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Bifurcations and symmetry breakings in the wake of a disk DAVID FABRE, FRANCK AUGUSTE, JACQUES MAGNAUDET, IMFT — We investigate by means of numerical simulations the wake of a circular flat disk. As for the related problem of a solid sphere, the flow experiences two successive bifurcations as the Reynolds number is increased. The first of these occurs for $Re \approx 115.5$ and breaks the axial symmetry, leading to a steady state with only a reflexional symmetry, characterised by the presence of a pair of counterrotating vortices and by the appearance of a constant lift force on the body. The second bifurcation occurs for $Re \approx 121.5$ and breaks the time invariance, leading to a periodic state. However, in contrast with the case of a sphere, this second bifurcation breaks the reflexional symmetry. The resulting state is fully three-dimensional, and the lift force exerted on the body oscillates in both amplitude and direction around a nonzero mean value. Then, a third bifurcation is observed for $Re \approx 139.5$, where the wake recovers a reflexional symmetry. In the resulting state the lift force oscillates around zero along a fixed direction. A model based on the normal form describing the interaction of a steady-state bifurcation and a Hopf bifurcation in presence of $O(2)$ symmetry is presented. This model allows us to reproduce the three successive bifurcations observed numerically, and to explain the differences with the case of a solid sphere. The application of this model to other cases of fixed or moving axisymmetric bodies will also be discussed.

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