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Amplification of Three-Dimensional Perturbations during Nominally Parallel Vortex-Cylinder Interaction XIONGBIN LIU, JEFFREY MARSHALL, University of Iowa — A computational study is reported which examines the amplification of three-dimensional flow features for nominally parallel vortex-cylinder interaction problems. We consider a helical vortex with small-amplitude perturbations that is advected onto a circular cylinder whose axis is parallel to the nominal vortex axis. The study assesses the applicability of the two-dimensional flow assumption for parallel vortex-body interaction problems in which the body impinges on the vortex core. The computations are performed using an unstructured finite-volume method for an incompressible flow, with periodic boundary conditions along the cylinder axis. Growth of three-dimensional flow features is quantified by use of a proper-orthogonal decomposition of the Fourier-transformed velocity and vorticity fields in the cylinder azimuthal and axial directions. The interaction is examined for different axial wavelengths and amplitudes of the initial helical waves on the vortex core, and the results for cylinder force are compared to the two-dimensional results.

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