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Orr-Sommerfeld and Squire modes in fully-turbulent channel flow[1] RYAN MCMULLEN, KEVIN ROSENBERG, BEVERLEY MCKEON, Caltech — The Orr-Sommerfeld (OS) and Squire (SQ) operators from classical stability literature have gained renewed interest in the context of linear analyses of turbulent shear flows. We demonstrate that the recently-proposed decomposition of the resolvent operator into two distinct families related to the OS and SQ operators (Rosenberg & McKeon, 2019) results in accurate low-order representations of the second-order statistics in turbulent channel flow. It is shown that the ability to match all components well is due to the isolation of the v response in the OS modes. This enables competition between the OS and SQ vorticity, which is interpreted as a phase difference between the two sets of modes. Additionally, the relative Reynolds number scalings for the two families of resolvent weights are derived for the universal classes of resolvent modes presented by Moarref et al. (2013). Implications for modeling nonlinear interactions in wall-bounded turbulence are discussed.

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