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A Multi-Fidelity Surrogate Model for the Equation of State for Mixtures of Real Gases[1] FREDERICK OUELLET, CHANYOUNG PARK, RAHUL KONERU, S. BALACHANDAR, Center for Compressible Multiphase Turbulence, University of Florida, BERTRAND ROLLIN, Embry-Riddle Aeronautical University — The explosive dispersal of particles is a complex multiphase and multi-species fluid flow problem. In these flows, the products of detonated explosives must be treated as real gases while the ideal gas equation of state is used for the ambient air. As the products expand outward, they mix with the air and create a region where both state equations must be satisfied. One of the most accurate, yet expensive, methods to handle this problem is an algorithm that iterates between both state equations until both pressure and thermal equilibrium are achieved inside of each computational cell. This work creates a multi-fidelity surrogate model to replace this process. This is achieved by using a Kriging model to produce a curve fit which interpolates selected data from the iterative algorithm. The surrogate is optimized for computing speed and model accuracy by varying the number of sampling points chosen to construct the model. The performance of the surrogate with respect to the iterative method is tested in simulations using a finite volume code. The model's computational speed and accuracy are analyzed to show the benefits of this novel approach.

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