

## Fluid Technology

# Numerical flow simulation for turbomachinery

Sulzer Innotec

Computational fluid dynamics (CFD) in the area of turbomachines and their components allows a detailed insight to be gained into the flow-fields. This type of analysis has become essential for new designs and for re-rating projects, as it allows the number and cost of tests to be reduced to a minimum. In addition to the primary objective of loss reduction, CFD also helps to understand the causes of flow instabilities or of special problems such as cavitation in pumps and water turbines. Sulzer Innotec has a variety of tools available for turbomachinery design and analysis. As a result of the past experience obtained on a wide variety of turbomachinery types within the Sulzer Corporation and with selected external customers, Sulzer Innotec has substantial know-how in the most suitable numerical methods for different types of questions related to turbomachinery flows.

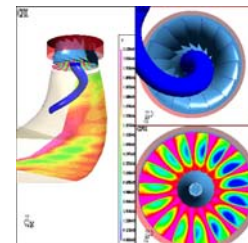
### Procedure

Computational fluid dynamics (CFD) for turbomachines usually follows the following steps:

- Definition of the required operating conditions by the customer
- Selection of most suitable preliminary geometries (1D- and Q3D- design methods)
- Grid generation
- Selection of a suitable CFD code together with adequate numerical models
- Numerical simulation of the flow
- Data analysis with suitable graphical presentation of the results.
- „Fine-Tuning“ of the geometry.

### Special issues related to numerical flow simulation in turbomachinery

- The selection of the most suitable CFD software and the choice of adequate models are decisive factors for the quality of the simulations.
- The quality of the calculations for decelerating flows or flow with strong swirl are strongly affected by the choice of turbulence model and the type and quality of grid.
- The use of the code CFX5 has been found highly satisfactory for the calculation of multiphase flows in turbomachinery (such as cavitation).



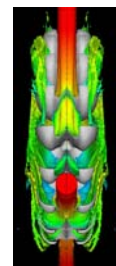
*Draft tube vortex, simulated for VA TECH HYDRO*

### Customer benefit

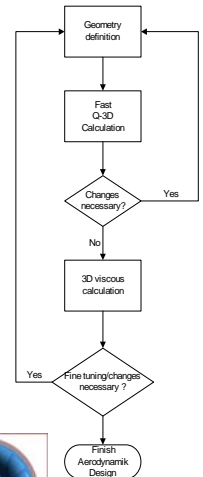
- CFD can be used for the design and the optimisation of all types of turbomachinery.
- Rapidly increasing computer capacity → more detailed description of more complex flow processes (with increasing attention to details such as unsteady interactions)
- Efficient procedures → Calculation and analysis of a large number of options in a short time → Reduction of number of tests → Insight into the flow patterns (including in positions that are not accessible for measurements) → deeper understanding of the fluid dynamic phenomena.



*Cavitation in a pump*



*Flow in a Pelton turbine (with free surfaces)*



Sulzer Innotec has many years of experience in the design and analysis of turbomachinery. A wide knowledge of the best techniques for numerical flow simulation (CFD) of specific turbomachinery problems is available from many comparisons with experimental data. In addition to Sulzer Pumps, many previous Sulzer turbomachinery companies and selected external customers make use of our services and interdisciplinary know-how for the development of new products.

You can profit from our experience in this area and share our newest technologies and solutions. For further information please contact our specialists.

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