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Viscous and inviscid centre modes in vortices: the vicinity of the neutral curves DAVID FABRE, IMFT, STÉPHANE LE DIZÉS, IRPHE — Le Dizès & Fabre (2007) have recently demonstrated that if the Reynolds number is sufficiently large, all trailing vortices with non-zero rotation rate and non-constant axial velocity become unstable with respect to a class of viscous centre modes. They have provided an asymptotic description of these modes which applies away from the neutral curves in the (q, k)-plane, where q is the swirl number which compares the azimuthal and axial velocities, and k is the axial wavenumber. Here, we complete the asymptotic description of these modes for general vortex flows by considering the vicinity of the neutral curves. Five different regions of the neutral curves are successively considered. In each region, the stability equations are reduced to a generic form which is solved numerically. The study permits to predict the location of all branches of the neutral curve (except for a portion of the upper neutral curve where it is shown that near-neutral modes are not centre modes). We also show that four other families of centre modes exist in the vicinity of the neutral curves. The asymptotic results are compared to numerical results for the case of the q-vortex model, and a good agreement is demonstrated for all the regions of the neutral curve.

> David Fabre IMFT

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