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A dynamic observer to capture perturbation energy in noise amplifiers JUAN GUZMAN, DENIS SIPP, Onera, PETER SCHMID, Ecole Polytechnique — We aim at building a reduced order model of a fluid system which accurately predicts the dynamics of a flow from a local wall measurement. This is particularly difficult in the case of noise amplifiers where the upstream noise environment triggering the receptivity of the flow is not known, which rules out classical Galerkin approaches to build reduced-order models. Here, we propose a methodology to obtain such a model from simultaneous time-resolved PIV and wall-shear stress measurements. The technique will be illustrated on the case of a transitional flat-plate boundary layer, where the snapshots of the flow are obtained with a DNS simulation. Yet, the considered approach is meant to be tractable in experiments so that special care has been taken to only use data available in an experiment. The proposed approach combines a reduction of the degrees of freedom of the system by a projection of the PIV snapshots onto a POD basis together with a system-identification technique to obtain a state-space model. Comparisons of velocity measurements at various places in the boundary layer between the DNS simulation and the obtained dynamic observer demonstrates the accuracy of the resulting model. Such a model may be used in a feedback control framework to delay transition.

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