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An adaptive selective frequency damping method[1] BASTIEN JORDI, COLIN COTTER, SPENCER SHERWIN, Imperial College London — The selective frequency damping (SFD) method is used to obtain unstable steady-state solutions of dynamical systems. The stability of this method is governed by two parameters that are the control coefficient and the filter width. Convergence is not guaranteed for arbitrary choice of these parameters. Even when the method does converge, the time necessary to reach a steady-state solution may be very long. We present an adaptive SFD method. We show that by modifying the control coefficient and the filter width all along the solver execution, we can reach an optimum convergence rate. This method is based on successive approximations of the dominant eigenvalue of the flow studied. We design a one-dimensional model to select SFD parameters that enable us to control the evolution of the least stable eigenvalue of the system. These parameters are then used for the application of the SFD method to the multi-dimensional flow problem. We apply this adaptive method to a set of classical test cases of computational fluid dynamics and show that the steady-state solutions obtained are similar to what can be found in the literature. Then we apply it to a specific vortex dominated flow (of interest for the automotive industry) whose stability had never been studied before.

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