POWER VISION
ENGINEERING

We focus on **modelling, simulation, analysis and optimisation** of hydroelectric power plants with a multiphysics approach including **hydraulic** circuit, **mechanical** systems, **electrical** installations and **control** devices.

SWISS ENGINEERING

POWER VISION
ENGINEERING

Solutions & expertise in hydropower transients and operation through softwares and engineering services since 2007.

ENGINEERING SERVICES

- Hydroelectric Transient Analysis
- Water Hammer Calculation
- System Stability Analysis
- Control System Optimisation
- Ancillary Services and Grid Code Compliance
- CFD and Complex Flow Simulations

SOFTWARES & SEMINAR TRAININGS

SIMSEN
Simulation Software for Hydraulic & Electric Systems Adjustable Speed Drives

Hydro-Clone®
Physically based Digital Twin for Hydro Power Plant Transient Monitoring

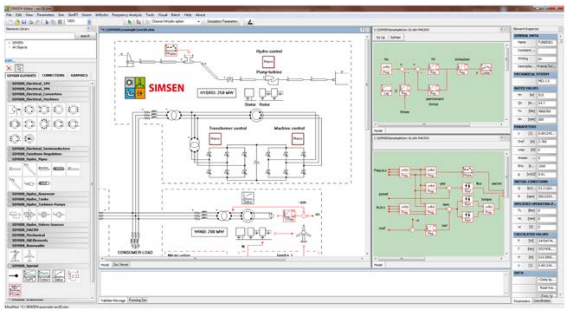
MyHPP Simulator
Simulator for Hydro Power Plant Operator Training

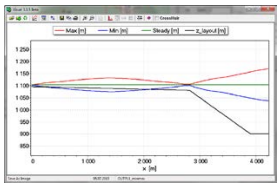
SIMULATION SOFTWARE

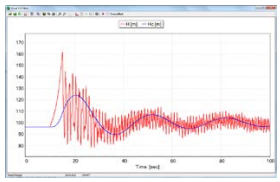
SIMSEN

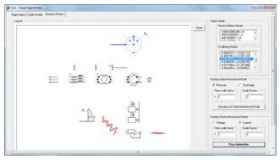
SIMULATION SOFTWARE FOR HYDRAULIC & ELECTRIC SYSTEMS ADJUSTABLE SPEED DRIVES

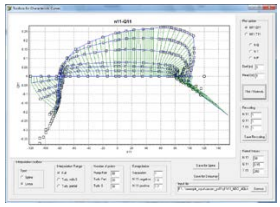
- Hydraulic and Electrical Transients
- Water Hammer Calculation
- Hydroelectric Systems
- Power Network Stability
- Complex Drives Control
- Load Flow











FEATURES

- From water to wire modelling
- Electrical + hydraulic system
- Advanced control system
- Variable speed pump-turbines
- Pumped storage transients
- Time + frequency domain analysis
- Eigenvalues + eigenvectors calculation
- Forced response analysis
- Two-phase flows
- Open channel flows
- Francis and Pelton turbine characteristic library
- Reversible Francis pump-turbine characteristic library
- Scripting capability
- FMI co-simulation with external softwares

EPFL

Power Vision Engineering is the exclusive distributor of the SIMSEN EPFL software

SIMULATION SOFTWARE

HYDRO-CLONE®

SIMSEN BASED SOLUTION

PHYSICALLY BASED DIGITAL TWIN FOR HYDRO POWER PLANT TRANSIENT MONITORING

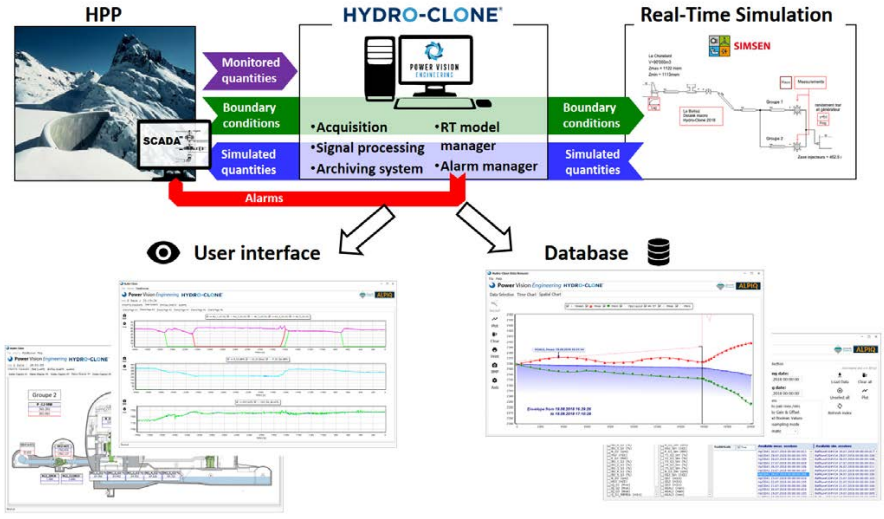
- Digital Twin of Hydroelectric Power Plant
- Real Time Water Hammer/Surge Tank/Unit Transient Monitoring
- Detection of Abnormal Pressure Transients prior to Reach Admissible Limit
- Detection of Anomalies
- Monitoring of Non Measurable Quantities
- Deviation of Hydropower Physical Characteristics
- Ahead of Time Projections of the State of the System (Decision Support Tool, Alert Awareness, What if...?)
- Anticipation of Potential Power Plant Damage
- Penstock Fatigue Monitoring

ALARM SYSTEM

Type 1: Exceedance of the admissible limit of a measured quantity

Type 2: Exceedance of the admissible limit of a non measurable quantity

Type 3: Divergence measurements/ simulations



HYDRO-CLONE PATENTS

European patents numbers: EP 2 801 879 B1 (2017) & EP 3 285 128 B1 (2020)

SIMULATION SOFTWARE

MyHPP SIMULATOR

SIMSEN BASED SOLUTION

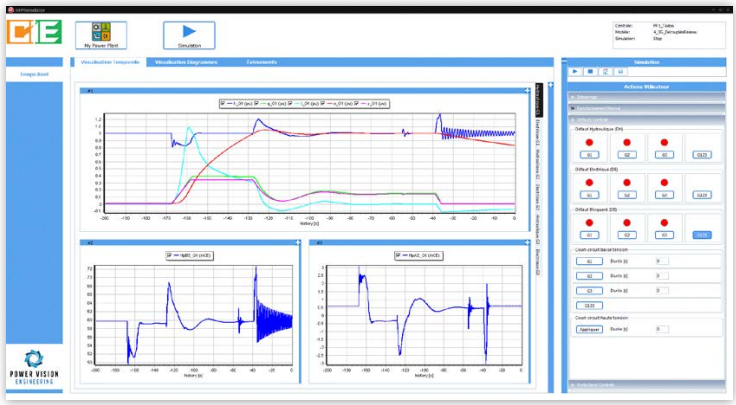
SIMULATOR FOR HYDRO POWER PLANT OPERATOR TRAINING

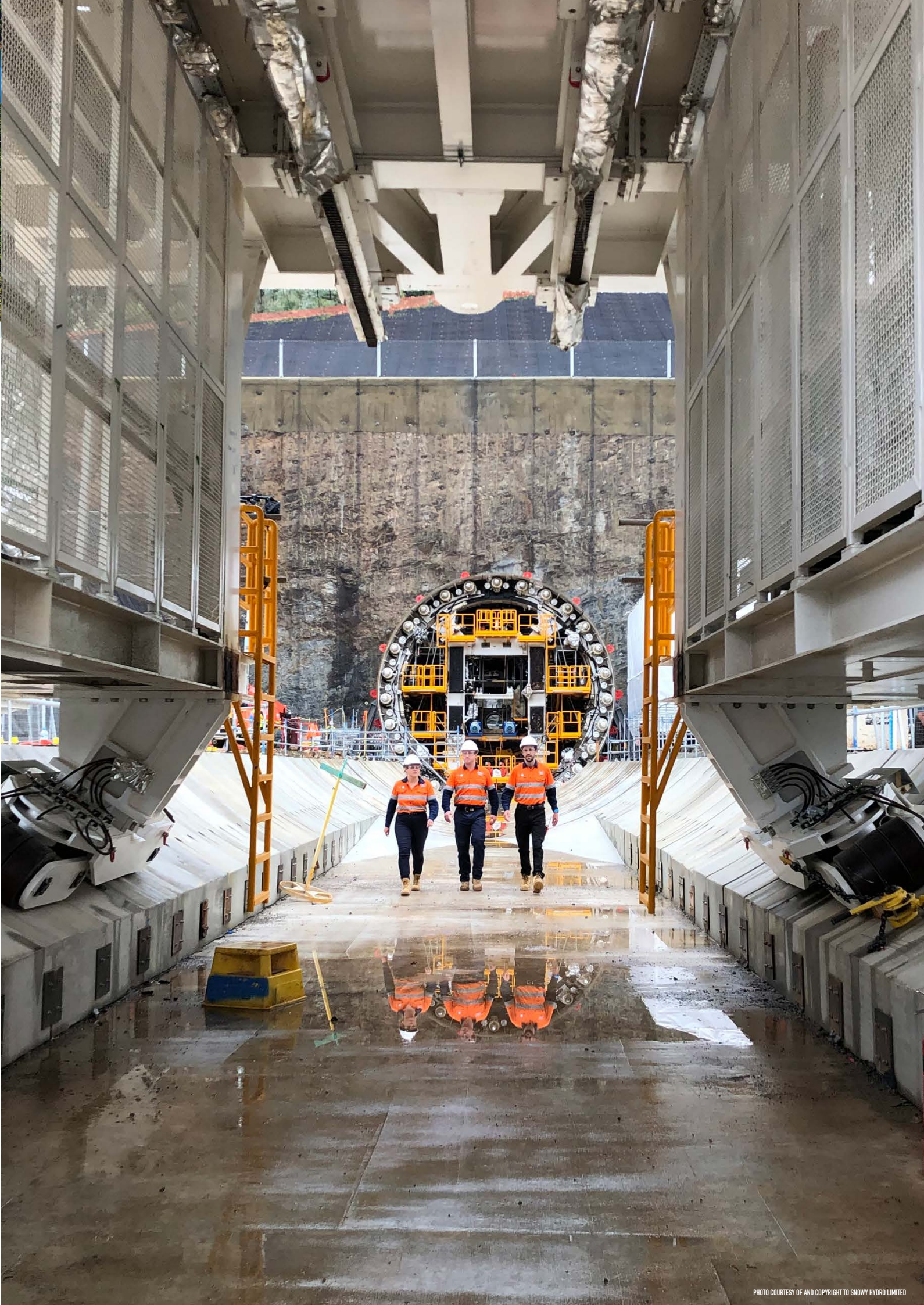
My HPP Simulator emulates the operation and dynamics of a specific hydro power plant during normal, abnormal and emergency conditions.

With My HPP, your operators:

- gain confidence and expertise
- improve awarness of operation risks
- increase knowledge and operator skills

Train your operators internally with this simulator.





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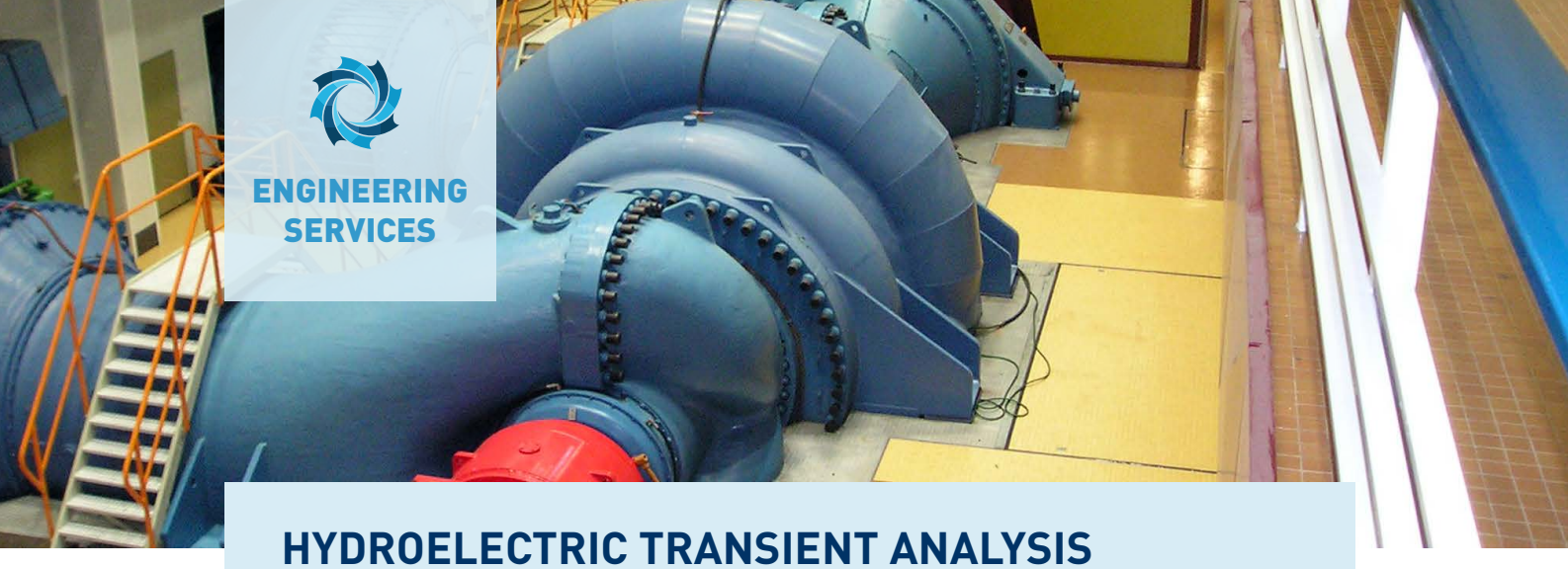
Power Vision Engineering
in each key step of your project

PROJECT STEPS	01 FEASIBILITY	02 DETAILED DESIGN	03 CONSTRUCTION	04 COMMISSIONING	05 MAINTENANCE TRAINING
ENGINEERING SERVICES	• Preliminary hydraulic and electric transient analysis • Hydraulic layout design for PSPP and HPP • Surge tank sizing • Hydraulic machine sizing and selection incl. variable speed technology • System stability evaluation	• Detailed hydraulic and electrical transient assessment • Hydraulic layout optimisation (1D+CFD) • Surge tank detailed design and optimisation (1D+CFD) • System stability evaluation: isolated and islanded grid • Resonance risk assessment (IEC 62882): part load and full load surge, RSI, Von Karman resonance • Hydraulic machine transients and dynamic behavior specifications	• Final hydraulic and electrical transient analysis with data from suppliers • Technical review of hydraulic machine bids • Hydraulic machine reduced scale mode tests follow-up • Transposition of pressure fluctuations from model to prototype (IEC 62882) • Surge tank physical model tests follow-up • Grid code compliance • Ancillary services evaluation	• Transient tests specification • Hydro-Clone® system deployment for hydraulic transient tests follow-up and validations • Operating sequence optimisation • Control system parameter optimisation • Pressure fluctuations assessments • Determination of final safe operating range of HPP and PSPP	• Long term hydraulic transient monitoring using Hydro-Clone® system • Hydraulic transients, system dynamics and pressure fluctuations troubleshooting • Training of plant operators with MyHPP Simulator
SIMULATION SOFTWARES	SIMSEN	SIMSEN	SIMSEN	SIMSEN HYDRO-CLONE®	SIMSEN HYDRO-CLONE® MyHPP SIMULATOR



ENGINEERING SERVICES

HYDROELECTRIC TRANSIENT ANALYSIS

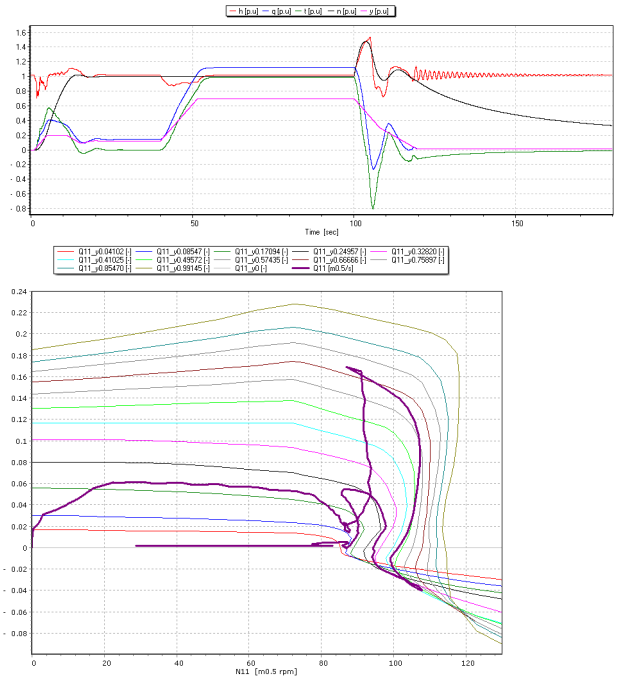
WATER HAMMER CALCULATION

TRANSIENT ANALYSIS

- Hydraulic and electric transient analysis
- Hydraulic layout design and optimisation for PSPP and HPP
- Surge tank design and optimisation
- Penstock protection valve transients
- Air-valve sizing
- Hydraulic short-circuit operation

STABILITY/
RESONANCE ANALYSIS

- Resonance risk assessment according to IEC 62882: part load and full load surge risk, rotor stator interactions (RSI) induced resonance, Von Karman vortex shedding induced resonance (valves, GV, SV)
- Penstock resonance risk assessment
- Follow-up of hydraulic machine reduced scale mode tests and transposition of pressure fluctuations from model to prototype according to IEC 62882 and resonance risk assessment
- Hydraulic system dynamics and pressure fluctuations troubleshooting



ENGINEERING SERVICES

SYSTEM STABILITY ANALYSIS

ANCILLARY SERVICES & GRID CODE COMPLIANCE

CONTROL SYSTEM OPTIMISATION

POWER NETWORK STABILITY ANALYSIS

- Isolated operation
- Islanded network
- Interconnected grid

ANCILLARY SERVICES ASSESSMENT

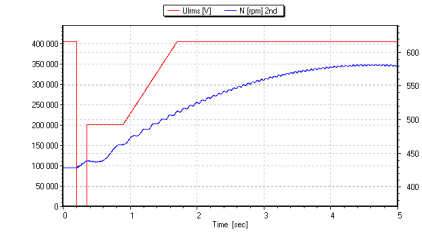
- Primary (FCR) and secondary (aFRR) control capabilities assessment
- Evaluation of penstock fatigue risk
- Variable speed unit contribution to grid stability
- Power System Stabilizer (PSS) optimisation

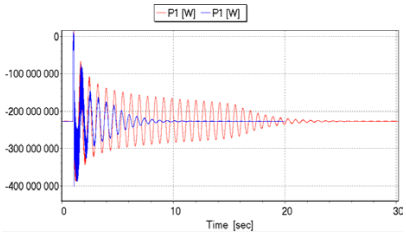
OPTIMISATION

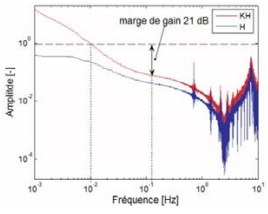
- Control/command strategy
- Control/command parameters
- Emergency procedures
- Annual production

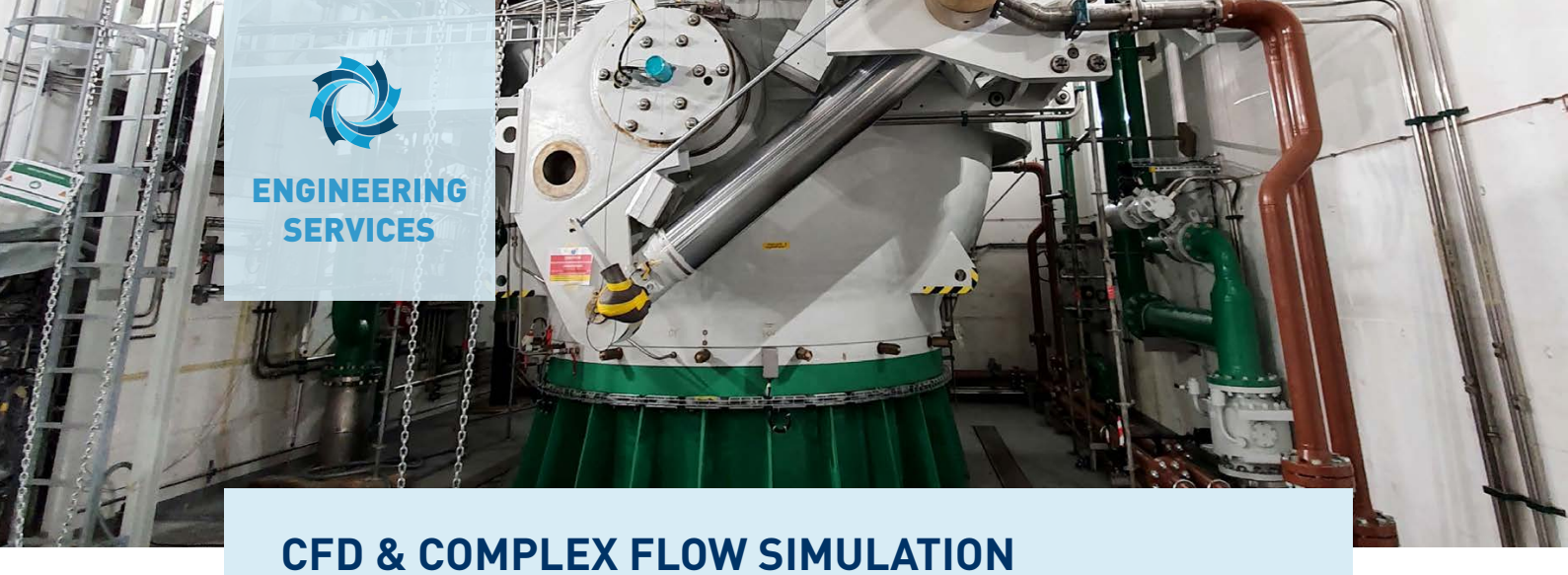
GRID CODE COMPLIANCE

- Short circuits
- Low voltage ride through (LVRT)
- Ramping rates optimisation
- Primary and secondary control for voltage and frequency control







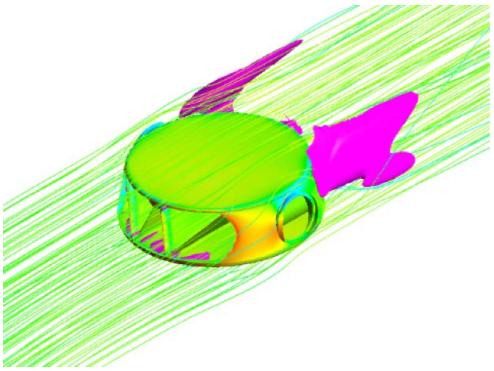


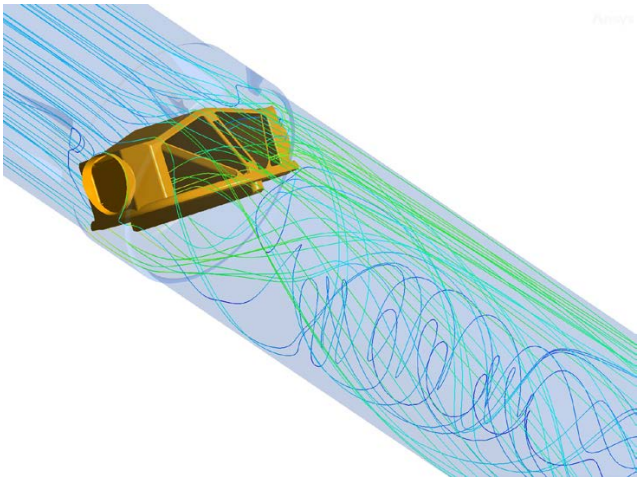
ENGINEERING SERVICES

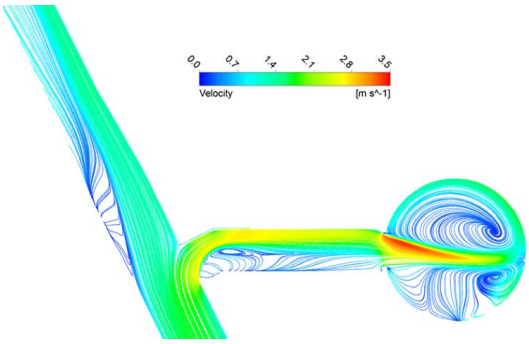
CFD & COMPLEX FLOW SIMULATION

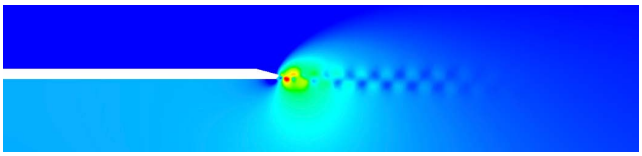
2D/3D STEADY/UNSTEADY CFD (ANSYS-CFX®)

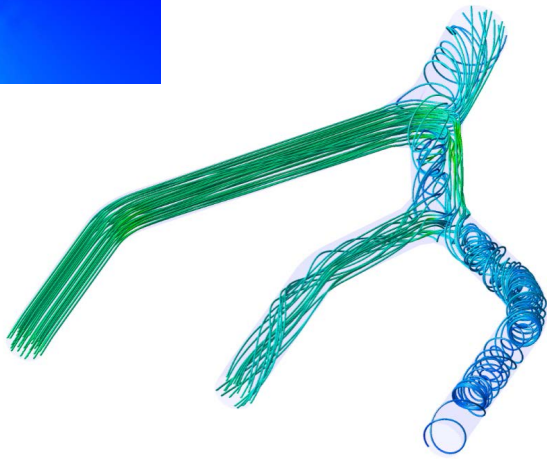
- Surge tank diaphragm optimisation
- Bifurcations flow stability
- Hydraulic short-circuit operation
- Von Karman vortices
- Part/Full load operation
- Valve torque and discharge characteristics
- Air-valve discharge characteristics











R&D PROJECTS

- INNOVATION
- LEADING EDGE RESEARCH & TECHNIQUES
- TECHNOLOGY TRANSFER BETWEEN ACADEMIA & INDUSTRY
- HYDRO EXPERTISE

HYPERBOLE

- HYPERBOLE European Project no. 608'532
- FP7 ENERGY 2013 Programme
- 42 months project (2013-2016)
- 10 partners

SFOE Projects
Swiss Federal Office of Energy

- RENOVHydro - Project no. SI/501436-01 (2016-2019)
- SHAMA - Project no. SI/501435-01 (2016-2019)
- SmallFLEX - Project no. SI/501636-01 (2018-2020)
- HydroLEAP - Project no. SI/502106-01 (2020-2024)

CCEM-CH
Swiss Electric Research

- HydroNET II – Project (2013-2016)

XFLEX HYDRO

- XFLEX HYDRO European Project no. 857832
- Horizon 2020 Framework Programme
- 48 months project (2019-2023)
- 19 partners

InnoSuisse Projects

- Penstock fatigue monitoring - Project no. 28112.1 PFIW-IW (2018-2020)
- RENOVHydro - Project no. 19343.1 PFIW-IW (2016-2019)

PARTNERS

Technology Platform for Hydraulic Machines
CH-1015 Lausanne
Switzerland

Power Electronics Laboratory
CH-1015 Lausanne
Switzerland

Hydro Alps Lab
CH-1950 Sion
Switzerland

MC-monitoring S.A.
CH-1762 Givisiez
Switzerland

Mhylab
CH-1354 Montcherand
Switzerland

PROJECTS AROUND THE WORLD

6x 340MW
SNOWY 2.0 PSPP
AUSTRALIA

Transient analysis of SNOWY 2.0 pumped storage power plant equipped with 6x340 MW reversible Francis pump-turbine including 3 variable speed units. Transient analysis verification in pumping and generating mode, and hydraulic layout and surge tanks optimisation.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4x 232MW
GOUVÃES PSPP
PORTUGAL

Transient analysis for 4x232 MW reversible Francis pump-turbines to be operated under a nominal head of 660 mWC, optimisation of upstream and downstream surge tanks.


FRANZ GEORG PIKL

420MW
FORCES MOTRICES HONGRIN-LÉMAN SA
SWITZERLAND

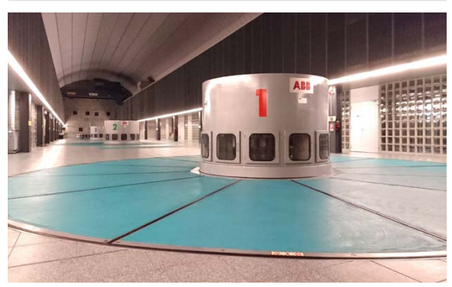
Expertise in hydraulic transient simulations for 240 MW → 420 MW upgrade of Forces Motrices Hongrin-Léman Power Plant, including surge tank modifications and commissioning assistance with Hydro-Clone.

6x 150MW
NANT DE DRANCE PSPP
SWITZERLAND

Transient analysis and CFD computation for hydraulic short-circuit safe operation of Nant de Drance 900 MW pumped storage power plant equipped with 6x150MW variable speed Francis pump-turbines, CFD computation of unsteady 3D flow developing in the downstream bifurcations and commissioning assistance with Hydro-Clone.

3x 423MW
CLEUSON-DIXENCE HPP
SWITZERLAND

Transient analysis for the rehabilitation of 1200 MW power plant with 3 Pelton turbines and ancillary services optimisation.



4x 230MW
MONTÉZIC PSPP
FRANCE

Hydroelectric transient analysis of 930 MW Montézic pumped storage power plant, RTE Grid Code compliance.

185MW
AVČE PSPP
SLOVENIA

Transient analysis of 185 MW variable speed pumped-storage power plant, influence of air vacuum valves and surge tank modifications.

POWER VISION
ENGINEERING

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