Product Requirement Document

Thorium Based Nuclear Turbo Fan for Aviation

This project, part of my master's thesis, focuses on the Computational Fluid Dynamics (CFD) study of unequally spaced axial flow fans to understand how pressure distribution affects noise reduction. The research involves creating 3D models of fan blades, meshing them using TurboMesh, and conducting CFD analysis using ANSYS to evaluate aerodynamic performance and noise characteristics.

How?

The project utilizes a custom code to generate 3D blade profiles for any NACA series airfoil. These profiles are then arranged to form an axial flow fan. The 3D models are meshed using TurboMesh, and CFD simulations are performed using ANSYS to analyze pressure distribution and its impact on noise reduction.

Feature Streams

- Develop and integrate code with MATLAB to create blade profiles for NACA series airfoils.
- Generate single blades and arrange them to form an axial flow fan.
- Utilise CFD to visualise pressure changes on stagnation points across the blades.
- Create a mesh for the 3D surface using TurboMesh to facilitate accurate CFD simulations.
- Conduct CFD simulations to visualize the overall flow characteristics around the fan blades.
- Analyse the results to determine the impact of pressure distribution on noise levels, stabilized pressure and airflow efficiency.

Business Context

This research benefits the aerospace and HVAC industries by offering design improvements that can lead to quieter and more efficient fan operations. By understanding the relationship between blade spacing and noise reduction, manufacturers can develop products that meet increasing market demands for quieter technology.

Success Criteria

Successful creation and validation of 3D blade models using custom code.
Accurate meshing and CFD simulation of fan models using TurboMesh and ANSYS.
Clear visualization and analysis of pressure distribution and its impact on noise reduction.
Publication of findings in a reputable academic journal or presentation at a relevant conference.
Positive feedback from industry experts on the practical applicability of the research findings.

Objectives and Goals

There is a growing demand for quieter and more efficient fan technologies in various industries. This research meets this need by providing a detailed study of how unequal blade spacing can be utilized to reduce noise, thereby enhancing product performance and user satisfaction.

Develop a robust method for creating and analyzing 3D models of unequally spaced axial flow fans.
Conduct comprehensive CFD simulations to understand the aerodynamic effects of unequal blade spacing.
Provide actionable insights for fan design optimization focused on noise reduction.
Contribute to the academic and industrial knowledge base on axial flow fan aerodynamics and noise reduction strategies.