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Transition to Turbulence in Stenotic Flows SONU VARGHESE, STEVEN FRANKEL, Purdue University, PAUL FISCHER, Argonne National Laboratories, Argonne, IL — Direct numerical simulations (DNS) of pulsatile flow through 75% (by area reduction) stenosed tubes have been performed, with the motivation of understanding the biofluid dynamics of actual stenosed arteries. The spectral-element method, providing geometric flexibility and high-order spectral accuracy, was employed for the simulations. DNS predicts a laminar flowfield downstream of an axisymmetric stenosis and comparison to previous experiments showed good agreement in the immediate post-stenotic region. However, the introduction of a geometric perturbation at the stenosis throat, in the form of an eccentricity that was 5% of the main vessel diameter, resulted in jet breakdown and transition to turbulence in the post-stenotic flowfield. Transition to turbulence was achieved as a starting vortex structure that formed during early acceleration broke up into elongated streamwise structures that subsequently underwent turbulent breakdown during peak inlet flow, confirmed by turbulent statistics and broadband velocity spectra. The impact of the flow on a hemodynamically significant parameter like wall shear stress was also studied.

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