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Streamline Topology of the Nearwake of a Circular Cylinder at Low Reynolds Numbers

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We consider the topology of instantaneous streamlines in the wake behind a circular cylinder. Using bifurcation theory, we describe the possible streamline patterns that may occur as the symmetric pair of vortices in the steady flow is perturbed. The result of the analysis is a two-parameter bifurcation diagram. We show that two different sequences of patterns in the periodic regime are to be expected. From numerical simulations we verify the existence of these sequences. At Re = 42, the flow becomes periodic, and the first sequence of patterns exists until Re = 45. For Re > 45 the second sequence exists, and no further qualitative changes occur for Re < 200 where 3D effects will become important. The present results differ from the scenario proposed by Perry et al. (J. Fluid Mech. 116, 1982) on the basis of experiments.

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