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Reduced-order model for near-wall dynamics with implications to wall-models PETER SCHMID, TARANEH SAYADI, Department of Mathematics, Imperial College London — The near-wall resolution requirements of wall-resolved large eddy simulations (LES) are almost as high as those of direct numerical simulations (DNS). This restriction severely limits the applicability of LES in high-Reynolds-number flows and complex geometries that are typical of engineering configurations. An alternative to the wall-resolved LES is the wall-modeled simulation, where the resolution requirement is relaxed by prescribing wall-stresses in the vicinity of walls. One such way of providing accurate values of wall-stresses is based on optimal flow-control techniques. In this study we propose models to extend the terminology of predictive control-based wall-models to complex geometries, by defining transfer functions relating the mean velocity to the second moments at an optimal planar location. As a result the added calculation in the near-wall region (for example RANS) will be omitted and replaced by boundary conditions described by pre-existing transfer functions. The relevant transfer functions are extracted using a data-driven as well as model-based approach. The predicted transfer functions are then compared to their system-identified equivalent for verification.

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