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Rare event-triggered transitions in aerodynamic bifurcation: a model from the transition to turbulence ARIANE GAYOUT, MICKAEL BOURGOIN, NICOLAS PLIHON, Laboratoire de Physique, ENS de Lyon, CNRS, France — Subcritical bifurcations in flows encompass a wide diversity of phenomena, spanning from the transition to turbulence to wake instability on 3D bluff bodies. When subject to a flow in a wind tunnel, a disk pendulum presents a subcritical bifurcation with the coexistence of two aerodynamic branches, one governed by drag and the other by lift. Between these branches, spontaneous transitions are observed experimentally. The waiting times ahead of the transitions are distributed following a double-exponential as a function of the control parameter, covering four orders of magnitude in time, for both transitions, thus reminding of the transition to turbulence. Applying a model originally thought for the transition to turbulence, we show that the observed transitions are controlled by rare events occurring in the aerodynamic forces acting on the disk. We then link these events to vortex shedding-induced fluctuations. By studying a simple yet complex in its behavior system, this work provides a direct application of transition-to-turbulence models that could be further extended to other out-of-equilibrium systems.

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