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A spray-flamelet formulation using an effective composition-space variable BENEDETTA FRANZELLI, AYMERIC VIÉ, MATTHIAS IHME, Center for Turbulence Research, Stanford — The modeling and simulation of spray flames is of primary importance as new combustion systems rely on the use of liquid fuels to feed the combustion process. The description of such flames is commonly performed using a mixture fraction variable that monotonically decreases from the fuel to the oxidizer side. Unfortunately, in the case of spray flames, this mixture-fraction variable is not monotonic as a result of the presence of an evaporation source term in the governing equations. To address this issue, a new composition space variable is defined, which is defined from the arc length along the gas-liquid mixture-fraction space. This monotonic definition enables the complete description of the spray-flame structure in composition space and the formulation of a well-posed spray-flamelet equation. A closure model for the scalar dissipation rate is proposed, and the potential of this effective composition-space variable is demonstrated by comparing simulation results in physical and composition space.

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