3D blade design

General Information

Type:	Master Thesis (30 ECTS) or Semester Project (10 ECTS)
Laboratory:	Laboratory for Applied Mechanical Design (LAMD)
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Background

Radial inflow turbine design process involves a step from mean-line parameters such as blade number hub and shroud radius, impeller length ...etc to 3D blade shape. For a radial inflow turbine there are two basic blade designs, radial-element blade and straight-element blade. In literature there are formulas that fixes 3D blade design (blade angle distribution) given mean-line geometries for both radial-element and straight-element blades[1]. Current in-house design code is able to build blade geometries with radial-element blades according to the equations from literature by generating human-readable files containing coordinate points for the blade shapes. There are also advanced curved element blades with improved aerodynamic performance. However there is little discussion on how designs compare among each other.

Objective

The objective of this project is to compare different blade types in terms of aerodynamic performance and structural strength.

Tasks

1. Familiarize yourself with the turbomachine design procedure.
2. Conduct a literature review on the design methods used for blades in radial turbomachines.
3. Modify the in-house design code to optimize blade angle distribution for radial-element, straigth-element and curved element blades.
4. For given set of mean-line parameters compare each blade type in terms of aerodynamic performance and structural strength.
5. Investigate how optimized geometries change for different set of mean-line parameters and operating conditions.

NB: adjustments may be required according to progress, results, and project duration.

Prerequisite knowledge

1. MATLAB
2. Fluid dynamics and CFD
3. Thermodynamics
4. Analytic geometry

[1]The possibility to work from the EPFL main campus in Lausanne can be discussed (semester project only)

References

[1] Ronald H. Aungier. *Turbine Aerodynamics: Axial-Flow and Radial-Flow Turbine Design and Analysis.* ASME Press, 2006.