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Physics-based Modeling of Shrub Fires: Study of Distribution of Bulk Density and Moisture Content AMBARISH DAHALE, BABAK SHOTORBAN, Department of Mechanical and Aeropspace Engineering, The University of Alabama in Huntsville, SHANKAR MAHALINGAM, College of Engineering, The University of Alabama in Huntsivlle — We utilized a physics-based model to investigate the influence of the spatial variation of solid-fuel bulk density and the solid fuel-moisture content on the behaviour of a shrub fire. The model accounts for the interaction of fluid dynamics, combustion of solid and gas phases, convective and radiative heat transfer, and thermal degradation of solid fuel. The turbulence was dealt with large eddy simulation and the gas-phase combustion was modeled through filtered flame surface density approach [Zhou & Mahalignam, Phys. Fluids, 2002]. Predictions from the model were compared against the experimental results, and fairly good agreement was observed between them. Vertical fire spread rate within the shrub and the time to initiate the ignition within the shrub were significantly affected by the spatial variation of the bulk density. They were also significantly influenced by the variation of the fuel moisture content. The amount of fuel burnt was also impacted by the change of fuel moisture content. The specific mechanisms responsible for the reduction in propagation speed in presence of higher bulk densities and/or moisture content were identified.

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