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Modification of mean wake flow behind very slender axially symmetric bodies by nonlinear convectively unstable helical modes J.T.C. LIU, KISEOK LEE, School of Engineering, Brown University — Recent experiments of Asai, et al. (2011) confirm earlier experiments of Sato & Okada (1966), Peterson & Hama (1976) that, for sufficiently slender axially symmetric bodies placed in a stream parallel to the axes, only convectively unstable modes exist. This is exploited theoretically (and computationally) by imposition of the most unstable helical modes to modify the otherwise round laminar wake flow. The local linear region is first considered theoretically to obtain the group velocities as a function of the streamwise distance, and which compared well with existing measurements. This information in used as convection velocity in a time-dependent nonlinear computation, as suggested by Spalart & Yang (1987) in the boundary layer case. The Reynolds stress modification of the developing laminar mean wake flow is assessed. The round wake is modified into an elliptic-like cross section for equal amplitudes for the n=+1,-1 modes; the consequences of unequal upstream amplitudes, such as a would be found in a slight axis misalignment, are presented. Accompanied are the energy transfer mechanisms between the mean flow and the modal content and that between the modes.

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