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Instability and transition modes of pulsatile stenotic flow HUGH BLACKBURN, CSIRO Australia, SPENCER SHERWIN, Imperial College London — Stability of pulsatile stenotic flow in an axisymmetric tube with a smooth 50% diametral stenosis is examined using Floquet analysis and direct numerical simulation. Inflow is a linear combination of Hagen–Poiseuille flow and a single fluctuating harmonic, giving a peak-to-mean ratio of 1.75. The two controlled parameters are Reynolds number and reduced velocity (alternatively, Reynolds number and Womersley number). The main features of the axisymmetric flows are vortex rings that are blown out of the stenosis throat with each pulse, and a shear layer trailing in the wake of each vortex that becomes more extended as reduced velocities increase. Two primary three-dimensional instability modes associated with the vortex rings are found: an alternating vortex-ring-tilting mode that is the most unstable mode at high reduced velocites, and a pair of wavy-vortex-core (or Widnall) modes that dominate at lower reduced velocities. Both these global modes lead to localized turbulent bursts, and these move upstream with time so that asymptotically the bursts occur within a comparatively few diameters of the throat. In addition, the extended shear layers that trail behind the vortex rings at high reduced velocities are susceptible to axisymmetric convective instability, and it is found that this can interact with and promote the global vortex-tilting mode.

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