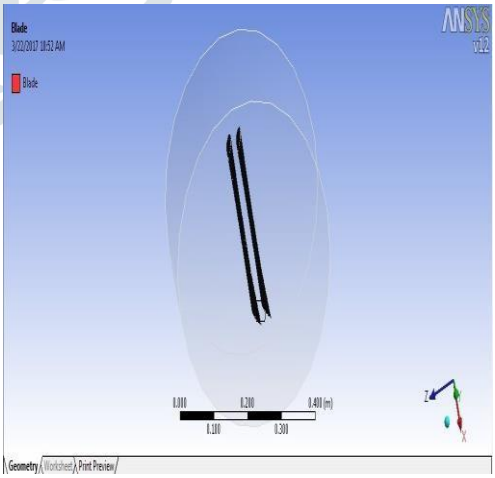
Plot results and create a report.

### 3.2.1 Creating geometry in CATIA (3D&2D) and converted into IGS format



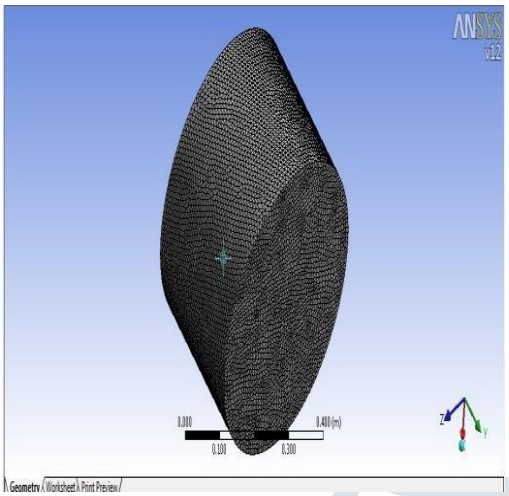




### 3.2.2 Generating the design model



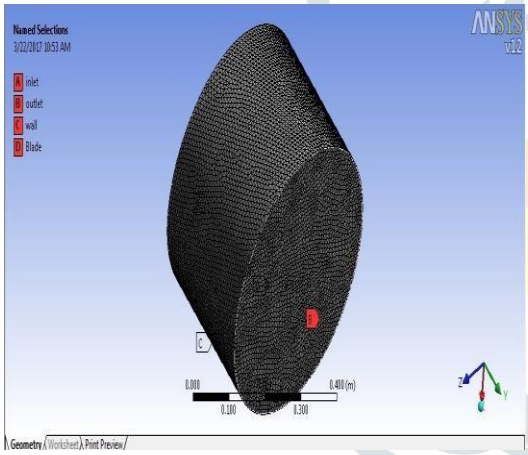
The blade model is being imported in ANSYS software. The blades are being placed in an enclosed section in order to give input parameters

### 3.2.3 Meshing method (coarse& fine)



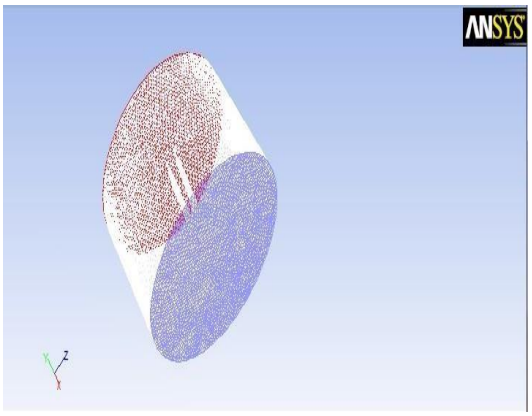
The model is meshed by using fine sizing method, and the mesh done is triangular mesh.

### 3.2.4 Initialize the input& boundary conditions



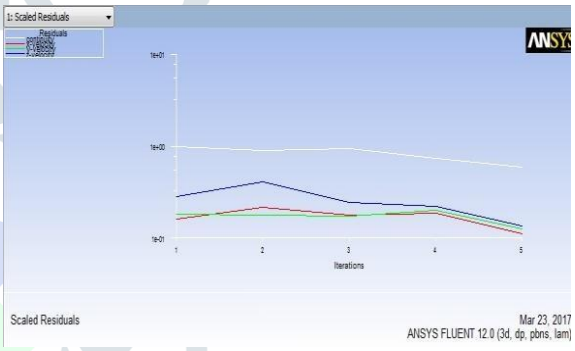
Inlet, outlet and wall boundary are initialised respectively.

### 3.2.5 Setup model



The model is set for software calculation.

## IV Graph



### 4.1 Comparison of numerical calculation and software calculation

All numerical calculation is done for getting optimum value. Where the approximate value is being obtained. So, by using the required parameters accurate value is being obtained in ANSYS fluent software. And the design requirement is being completed in CATIA software.

## V. Conclusion

By the optimised input value we've done the analysis in ANSYS fluent software. Theoretical calculation is being calculated for an optimum value. The objective of increasing the outlet pressure by an approximate value obtained in numerical analysis as well as in software simulation is being achieved, from this analysis setup result is obtained.

# *References*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