

Comparison of PIV Measurements in the Vaneless Space of the TR-Francis Turbine at Speed-No-Load to CFD Simulation results

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ABSTRACT

It is becoming increasingly common for Francis machines to operate at conditions such as speed-no-load (SNL) and deep-part-load (DPL). These operating zones are characterized by the presence of large cavitation volumes, interblade and vaneless space vortices and flow recirculation.

Researchers at the Heki Laboratory performed stereoscopic endoscopic Particle Image Velocimetry (PIV) measurements at the inlet of the TR-Francis model turbine at SNL and DPL. These measurements provide time resolved 3-component velocity fields on planes covering a portion of the vaneless space and the runner channels.

In the current work, the SNL operating point for the TR-Francis turbine was simulated using Ansys CFX with the SAS-SST turbulence model. Flow phenomena, such as vortices and recirculation, are compared visually with the PIV measurements.