# Tutorial 3: Pressure Transients a Water Pipe

# Problem Description:

A pipe with an inner diameter of 0.8 m, a wall thickness of 0.019 m, and a length of 6000 m connected to a reservoir with water is considered. Friction pressure drop shall be calculated using the Darcy Weisbach friction factor formula with a roughness value of 2 mm. Pipe material is stainless steel (Youngs modulus = 100 GPa, Poisson’s ratio = 0.26). The initial fluid velocity is 1.5 m/s. The steady-state pressure head in the upper reservoir is 100 m. The transient pressure in the pipe when a value at the pipe end is closed needs to be estimated. Valve closure time is 20 s (linear flow reduction to be assumed). The bulk modulus of elasticity of water is 2.07 GPa, density is 1000 kg/m3, and kinematic viscosity is 1.31 x 10-6 m2/s.

# Results

Simulation is carried out with a time step size of 0.005 s. The results are compared against analytical results (Method of Characteristics MOC) [16]. The pressure evolutions at the outlet and the half-length of the pipe are shown in Figure 1 and Figure 2, respectively. The results show good agreement with the literature. Thus, the code can effectively simulate pressure transients in incompressible (Problem 3.2.3) and compressible (Problems 3.2.1 and 3.2.2) flow networks.

Chart, line chart

Description automatically generated

Figure 1: Evolution of Pressure at Pipe Outlet (Problem 3.2.2)

Chart, line chart

Description automatically generated

Figure 2: Evolution of Pressure at Pipe Half Length (Problem 3.2.2)