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Adaptable Fluidic Control of Round Inlet Flow in Cross Flow[1]
DEREK NICHOLS, BOJAN VUKASINOVIC, ARI GLEZER, Georgia Institute of Technology, MATTHEW DEFORE, BRADLEY RAFFERTY, The Boeing Company — Asymmetries in the suction flow into a round inlet are investigated in wind tunnel experiments in the presence of lateral flow across its entrance plane. For a given inlet flow, the presence of supercritical cross flow leads to the formation of a three-dimensional, horseshoe-like azimuthal separation domain having its tip near the center of the windward inlet surface. The evolution of the separation topology and its response to fluidic actuation using distributed arrays of surface-embedded fluidically-oscillating jets are investigated over a range of inlet flow rates and supercritical cross flow speeds. Because the azimuthal orientation and extent of the separation domain change with the inlet flow rate, azimuthally-varying control approaches are devised for optimal suppression of the separation at different inlet flow rates using spatially-varying fluidic actuation patterns. It is shown that this control approach yields significant broadband reduction of the total pressure distortions that are induced by the azimuthal separation and that switching between the azimuthal distributed actuation domains can effect optimal suppression of these distortion.

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