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Chemical Kinetics Reduction of High Pressure Non-Equilibrium Plasma Discharges in Complex Gases Using Principal Component Analysis ASHISH SHARMA, LAXMINARAYAN L. RAJA, The University of Texas at Austin — Kinetic models of plasma discharge in complex gases involve solving the continuity equation for each reaction for updation of species at each time step. The number of reactions, especially in complex gases like methane, can be really large and thus, this approach is computationally expensive. It also makes the system very stiff due to orders of magnitude difference in rate constants. Principal Component Analysis (PCA) is technique which allows the identification of significant variables governing the course of a chemical kinetics model. This allows us to describe its behavior in a lower dimensional space with lesser variables and reduction is obtained since kinetic reactions only need to be solved for these principal components and not for all the species in the plasma discharge model. The non-linear nature of the source terms in plasma discharges also makes the traditional PCA technique less effective. In the current work an attempt has been made to develop an approach for reduction of chemical kinetics of non-equilibrium plasma discharges in methane gas at atmospheric pressure using PCA. The approach also explores the use of linear and non-linear source term reconstruction techniques for effective projection of source terms back to the higher dimensional space.

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