Time Dependent Stability: Computation and Applications

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Time dependent stability spectra such as Lyapunov exponents and Sacker-Sell spectrum provide stability information for time dependent solutions of differential equations. These stability spectra fill roles that real parts of eigenvalues play for time independent solutions. In this talk we review time dependent stability spectra and their properties, numerical techniques for extracting stability spectra and their approximation properties, and then turn our attention to applications of such stability spectra. Particular attention will be paid to time dependent stability of numerical time stepping techniques and stiffness detection and to applications to data assimilation via decomposition of the tangent space of nonlinear time evolving models into time dependent stable and unstable subspaces.