Oscillating cylinder across a channel

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TIn this test, we consider a cylindrical pillar oscillating in a cuboid channel as shown in Figure 1. The size of the cuboid is: length $L = 3$, height $H = 1$ and width $W = 1$. The cylinder is located at the center of the cuboid, with base's radius of $r = 0.05$ and height $h = 0.8$. We use a symmetry boundary condition on the top, front and back surfaces of the cuboid, all the velocity components are fixed to be zero at the bottom of the cuboid, and the inlet and outlet flow are defined by:

$$u_x = 15y\,(2-y)\,sin\,(2\pi t)\,, \quad u_y = u_z = 0. \tag{1}$$

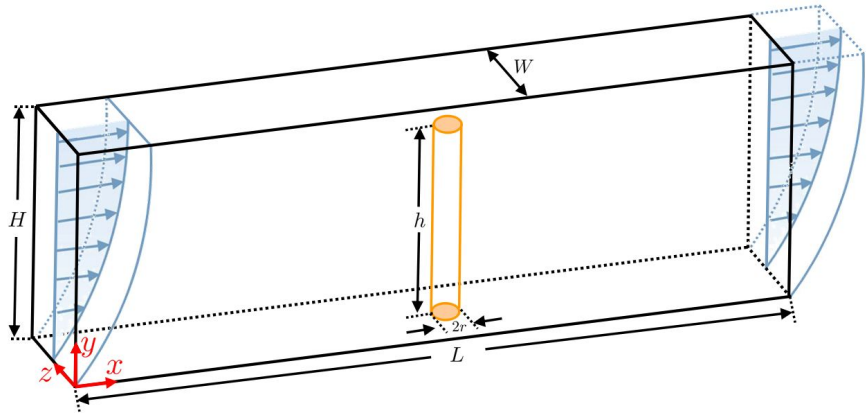

Figure 1: Sketch of the oscillating cylinder in a cuboid.

We use a uniform mesh of size of 0.05 in all directions and time step of $\Delta t = 1.0 \times 10^{-4}$. In order to visualize the results of this simulation, snapshots of the velocity norm on the background mesh and the solid deformations are presented in Figure 2 and 3 respectively.

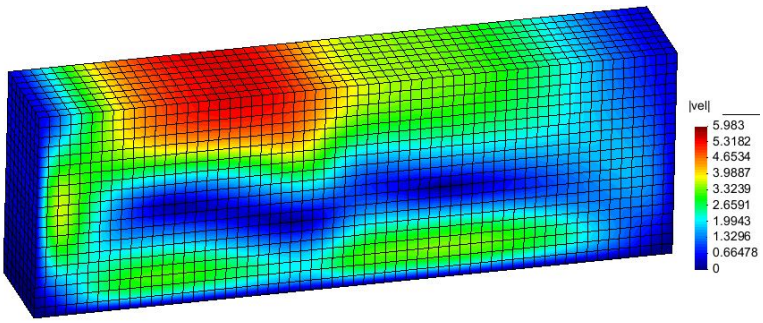

Figure 2: Velocity norm at $t = 2.0$.

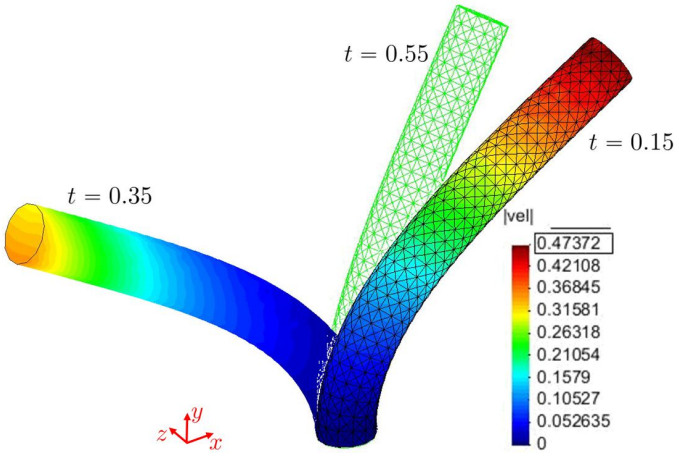

Figure 3: Solid deformation at three different stages.