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Spectral Galerkin discretization for hydrodynamic stability problems. (English)

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Summary: We present a spectral Galerkin discretization for calculating the eigenvalues of Orr-Sommerfeld equation. The matrices of the resulting generalized eigenvalue problem are sparse. A convergence analysis of the method is performed which indicates that a) no spurious eigenvalues occur, and b) reliable results can only be expected under the assumption of scale resolution, i.e., that Re/p^2 is small; here Re is the Reynolds number and p is the spectral order. Numerical experiments support that the assumption of scale resolution is necessary in order to obtain reliable results. Exponential convergence of the method is shown theoretically and observed numerically.

MSC:

76M22	Spectral methods applied to problems in fluid mechanics	Cited in **6** Documents
76E05	Parallel shear flows in hydrodynamic stability	
65L15	Numerical solution of eigenvalue problems involving ordinary differential equations	

Keywords:

exponential convergence; hydrodynamic stability; eigenvalue problem; spectral Galerkin discretization; Orr-Sommerfeld equation; scale resolution

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