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**Adjoint-based sensitivity of flames to ignition parameters in non-premixed shear-flow turbulence** JESSE CAPECELATRO, University of Michigan, DANIEL BODONY, JONATHAN FREUND, University of Illinois — The adjoint of the linearized and perturbed compressible flow equations for a mixture of chemically reacting ideal gases is used to assess the sensitivity of ignition in non-premixed shear-flow turbulence. Direct numerical simulations are used to provide an initial prediction, and the corresponding space-time discrete-exact adjoint is used to provide a sensitivity gradient for a specific quantity of interest (QoI). Owing to the ultimately binary outcome of ignition (i.e., it succeeds or fails after some period), a QoI is defined that both quantifies ignition success and varies smoothly near its threshold based on the heat release parameter in a short-time horizon during the ignition process. We use the resulting gradient to quantify the flow properties and model parameters that most affect the initiation of a sustained flame. A line-search algorithm is used to identify regions of high ignition probability and map the boundary between successful and failed ignition. The approach is demonstrated on a non-premixed turbulent shear layer and on a reacting jet-in-crossflow.

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