Semester/MSc project proposal

Implementation and testing of a control for a radial turbine

General Information:

Laboratory: Laboratory of Applied Mechanical Design (LAMD)
Partners: Intern
Supervisor: Patrick H. Wagner, Prof. J. Schiffmann
Location: Neuchâtel (travel and lunch allowance - lump sum)
Starting date: February 2018
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Background and Objectives:

A small-scale steam turbine with a diameter of 15 mm was tested successfully at LAMD. The turbine was tested with cold air initially. The next step is to test it with hot air at 200° C and later on with water vapor. The turbine has partial admission and prismatic blades. The stator in the figure is turned upside-down.

Figure 1 – Current manual turbine control valve (left) and Matlab Simulink model (right)

Within a first semester project, a student implemented a dynamics turbine model in Matlab Simulink (see Figure 1 right). The task of the new semester project is to validate the model with experimental data and implement a control strategy. The measured input is the turbine rotational speed and the controlled output is the position of the turbine inlet valve. A physical valve should be selected by the student. Figure 1 shows the current manual Festo control valve. The rotational speed measurement (already implemented), the valve control and the turbine control strategy is implemented in LabView by the student and finally tested in the real application, the turbine control.

Tasks:

- Understanding the turbine dynamics and the already-available dynamic model
- Validation of the dynamic model with experimental data
- Implementing a control strategy for the turbine
- Selection of necessary hardware (control valve)
- Actual testing of the control strategy on the real unit