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Control of Flow past a Stationary Circular Cylinder: Effects of a Single Straight Wire and a System of Helical Wires ALIS EKMEKCI, University of Toronto, DONALD ROCKWELL, Lehigh University — Effects of geometric disturbances on the surface of a circular cylinder are investigated experimentally via Particle Image Velocimetry (PIV). Consideration is given to a single straight wire and a system of three equidistant helical wires. The Reynolds number is 10,000 and the scale of the wire is about one percent of the cylinder diameter; moreover, the wire diameter is smaller than the thickness of the unperturbed boundary layer developing around the cylinder. A straight wire, located at an angle of 60° from the forward stagnation point of the cylinder, yields bistable shear layer oscillations between two distinct states involving reattachment and no reattachment downstream of separation at the wire. For the helical wire system, bistable oscillations also occur at the flow cross-section where the helical wire passes through this same critical angular location on the cylinder surface. These types of small-scale geometric disturbances do not attenuate the Karman instability in the presence of bistable oscillations. However, they markedly influence the onset of instability of the separated shear layer.

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