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Transient growth of perturbations in a columnar vortex FAZLE HUSSAIN, DHOORJATY PRADEEP, University of Houston — Linear transient growth is studied in a normal-mode-stable vortex. Energetically "optimal" perturbations – attaining over thousand-fold amplification at moderate Reynolds numbers, $Re \sim 10^4$ – grow via two inviscid mechanisms: (*a*) 2-D perturbations with "positive-tilt" streamlines (contributing positive Reynolds stress, hence production) grow until the mean swirl transforms the streamlines to "negative tilt" (negative stress); (*b*) 3-D perturbations grow via the tilting and stretching of perturbation radial vorticity. Competition between the amplifying effect of mean strain and growth-arresting effect of mean vorticity, in addition to viscous damping, fixes the optimal radius of initial perturbation. With increasing growth, axisymmetric, $m = 0$, modes originate at increasingly larger radii outside the core, whereas $m = \pm 1$ modes are localized close to the vortex axis, where they resonantly excite vortex core waves. Resulting strong growth of bending waves appears likely to cause core transition, hence enhanced vortex decay – a phenomenon of interest in high-Re practical flows, e.g. aircraft wake.

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