A Proposal for a Combustion Model Considering the Lewis Number and Its Evaluation

Authors : Fujio Akagi, Hiroaki Ito, Shin-Ichi Inage

Abstract : The aim of this study is to develop a combustion model that can be applied uniformly to laminar and turbulent premixed flames while considering the effect of the Lewis number (Le). The model considers the effect of Le on the transport equations of the reaction progress, which varies with the chemical species and temperature. The distribution of the reaction progress variable is approximated by a hyperbolic tangent function, while the other distribution of the reaction progress variable is estimated using the approximated distribution and transport equation of the reaction progress variable considering the Le. The validity of the model was evaluated under the conditions of propane with Le > 1 and methane with Le = 1 (equivalence ratios of 0.5 and 1). The estimated results were found to be in good agreement with those of previous studies under all conditions. A method of introducing a turbulence model into this model is also described. It was confirmed that conventional turbulence models can be expressed as an approximate theory of this model in a unified manner.

 ${\bf Keywords: combustion \ model, \ laminar \ flame, \ Lewis \ number, \ turbulent \ flame}$

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