CFD/C*M*FD Simulation in Hydro Engineering

CFD/CMFD or fluid-flow simulation play an important role in the hydro engineering segment. AMS supports you with the powerful platform TransAT, providing accurate, time-efficient solutions across the entire engineering cycle, from FEED to detailed design analysis.

SITUATION TODAY

Digitalisation and new technologies are presenting huge opportunities to transform and modernise engineering - leading to better decision making, efficiency and cost savings.

Traditionally, in their search for innovative and safer solutions to complex issues, engineers relied upon a 'trial and error' approach. Further, analytical solutions and simplified models have proven partial successful only, pleading in favour of more complete multi-dimensional and transient approaches.

CLIENT ISSUES

- How can we stay ahead of the game ?
- How can we gain critical insight and upfront visibility ?
- What can we do to further optimise designs and decrease the margin of error ?

PÖYRY'S AMS SERVICE

Building on the latest digital techniques and CAE solutions, Pöyry's AMS service is enabled by the powerful fluid-flow (CFD/ C*M*FD) simulation platform **TransAT**, which delivers transient, multi-dimensional process predictions present in key business sectors, including hydro engineering.

Pöyry's AMS supports operators, engineering companies and EOM suppliers with technical studies and documentations within the wide hydro engineering discipline. We provide services that enable stakeholders to evaluate, complete and produce at competitive costs and reduced economic and environment risk. Our experts offer cutting-edge consulting services, covering various segments in hydro engineering for maximized asset value, from hydro power, to hydraulics, environmental and coastal engineering.

KEY FEATURES - AMS SERVICE

- TransAT is highly flexible and can be tailored to your unique scenario and needs
- Intuitive user interface means that it is straightforward to model your scenario
- 3D outputs are high quality and visually engaging, explaining complex scenarios
- Supported by Pöyry's team of specialists who understand your specific challenges

KEY BENEFITS OF AMS

Better informed decisions - earlier on: by effectively modelling and simulating your initial feasibility study and proof of concept, you get vital upfront insight needed to support investment decisions.

Maximise efficiency and reliability: by validating new ideas and improving designs, as well as retro-fitting existing operations. Overall confidence increases in the results of engineering studies.

Reduce risk, saving time and money: conduct virtual simulations of real life scenarios in less time and at a fraction of the cost of 'real' Laboratory experiments. Reduce margin of error and risks.

Hydro Engineering feature issues:

- Hydro power
- Hydraulics engineering
- Civil engineering
- Environment
- Coastal engineering

HYDROPOWER

Pöyry's AMS services in this sector include 3D free-surface solutions for the design of hydraulic machinery like water turbines (Fig. 1), pumps, valves, and for studying the performance of paddle wheels and novel tide energy systems producing hydropower.

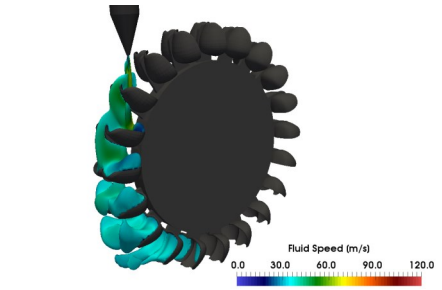

FIG 1. WATER FLOW IN PELTON TURBINE

We also optimise conduits through simulation of transients like water release flows, water hammer, hydraulic jumps, hydraulic response in waterways, energy dissipation by impinging jets, and strong vortex flows. Further, our simulation tool can provide a detailed analysis of the water-flow process in the different components of the hydropower plant, including the intake, the conduits, the penstock, the discharge, and the reservoir.

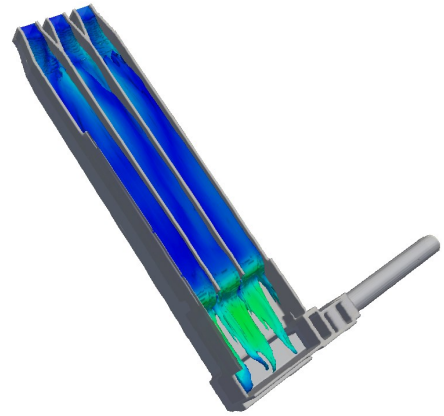

FIG. 2. WATER FLOW IN A HYDROPLANT

Albeit traditional design tools are sufficient, detailed CFD/CMFD simulations intervenes whenever the situation is too complex for analytical calculation or requires fine tuning.

Today, our simulation services can be used for new build projects as well as for retrofitting or extending existing hydropwer plants.

HYDRAULICS SYSTEMS

Hydraulic engineering problems of various nature are now within reach of our CFD/ CMFD simulation solutions — thanks to the great free-surface module of TransAT— including preventive applications relevant to floods, land sliding, snow avalanches, or design of water storage systems, water dams and spillways (Fig. 3).

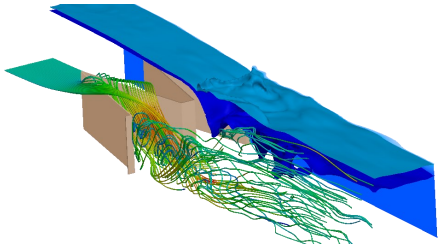

FIG. 3. WATER FLOW IN A SPILLWAY

Advanced simulation is now acknowledged as an affordable and accurate way to optimize spillway characteristics since it helps investigate various flow conditions at lower costs compared to lab experiments.

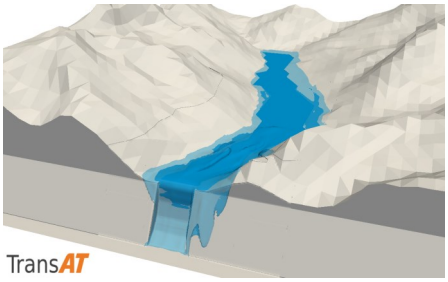

FIG. 4. ICE SLIDING IN A DAM

Free overfall systems observed at nick point of rivers benefit from advanced simulation as well, enabling the prediction of flow transition from subcritical to supercritical.

Tailings dams erosion constitute a case in the sector: Here possible sliding ice/snow sliding in the reservoir can create progressive waves that may cause the erosion of the dam. TransAT has a unique modelling capability for bedload transport and erosion (Fig. 5).

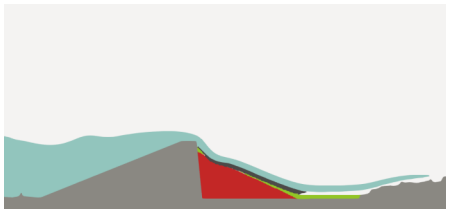

FIG. 5. EROSION OF A DAM

COASTAL ENGINEEERING

In the broad coastal engineering area, the challenges are numerous, including sea-water pollution from industrial an domestic discharges, brine disposal in the vicinity of desalination plants, etc.The design of coastal

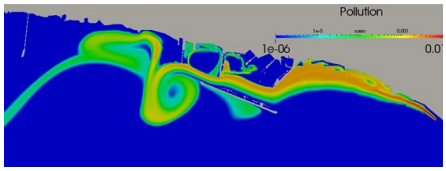

FIG. 6. POLLUTION ALONG SEA COAST

structures like channel intakes of desalination plants can benefit from CFD studies, too. The same is true for harbour protection systems against waves.

DESALINATION PLANTS

Desalination plants implicate various issues, including the mixing of the brine in the sea. The plants require continuously refurbishing of their initial design, in particular as to the proper dimensioning the intake and discharge systems to avoid recirculation. In some unexpected cases (pollution penetration), the intake system requires retrofitting of its base design, as shown in Fig. 7, where an additional barrier has been proposed. mulations.

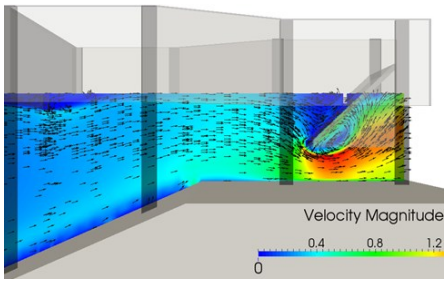

FIG. 7. FLOW IN A PLANT INTAKE

TRANSAT CFD/CMFD PLATFORM

TransAT is a versatile fluid-flow simulation platform (CFD) using the Immersed SurfacesTechnology for multi-dimensional meshing. The platform is best suitable for multiphase flows using tailored predictive techniques and models for complex physics. TransAT can be used in the energy, industry and infrastructure sectors.

TransAT Website: www.transat-cfd.com

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