LadHyX Seminar – July 7, 10:45, – LadHyX Library

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Dynamics and Bifurcations of Swirling Jets

Among the family of canonical shear flows, swirling jets represent a remarkable genus with widespread practical and scientific interest. Despite this interest, the swirling jet parameter space has proven difficult to repeatably characterize via experiments and conventional time-marching computations. Even in the laminar regime, swirling jets host a suite of rich physics related to the complex interplay among axial and azimuthal shear layers, centrifugal forces, propagating inertial waves, and various geometric effects. These myriad interactions lead to pronounced nonlinear effects including, in particular, multivalued relationships among distinct steady and unsteady states. In this seminar, I will summarize results from three recent reports that rigorously characterize the dynamics and bifurcations of circular and annular laminar swirling jets using branch continuation methods. This approach allows a concrete exposition of the swirling jet's underlying state space, which can then be related back to its behavior in the physical space. The chosen examples offer insight into several important dynamical features of swirling jets including central jet/wall jet transitions and precessing vortex core (PVC) oscillations.