

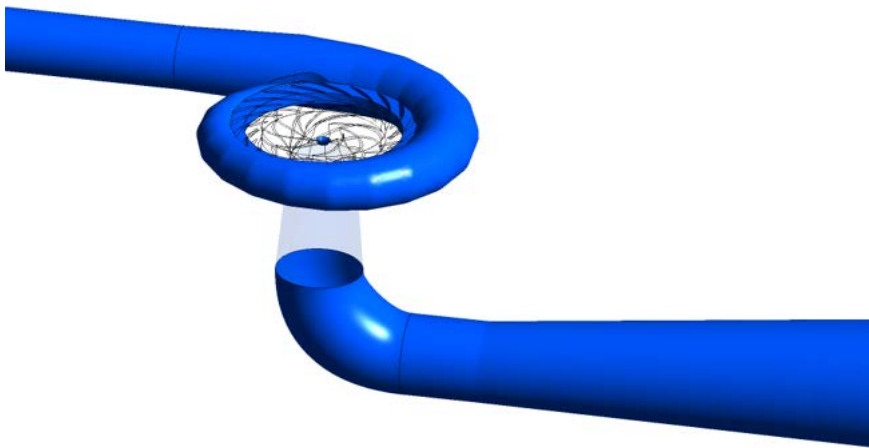


Fast S-shape CFX Method

S-shape calculation time reduction

CONTEXT

In a previous PhD, an ANSYS CFX method was developed to calculate the S-shape of a pump-turbine with very high accuracy. This method is still too expensive in computation time and in costs. At the end of the PhD, an S-shape was calculated in 36 days using 2 CFX licenses, and 2x32 cores. In order to drastically decrease this computational time, new efforts have been performed.



TECHNOLOGY DESCRIPTION

Using the same efficient physical models, a fast numerical method has been developed to compute the S-shape of pump-turbine designs. This method uses criteria based on flow parameters calculated from steady CFX calculations which require relatively few computational resources. These criteria make it possible to correctly select the position of certain important operating points in the S-shape, such as the point of maximum reduced speed $n11$. Then the selected points are calculated thanks to the adequate unsteady simulations, making it possible to get the accurate position of the characteristic. Computational time is optimised and unsteady CFX simulations are only focused on the essential operating points of the S-shape. Compared to the complete unsteady calculation approach, the differences between simulations and experimental results increase slightly but still allow for all relative studies.

With this new method, the time needed to estimate the S-shape is divided by around 3. A quick comparison between different hydraulic designs (runner, guide vanes, etc.) is now possible before the scaled model tests in order to pre-select the design with the least pronounced S-shape. Finally, to further optimise time, the method has been automated with a user interface software (Scilab).

APPLICATION DOMAIN

Pump-turbine runner design

ADVANTAGES



Faster S-shape estimation



Runner comparison and classification



Money saving

TRL SCALE



DELIVERABLES

User Interface Software
 Technical reports
 Technical training upon request

