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Experimental investigation of flow-structure interaction between a model biofilm streamer and water flow FARZAN KAZEMIFAR, GIANLUCA BLOIS, University of Notre Dame, SUMIT SINHA, RICHARD HARDY, Durham University, JAMES BEST, University of Illinois, GREGORY SAMBROOK SMITH, University of Birmingham, KENNETH CHRISTENSEN, University of Notre Dame
— Biofilms are permeable and deformable material whose bulk structure is composed of extracellular polymeric substance (EPS) that houses bacterial colonies. The EPS is responsible for the mechanical properties of the biofilm. In this study we investigate the fluid-structure interaction between a model biofilm streamer and water flow in a closed-loop water channel in the laminar and transitional flow regimes, using the particle image velocimetry (PIV) technique. The model streamer is fabricated from acrylamide polymer hydrogel. The purpose for using this material is twofold: 1) its mechanical properties (i.e. elastic modulus) can be tuned by controlling its chemical composition, 2) the hydrogel is transparent with a refractive index (RI) very close to that of water, thus minimizing the optical distortions for flow visualization. The velocity vector fields obtained from PIV measurements are used to investigate the temporal evolution of the flow structure in the vicinity of the streamer, focusing on the vortex shedding mechanism and the resulting oscillations of the streamer.

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