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Numerical investigation of spontaneous flame propagation under Reactivity Controlled Compression Ignition (RCCI) conditions ANKIT BHAGATWALA, Sandia National Laboratories, RAMANAN SANKARAN, Oak Ridge National Laboratories, SAGE KOKJOHN, University of Wisconsin Madison, JACQUELINE CHEN, Sandia National Laboratories — Results from one and two-dimensional direct numerical simulations under dual-fuel Reactivity Controlled Compression Ignition (RCCI) conditions will be presented. These simulations employ an improved model of compression heating through mass source/sink terms developed in a previous work, which incorporates feedback from the flow to follow a predetermined experimental pressure trace. One-dimensional simulations explored the effect of temperature and fuel concentration gradients on the combustion mode. Two-dimensional simulations explored parametric variation in temperature stratification, pressure profiles and n-heptane concentration. Statistics derived from analysis of local diffusion/reaction balances were used to elucidate combustion characteristics for the different cases. Both deflagration and spontaneous ignition modes were observed to co-exist. Higher n-heptane concentration and higher level of thermal stratification resulted in a greater degree of flame propagation, whereas lower n-heptane concentration (higher fraction of iso-octane) and higher pressure resulted in more prevalent autoignition. Starting with a uniform initial temperature and a stratified n-heptane concentration also resulted in a large fraction of combustion occurring through flame propagation.

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