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REDUCED ORDER SUBSCALES FOR POD MODELS

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In this work the Reduced-Order Subscales for Proper Orthogonal Decomposition models are presented. The basic idea consists in splitting the full-order solution into the part which can be captured by the reduced-order model and the part which cannot, the subscales, for which a model is required. The proposed model for the subscales is defined as a linear function of the solution of the reduced-order model. The coefficients of this linear function are obtained by comparing the solution of the full-order model with the solution of the reduced-order model for the same initial conditions, which, for convenience, are evaluated in the snapshots used to train the original reduced-order-model. The difference between both solutions are the subscales, for which a model can be built using a least-squares procedure. The subscales are then introduced as a correction in the reduced-order model, resulting in an important improvement in accuracy. The enhanced reduced-order model is tested in several numerical examples. These practical cases show that the use of the subscales leads to more accurate solutions, successfully corrects errors introduced by hyper-reduction, and allows to solve complex flow problems using a reduced number of degrees of freedom.