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Deep learning-based assignment of combustion submodels for large-eddy simulation WAI TONG CHUNG, Stanford University, AASHWIN MISHRA, Center for Turbulence Research, Stanford University, NIKOLAOS PERAKIS, Technical University Munich, MATTHIAS IHME, Stanford University — This work introduces a data-assisted approach in the form of a neural network classifier for local and dynamic combustion submodel assignment in simulations of a rocket combustor. In this data-assisted simulation three different combustion models – finite-rate chemistry (FRC), flamelet progress variable (FPV), and inert mixing (IM) models – are assigned in the same domain using neural networks. *A priori* and *a posteriori* assessments are conducted to (i) evaluate the accuracy and adjustability of the classifier for targeting different quantities-of-interest (QoIs), and (ii) assess improvements of the data-assisted simulations compared to monolithic FRC and FPV model utilization in predicting target QoIs during simulation runtime. Results from employing neural networks, trained with local flow properties as input variables and combustion model errors in temperature and emissions as training labels, are compared with results from employing random forests, representing another classication approach. These results demonstrate that the present data-driven framework holds promise for the dynamic combustion submodel assignment in reacting flow simulations.

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