
SANJEEVA BALASURIYA, University of Adelaide

Analogues of eigenvectors and their control in nonautonomous flows

In autonomous flows, eigenvectors of saddle fixed points are locally tangent to stable and unstable manifolds, which form important flow separators. Computing fixed points or instantaneous eigenvectors however does not identify local flow separators in nonautonomous flows. The correct analogues of eigenvectors are time-parametrised local tangents to time-varying stable and unstable manifolds at hyperbolic trajectory locations. These vectors indeed represent Oseledets spaces. For two-dimensional nearly-autonomous flows, these analogues are characterised in terms of a time-history of local velocity shear using definitions which can be applied to both finite- and infinite-time flows. The reverse question of whether one can force the Oseledets spaces to vary in any prescribed time-varying fashion is also addressed. A methodology for controlling the 'eigenvector' directions in this way by applying a local velocity shear is developed. The control method is verified for both smoothly and discontinuously time-varying directions using finite-time Lyapunov exponent fields, and excellent agreement is obtained.