

Abstract Submitted
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The structure of the non-linear feedback term in resolvent analyses of turbulent wall-bounded flows¹ PIERLUIGI MORRA, KTH Royal Institute of Technology, PETRONIO A. S. NOGUEIRA, ANDR V. G. CAVALIERI, Instituto Tecnológico de Aeronáutica, DAN S. HENNINGSON, KTH Royal Institute of Technology — In resolvent analyses of turbulent channel flows it is common practice to neglect or model the non-linear forcing term which forms the input of the resolvent. However, the structure of this term is mostly unknown. Here, this non-linear forcing term is quantified. The cross-spectral density (CSD) of this term is computed. The CSD is evaluated for two channel flows at friction Reynolds numbers 180 and 550 via direct numerical simulations (DNS). It is found that the forcing is structured, and that it is the combination of oblique streamwise vortices and a streamwise component which counteract each other, as in a destructive interference. It is shown that a rank-2 approximation of the forcing, based on the spectral proper orthogonal decomposition (SPOD) modes, leads to the bulk of the response. Moreover, it is found that the non-linear forcing term has a non-negligible projection onto the linear sub-optimal forcings of resolvent analysis, which demonstrates that the linear optimal forcing is not representative of the non-linear forcing.

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