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Large eddy simulation of turbulent diffusion flame with hybrid fuel of CH4/H2 in various background conditions SUNGMIN HONG, WOOK LEE, Dept. of Mechanical Engineering, Sogang University, Korea, HAN HO SONG, Dept. of Mechanical and Aerospace Engineering, Seoul National University, Korea, SEONGWON KANG, Dept. of Mechanical Engineering, Sogang University, Korea
— A turbulent diffusion flame with hybrid fuel of methane and hydrogen is analyzed to investigate the effects of operating conditions on flame shape, rate of fuel consumption and pollutant formation. Various combinations of operating parameter, i.e. hydrogen concentration, background pressure and temperature, are examined in relatively high pressure and temperature conditions that can be found at the end of compression stroke in an internal combustion engine. A flamelet-progress variable approach (FPVA) and a dynamic subgrid scale (SGS) model are used for large eddy simulation (LES). A comparison with previous experiments and simulations in the standard condition shows a good agreement in the statistics of flow fields and chemical compositions, as well as in the resultant trends by similar parametric studies. As a result, the effects of added hydrogen are found to be consistent for most of the chemical species in the range of background pressure and temperature conditions. However, the flow fields of some species such as OH, NO, CO at a higher pressure and temperature state show a behavior different from the standard condition. Finally, hydrogen addition is shown to improve flame stability which is measured by the pressure fluctuations in all the tested conditions.

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