MASTER THESIS

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Pressure pulsations in high head Francis turbines

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Background

As energy demand is growing along with the quest for green energy, the operating range for hydropower is being pushed into non-favourable conditions. The unsteady flow regimes at these conditions lead to transient phenomena's like pressure oscillations that can propagate through the whole turbine, threatening the reliability of the turbine. It is therefore important to identify these pressure pulsations to ensure safe operation.

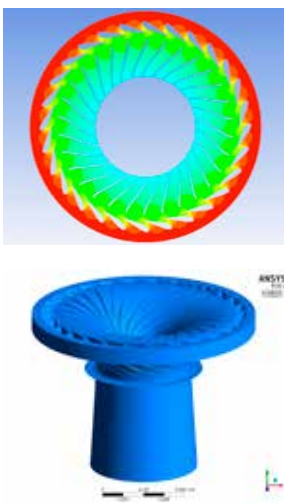

Fig. 1: Computational domain (left) and pressure contour (right).

Method

A transient simulation of the Francis model turbine at NTNU is to be performed for several guide vane openings ranging from a 4 degree opening to 14 degrees opening. The simulations are performed in ANSYS CFX using the SST turbulence model. The primary focus is on rotor-stator interactions (RSI).

Further work

Because pressure pulsations also arise from other phenomenas than RSI, simulations of the whole waterway is necessary. Simulations at different rotational speeds is also vital in order to obtain a hill diagram.