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Helical vortex systems: linear instability analysis and nonlinear dynamics CAN SELUK, LIMSI — We investige the stability properties of helical vortices. Instabilities in such vortex systems have mainly been studied theoretically (Widnall 1972, Okulov and Srensen 2007) in an inviscid framework for small core size vortices. The aim of the present study is to generalize these works to the viscous framework for arbitrary core sizes and vorticity profiles. The base flows considered here are helically symmetric: fields are invariant through combined axial translation of distance Δz and rotation of angle $\Delta\theta = \Delta z/L$ around the z-axis, where $2\pi L$ denotes the helix pitch. We first perform a linear temporal stability analysis of these base flows, using an Arnoldi procedure coupled to two different codes: (i) a linearised version of the helical DNS code HELIX, (ii) another linear code called HELIKZ, which computes the dynamics of arbitrary perturbations in the vicinity of a helically symmetric base flow. These two codes permit the investigation of different types of instability modes: (i) modes having the same helical symmetry as the base flow which generalize the Okulov modes ; (ii) modes depending on z as $\exp ikz$ which generalize the Widnall modes.

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