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Impact of Mixed Boundary Conditions on Non-Premixed Combustion Model with a Low Diffusion Rate and Discontinuous Data: Higher Order Numerical Analysis

Abstract

In this talk, I shall mainly focus on the theoretical and computational impacts of mixed-type flux conditions and nonsmooth data on boundary/interior layer-originated singularly perturbed semi-linear reaction-diffusion problems. These problems appear in the non-dimensionalized form of non-premixed combustion models and catalytic reaction models. The inclusion of arbitrarily small diffusion term results in boundary layers. These boundary layer phenomena can be influenced by specific flux conditions, which are normalized by perturbation parameter. Additionally, the presence of a nonsmooth source function gives rise to interior layer phenomena. The aim of this talk is to show the effect adaptive meshes at the region of large gradients and their influence on rate of accuracy when standard discretizations are used. Nonlinear problems require extra attention as the standard discretizations are not effective for these cases. Theoretical results are supported by various experiments on nonlinear problems, illustrating the point-wise rates and highlighting both linear and higher-order accuracy at specific points.