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Sensitivity Analysis of a Plane Mixing Layer using the Sensitivity Equation Method MOHSEN ZAYERNOURI, MEREDITH METZGER, University of Utah — Sensitivity field evolution of the incompressible, two-dimensional mixing layer to perturbations in both Reynolds number, Re_{δ_0}, and Prandtl number, Pr, has been examined using the sensitivity equation method. In this method, the sensitivity coefficients (i.e., the partial derivative of vorticity and temperature with respect to Re_{δ_0} and Pr) are obtained from direct numerical simulation of the sensitivity equations coupled with the governing equations of the fluid motion. This is achieved using an unsteady finite volume based fractional step algorithm. Coherent structures in the sensitivity field depict mechanisms responsible for enhanced vortex growth and scalar mixing with increasing Re_{δ_0} and Pr, respectively. Two distinct configurations were found in the sensitivity field of vorticity. The first configuration represents an increasing growth in the mixing layer as Re_{δ_0} increases, while the second configuration depicts the saturation state for the vorticity field. The sensitivity of the temperature field to changes in Pr exhibits a third configuration describing enhanced scalar with increasing Pr. These interpretations are confirmed with calculations of integral quantities, namely the rate of growth of the mixing layer with Re_{δ_0} and the evolution of the probability density function of the scalar field with Pr.

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