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Approximation of traveling wave solutions in wall-bounded flows using resolvent modes[1] BEVERLEY MCKEON, California Institute of Technology, MICHAEL GRAHAM, University of Wisconsin-Madison, RASHAD MOARREF, California Institute of Technology, JAE SUNG PARK, University of Wisconsin-Madison, ATI SHARMA, University of Southampton, ASHLEY WILLIS, Unversity of Sheffield — Significant recent attention has been devoted to computing and understanding exact traveling wave solutions of the Navier-Stokes equations. These solutions can be interpreted as the state-space skeleton of turbulence and are attractive benchmarks for studying low-order models of wall turbulence. Here, we project such solutions onto the velocity response (or resolvent) modes supplied by the gain-based resolvent analysis outlined by McKeon & Sharma (JFM, 2010). We demonstrate that in both pipe (Pringle et al, Phil. Trans. R. Soc. A, 2009) and channel (Waleffe, JFM, 2001) flows, the solutions can be well-described by a small number of resolvent modes. Analysis of the nonlinear forcing modes sustaining these solutions reveals the importance of small amplitude forcing, consistent with the large amplifications admitted by the resolvent operator. We investigate the use of resolvent modes as computationally cheap "seeds" for the identification of further traveling wave solutions.

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