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One-way spatial integration of Navier-Stokes equations: stability of wall-bounded flows GEORGIOS RIGAS, TIM COLONIUS, Caltech, AARON TOWNE, Stanford University, MICHAEL BEYAR, Boeing Research & Technology — For three-dimensional flows, questions of stability, receptivity, secondary flows, and coherent structures require the solution of large partial-derivative eigenvalue problems. Reduced-order approximations are thus required for engineering prediction since these problems are often computationally intractable or prohibitively expensive. For spatially slowly evolving flows, such as jets and boundary layers, a regularization of the equations of motion sometimes permits a fast spatial marching procedure that results in a huge reduction in computational cost. Recently, a novel one-way spatial marching algorithm has been developed by Towne Colonius (JCP 300: 844-861, 2015). The new method overcomes the principle flaw observed in Parabolized Stability Equations (PSE), namely the *ad hoc* regularization that removes upstream propagating modes. The one-way method correctly parabolizes the flow equations based on estimating, in a computationally efficient way, the local spectrum in each cross-stream plane and an efficient spectral filter eliminates modes with upstream group velocity. Results from the application of the method to wall-bounded flows will be presented and compared with predictions from the full linearized compressible Navier-Stokes equations and PSE.

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