



1D-3D FMI co-simulation between SIMSEN and CFX

Hydraulic systems may experience excitation caused by complex flow patterns within various components of the system. A computationally effective way to predict the interaction between the hydraulic system and the excitation source is to conduct a co-simulation using two independent simulation codes. One code models the fluid pipe system using a one-dimensional compressible approach, while the other code simulates the excitation source with a three-dimensional model. Recognized as a standard communication protocol for linking two simulation codes that solve a system of ordinary differential equations, the Functional Mockup Interface, FMI, protocol has been implemented in SIMSEN to couple with the Ansys CFX software solution. The FMI feature has been used for simulations of three test cases involving different physics of interest occurring in hydroelectric power plants: water hammer in piping systems, mass oscillation induced by surge tank device and resonance with piping systems induced by cavitating flow conditions. By increasing complexity of the test case, it is shown that this approach is valid to address complex unsteady, compressible and cavitating flow phenomena.

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