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A pseudospectra-based approach to non-normal stability of embedded boundary methods[1] NARSIMHA RAPAKA, RAVI SAMTANEY, King Abdullah Univ of Sci Tech (KAUST) — We present non-normal linear stability of embedded boundary (EB) methods employing pseudospectra and resolvent norms. Stability of the discrete linear wave equation is characterized in terms of the normalized distance of the EB to the nearest ghost node (α) in one and two dimensions. An important objective is that the CFL condition based on the Cartesian grid spacing remains unaffected by the EB. We consider various discretization methods including both central and upwind-biased schemes. Stability is guaranteed when $\alpha \leq \alpha_{\max}$ where $\alpha_{\max}$ ranges between 0.5 and 0.77 depending on the discretization scheme. Also, the stability characteristics remain the same in both one and two dimensions. Sharper limits on the sufficient conditions for stability are obtained based on the pseudospectral radius (the Kreiss constant) than the restrictive limits based on the usual singular value decomposition analysis. We present a simple and robust reclassification scheme for the ghost cells ("hybrid ghost cells") to ensure Lax stability of the discrete systems. This has been tested successfully for both low and high order discretization schemes with transient growth of at most $\mathcal{O}(1)$. Moreover, we present a stable, fourth order EB reconstruction scheme.

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