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Development of a “Numerical Test Rig” for Hydraulic Turbomachinery

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Summary

A “Numerical Test Rig” for hydraulic turbomachinery is being developed on behalf of the VDMA Fachverband Pumpen + Systeme. This powerful software system consisting of two basic modules is described. First, the design module which enables the user to generate an initial design of centrifugal pumps of arbitrary specific speed as well as to modify and improve the design of components interactively. Second, the analysis module which contains three sub modules, the CFD-Codes to recalculate the three-dimensional and turbulent flow including the effect of cavitation, a CSA-Code for the recalculation of the displacements and the stresses of components as well as the flow induced vibrations and finally CHA-Code to evaluate the generated acoustic sources as well as the noise being transported up- and downstream of pumps and across the housing of pumps by vibro-acoustics.

All modules, besides the hydro-acoustics module (CHA), have been and are being developed at the Institut für Fluidmechanik at the TU München, whereas the CHA-Code is being developed in cooperation with the Institut für Modellierung und Berechnung of the TU Hamburg-Harburg. The CFD-Code has been evaluated and calibrated in cooperation with the Institut für Turbomaschinen und Fluidantriebstechnik of the TU Darmstadt, whereas the CHA-Code is being calibrated by comparing the predicted acoustic spectra with available spectra measured at the German Pump Manufacturer WILO in Dortmund.

The various modules of the “Numerical Test Rig” will be demonstrated at the Pump Users International Forum.