EN

Analysis of the fluid-structure interactions in a Francis runner in no-load and start-up conditions

Project Description

Hydro-electricity, the main renewable energy worldwide so far, represents 60% of the electricity produced in Canada. It is part of the solutions to ensure the quality of life of people and to preserve the environment. In the last 20 years, this energy production has evolved to accommodate market deregulation and the introduction of other intermittent renewable energy sources on the power grid. Hydraulic turbines must therefore be started and stopped much more often and must spend considerable time spent at off-design conditions where mechanical stresses are significantly higher than at best efficiency point. Those changes exacerbated structural problems leading to production losses and increased maintenance cost.

The major industrial players in the design and operation of large hydraulic turbines in the province of Quebec (Andritz Hydro, EDF, General Electric, Hydro Québec, Voith Hydro) have united their efforts in a project spearheaded by the Laboratory of Hydraulic Machines (LAMH) from Laval University and in collaboration with Polytechnique Montreal to tackle this problem. The Tr-FRANCIS research project aims at studying fluid-structure interactions during transient and no-load regimes in Francis turbines by establishing a collaboration between industrial partners and academic researchers. This great research endeavour will train 3 Postdoc researchers, 5 PhD and 10 MSc students between 2017 and 2022 in a stimulating environment.

A PhD candidate position is currently open as part of Tr-FRANCIS. This PhD thesis project aims at analysing the fluid-structure interactions in a Francis runner in no-load and start-up conditions. The main goals are to develop simplified simulation methodologies to account for added mass and added damping under no load and start-up conditions, and to validate the hypothesis that structural deflections of the runner blades have negligible impacts on the flow dynamics. We will explore simulation strategies in order to avoid complex fully coupled CFD-FEA simulations. In collaboration with other students involved in Tr-FRANCIS, the candidate will plan experimental measurement campaigns on a model hydraulic turbine to validate the modeling approach.

The sought candidate processes a strong background in vibrations, dynamics, fluid mechanics, finite element method, and computational fluid dynamics. He/she will develop analytical models, perform numerical simulations

Field of research

Mechanical Engineering

Research Director

Prof. Frédérick Gosselin

Research Environment

Polytechnique Montreal – Mechanical Engineering

http://www.fgosselin.com http://www.polymtl.ca/lm2/

Financial support available

- 20 000$CDN per year for 4 years.

Required Profile

Mechanical Engineering or equivalent

Required Documents

- Cover letter,
- Resume (CV),
- Transcript (student record),
- Writing sample (a report or paper the student wrote).

For more information

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