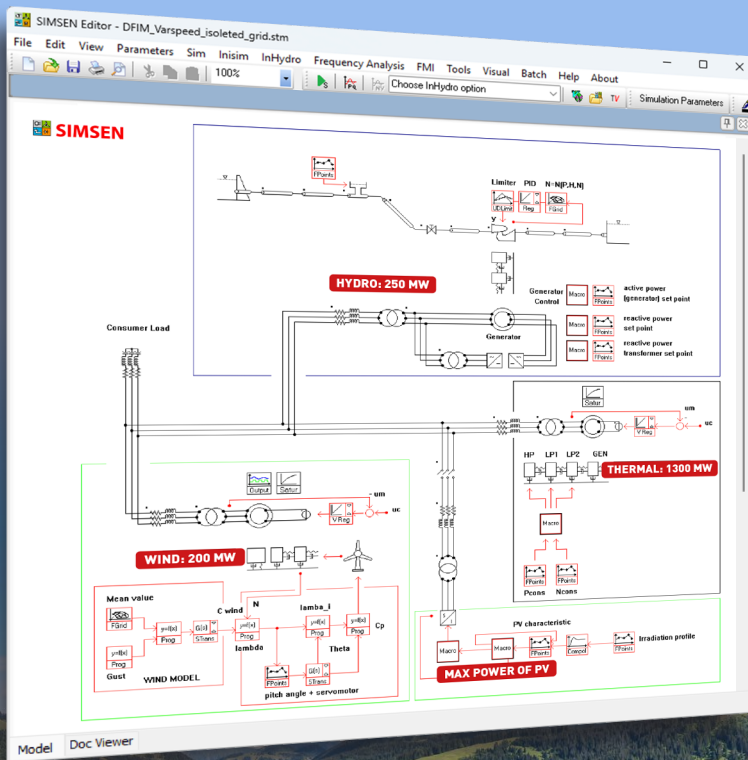
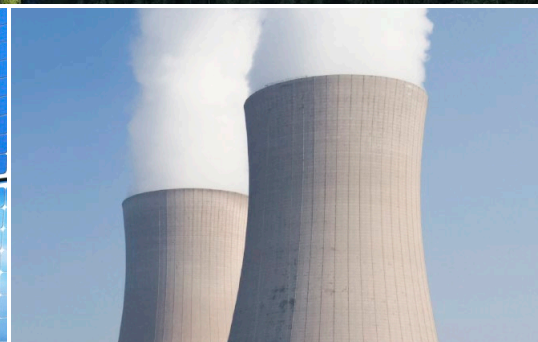
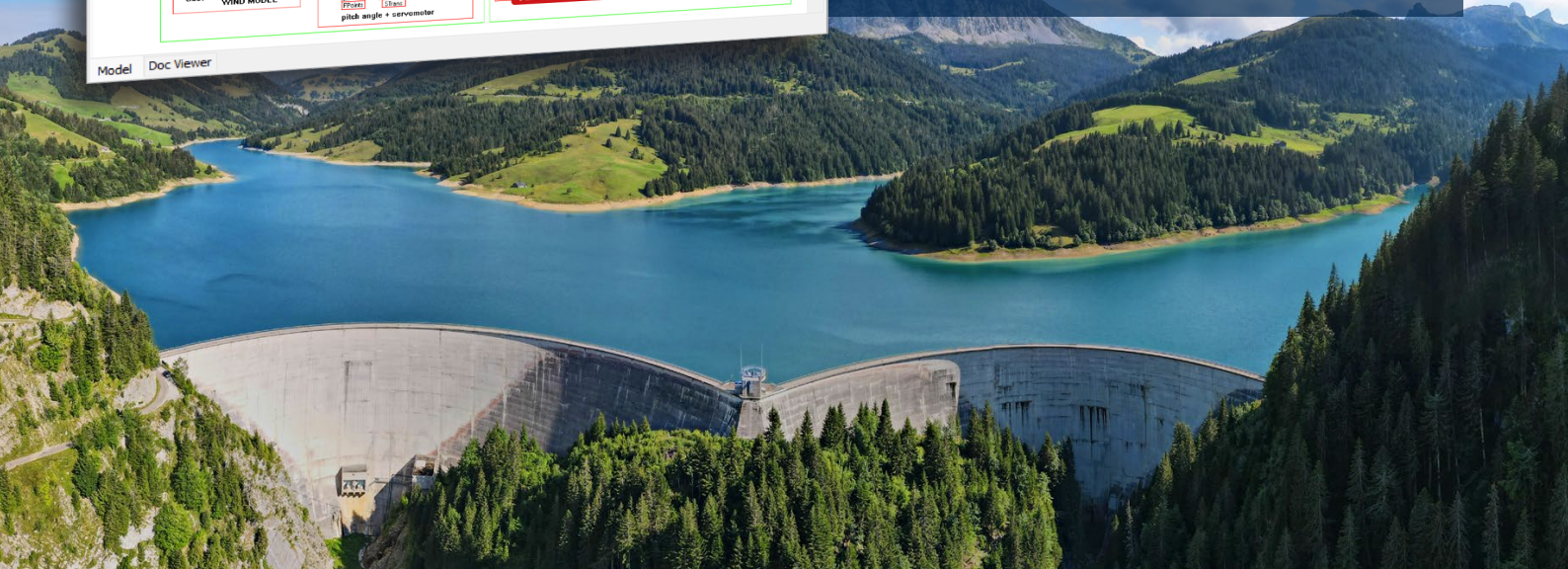


SIMULATION SOFTWARE FOR HYDRAULIC & ELECTRIC SYSTEMS ADJUSTABLE SPEED DRIVES



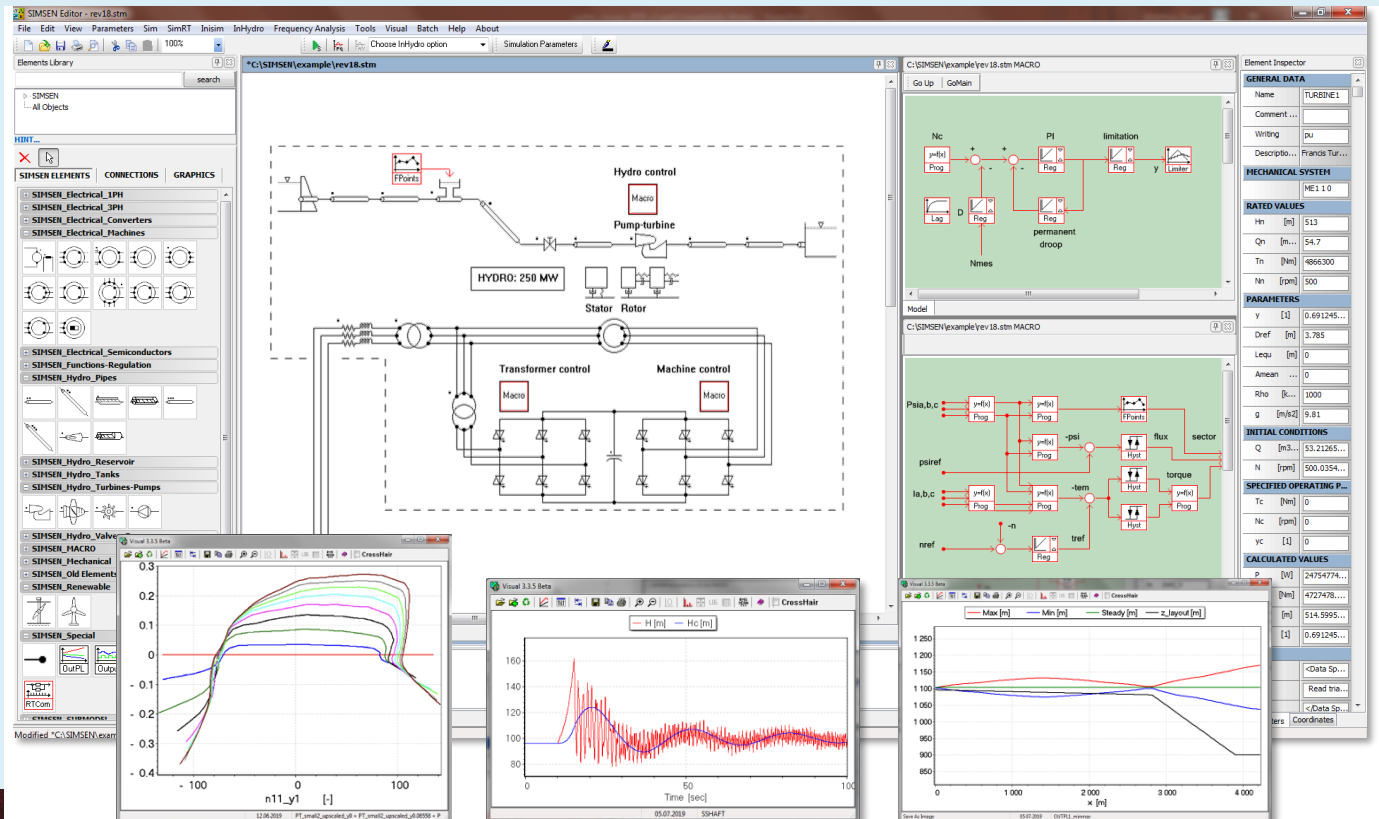
-  Water Hammer Calculation
-  Electromagnetic Transient (EMT)
-  Hydroelectric Systems
-  System Stability
-  Frequency Analysis
-  Complex Drives Control
-  Load Flow
-  Grid Code Compliance



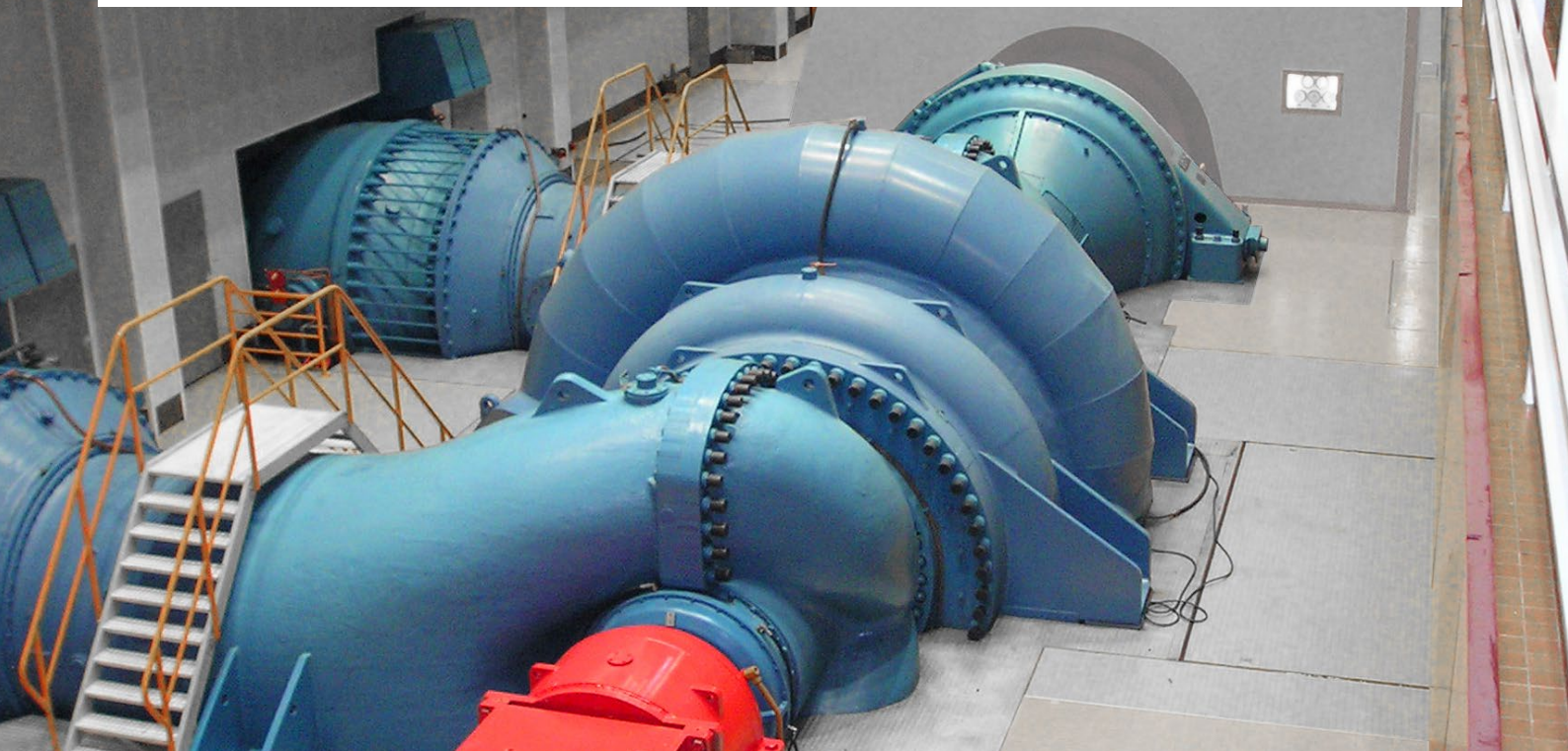


FEATURES OF SIMSEN SIMULATION SOFTWARE

- **From water to wire modelling**
- Modular structure with arbitrary topology
- No restriction on the network size
- Three phases systems in ABC phase quantities
- Events detection and back-tracking
- Load-Flow calculation
- Parameterization
- **Harmonics analysis, eigen values, eigen vectors calculation and representation**
- **FMU 1D-3D co-simulation with CFD**



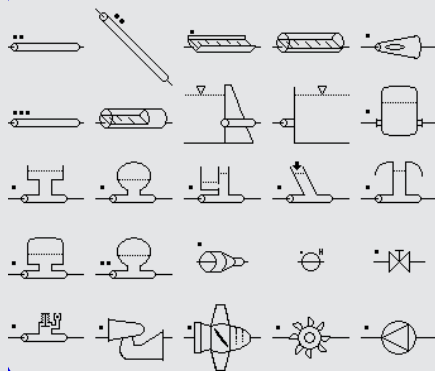
SIMSEN GRAPHICAL USER INTERFACE



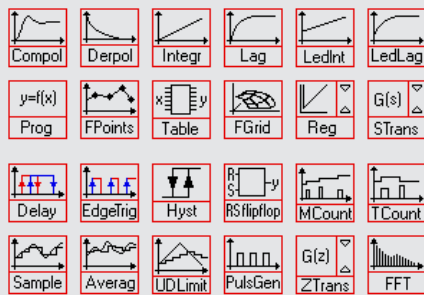


INCLUDED LIBRARIES

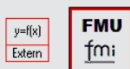
HYDRAULIC SYSTEMS



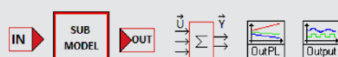
ANALOG & DIGITAL CONTROL BLOCKS



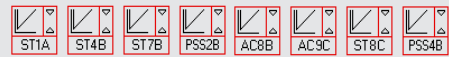
APPLICATION COUPLING



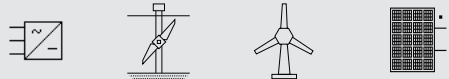
SPECIAL UNITS



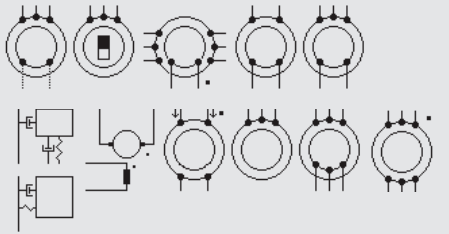
IEEE STANDARD EXCITATION SYSTEMS AND PSS



NEW RENEWABLE AND AVERAGE CONVERTS



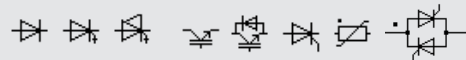
ELECTRICAL MACHINES AND ROTATING INERTIAS



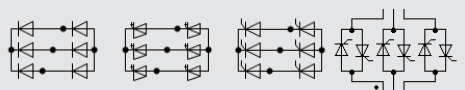
1 PHASE UNITS



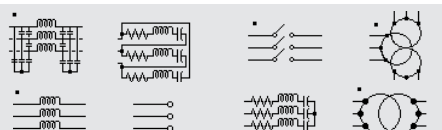
1 PHASE SEMI-CONDUCTORS



3 PHASES CONVERTERS



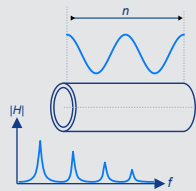
3 PHASES UNITS



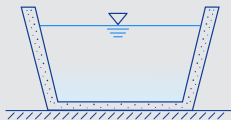


ADD-ON LIBRARIES

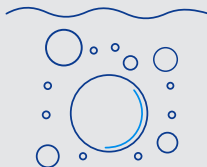
LIBRARY A: FREQUENCY DOMAIN (SPECTRAL) ANALYSIS TOOLS



LIBRARY B: OPEN CHANNEL



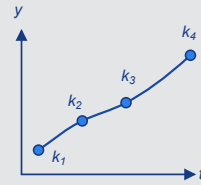
LIBRARY C: TWO-PHASE FLOW



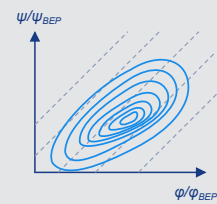
LIBRARY D: SCRIPTING TOOLS



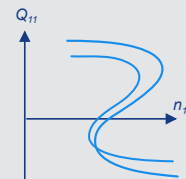
LIBRARY E: ADVANCED INTEGRATION METHODS



LIBRARY F: HYDRAULIC TURBINE CHARACTERISTICS



LIBRARY G: HYDRAULIC PUMPS AND REVERSIBLE FRANCIS PUMP- TURBINE CHARACTERISTICS



LIBRARY H: FUNCTIONAL MOCKUP INTERFACE (FMI)

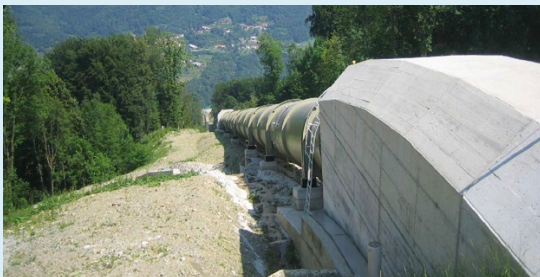




SPECIFIC FEATURES

HYDRAULIC SYSTEMS

- Water hammer calculation
- **4 quadrants transient behavior**
- **Francis/Pelton/Kaplan/Pumps and reversible Francis pump-turbines**
- Surge tanks, surge shafts, differential surge tanks
- PID Turbine governors
- Hydroelectric interactions
- Cavitation/Water column separation
- Open channel flows
- Piezometric line visualization
- **Database of realistic 4/2 quadrants characteristics for Francis & Pelton turbines, pumps, reversible Francis pump-turbine**



ELECTRICAL POWER NETWORKS

- Electrical 3ph machines models 2.1-3.3 according to IEEE standard 1110
- Single phase synchronous machine model
- Electromagnetic transients in AC/DC
- **Transient stability and general fault analysis**
- SubSynchronous Resonance (SSR)
- Torsional analysis
- FACTS, HVDC, SVC
- **Grid code compliance (FRT)**
- **IEEE Standard excitation systems and PSS**



ADJUSTABLE SPEED DRIVES

- **DFIM FSFC modelling**
- Power electronics converters
- Multi level modular converters (MMC)
- Voltage Source Inverters (VSI)
- LCI 6 and 12 pulses
- **Cyclo-converters**
- **Analog/digital mixed signals simulation**
- **PWM PLL based control**
- Vector control
- IGBT GTO Thyristor



REGULATION PART

- Easy definition of any control structure
- S-transfer functions, PID regulator
- Programmable unit, logical table
- Digital devices, Z-transfer functions
- Control devices, on-line FFT
- User defined DLL for control
- **Coupling with external application (Matlab, Labview, EMTP-RV, Electromagnetic/Fluid FEM, HIL, etc)**





SIMSEN

SIMULATION SOFTWARE FOR HYDRAULIC & ELECTRIC SYSTEMS ADJUSTABLE SPEED DRIVES

They are using SIMSEN:



EPFL

SIMSEN Research and ownership:

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CH-1015 Lausanne
Switzerland +
simсен.epfl.ch
simсен@epfl.ch



Demo version available on:
<http://simсен.epfl.ch>



HDE

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ENGINEERING SA

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