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Uncertainty quantification and optimization of spray break-up submodel using regularized multi-task neural nets. XIANG GAO, Microsoft Research, HONGYUAN ZHANG, KRISHNA BAVANDLA, PING YI, SUO YANG, University of Minnesota — For a high-fidelity simulation of engine combustion, parameters of a spray atomization break-up submodel needs to be optimized for the specified conditions to match with the non-reactive experiment. The well-accepted KH-RT spray breakup model include at least 6 parameters and they are not independent of each other, thus cannot be optimized independently. Properly tuning is time-consuming and often need expertise-guide. We propose a regularized multi-task neural nets approach to find optimal submodel parameters θ at the working condition X that minimizes "error" ϵ. The proposed model includes two neural nets: a predictor and an autoencoder. Predictor is trained to predict the submodel parameters θ for a given X and ϵ. The optimal θ then can be estimated by setting ϵ as zero. Autoencoder is used to learn a latent representation of a pair of (X, θ), which is encouraged by a regularization term to share the same latent space as the predictor. For an unseen condition X and estimated optimal ϵ, we can use the autoencoder to find similar (X, θ) pairs from the training data to interpret the predictor prediction and quantify the uncertainty.

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