The Use of Linear Solvers in Generalized Eigenvalue problems for Flow Instability Analysis

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Viscous linear three-dimensional BiGlobal instability analyses of incompressible flows have been performed using finite-element numerical methods, with a view to extend the scope of application of this analysis methodology to flows over complex geometries. The initial-value-problem (IVP), based on the linearized Navier-Stokes equations (LNSE), as well as the real and the complex partial-di fferential-equation-based generalized eigenvalue problems (EVP), have been solved.
In either its real or its complex form, the EVP has been solved without the need to introduce pseudo-compressibility into the incompressible equations, which has simpli ed the systems to be solved without sacri cing accuracy. An Arnoldi approach has been used in order to recover the most signi cant eigenvalues. In this context, the associated solutions to the resulting linear systems were obtained by direct methods using the MUMPS library.