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Nonlinear stability of a swirling jet interacting with a solid wall¹ JOAQUIN ORTEGA-CASANOVA, RAMON FERNANDEZ-FERIA, University of Malaga (Spain) — We consider in this work the nonlinear stability of a q-vortex interacting with a solid surface perpendicular to its axis at moderately high Reynolds numbers. We use a direct numerical simulation based on a potential vector formulation with a Fourier decomposition in N azimuthal modes. This method is specially suited for the study of the nonlinear stability of axially symmetric flows because one may follow the raising of the different non-axisymmetric modes from just numerical noise, their nonlinear development, and their nonlinear interaction. For a given Reynolds number we find that there exists different transitions as the swirl number is raised, including the development of non-axisymmetric instabilities for different azimuthal modes, their mutual nonlinear interaction, and the formation of a vortex breakdown bubble that turns the flow almost axisymmetric again. We compare these transitions with those appearing in the same flow in absence of the solid wall, and discuss the relevance of the results in the context of seabed excavation processes.

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Ramon Fernandez-Feria University of Malaga (Spain)

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