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Optimal transient disturbances in stenotic flows HUGH BLACKBURN, Monash University, SPENCER SHERWIN, Imperial College London, DWIGHT BARKLEY, University of Warwick — Separating flows in stenotic geometries can have extended shear layers that are extremely sensitive to disturbance, leading to very large disturbance energy growth, even if the flow is stable in the large time limit. By adapting numerical methods for analysis of linear transient disturbance growth to cope with arbitrary domain geometries, we have been able for the first time to compute transient growth in comparatively simple (axisymmetric) stenotic geometries, for both steady and pulsatile inflows. At Reynolds numbers well below the stability limit, we find that extremely large (e.g. eight-to-ten magnitude) energy growth is possible for optimal disturbances. For the flows examined, optimal disturbances take the form of sinuous waves that grow on initially axisymmetric shear layers, and exhibit characteristics of local convective instability. The practical implication is that transient response to perturbation, rather than flow instability, is likely to dominate observed features for physiological studies of many separated flows.

[X] Prefer Oral Session
[ ] Prefer Poster Session

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