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CABLE DYNAMICS IN AN INTERNAL FLOW WITH OBSTACLES

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In this 3D study, we consider cable dynamics inside a duct to understand how cables do or do not get stuck on obstacles. While cable motion strongly depends on the surrounding flow, the flow is not influenced much by the cable motion because the blockage is very small. Therefore, we assume one-way dependence between the cable and the flow field. First, we compute in 3D the flow inside the channel (see Figure 1) and store the time-dependent flow data. Then we compute several different patterns of cable dynamics (see Figure 2).

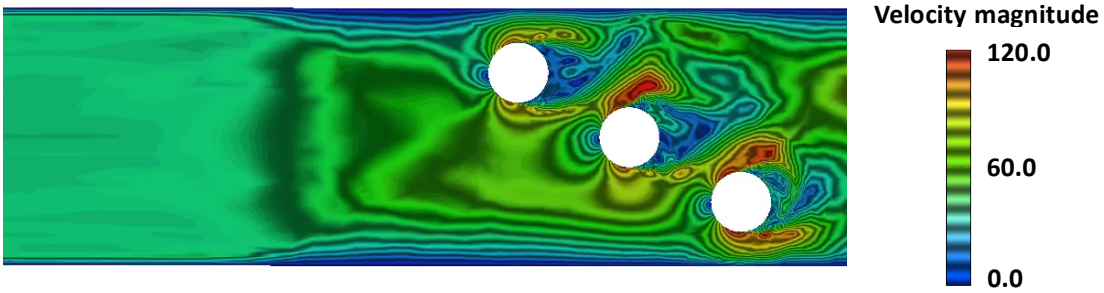

Figure 1. Cross-sectional view of the flow past three cylinders from 3D computation. The velocity magnitude is in m/s, and the cylinder diameter is 2 cm.

In computing the flow field, we use ST-VMS method [1]. The forces acting on the cable are computed based on the technique we have developed for parachute suspension lines [2], and the contact between the cable and an obstacle is based on the Surface-Edge-Node Contact Tracking (SENCT-FC) technique [3]. To store the flow data we use the space–time successive projection technique [4].

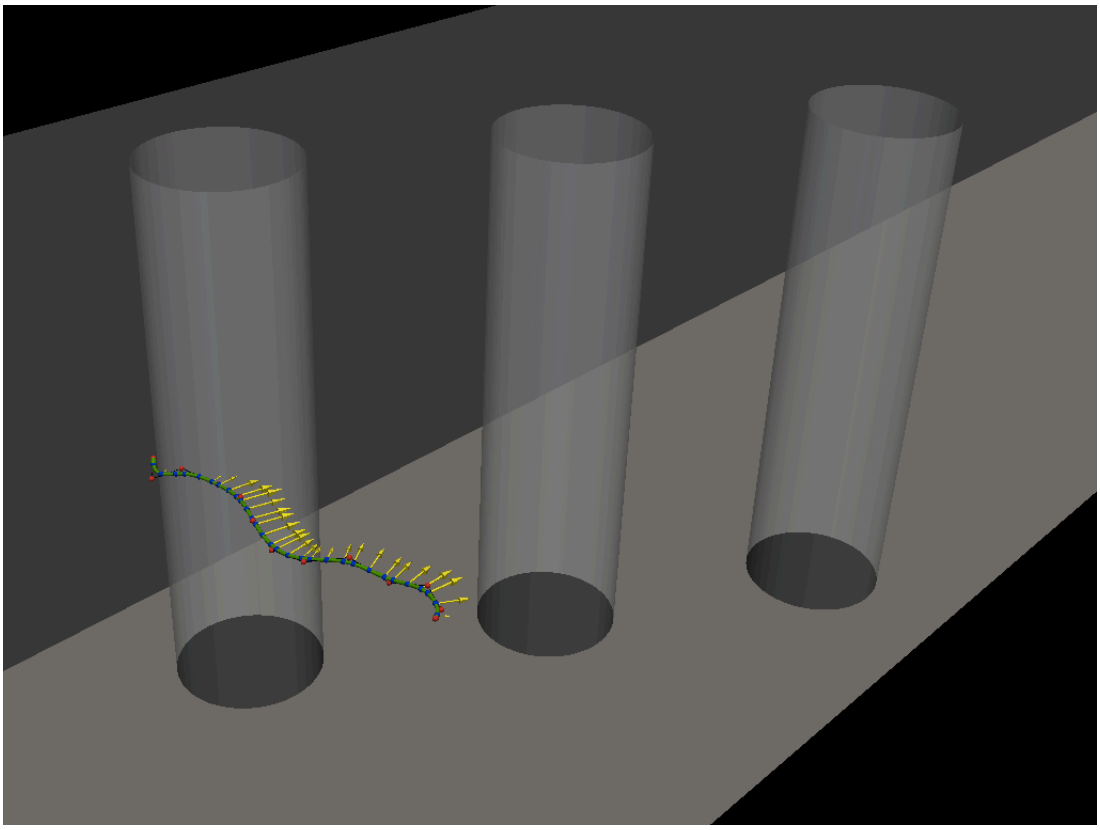

Figure 2. Cable dynamics when in contact with an obstacle. The arrows show the fluid force at each integration point along the cable.

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