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Mechanical model of separation phenomena ROUSLAN KRECHETNIKOV, JERROLD E. MARSDEN, Caltech, HASSAN M. NAGIB, IIT — In this talk we discuss the low-dimensional modelling of separated flows. First, we recall the essential physics and identify the governing variables, which highlight a non-Eulerian character of the main dynamical entity – the separation bubble. The extraction of this most essential information demonstrates a universality of the separation bubble behavior and its striking similarity to the dynamics of real bubbles or drops in interfacial physics. This suggests the existence of a low-dimensional model that captures the main features of separation phenomena. Guided with this observation, we develop a mechanical analog for the behavior of separated fluid flows. In view of the complexity of the dynamics, the low-dimensional model at this stage is intended to capture only some of the essential features of the phenomena, namely the primary bifurcation and the hysteresis. The construction of the model also provides a deeper look at the physical mechanisms which govern the separation bubble. Our study is motivated by the problem of active flow control with the goal that the resulting low-dimensional model can serve as a model-based observer for a closed-loop control.

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