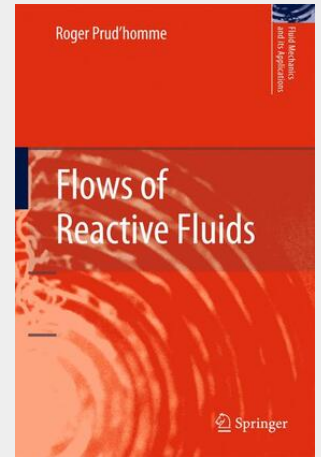


Flows of Reactive Fluids

Reactive fluids are present in many situations of great importance, such as in combustion chambers or around spacecraft re-entering the atmosphere. Analyzing the flow properties of such fluids represents one of the most difficult challenges to current technology. Indeed, all of the most difficult aspects of fluid mechanics appear to be grouped together in this research field! Such fluids are complex mixtures with compositions that vary rapidly in time and space. They are not usually at thermodynamic equilibrium, since the reaction times of the chemical reactions involved may not be negligible in comparison with the transit time of the fluid. However, the author of this book limits its scope to typical phenomena that are not very far from local equilibrium but can nevertheless exhibit the most important types of irreversible processes. The production of entropy is highly dependent on the chemical reaction pathway, which is difficult to simplify. Also, most of the classical problems that characterize fluid mechanics—such as turbulence, the presence of thin boundary layers or shear layers, and the propagation of acoustic waves and shock waves—are also present, and are much more difficult to analyze and describe than they are for homogeneous fluids, because reactive mixtures interact with these phenomena. For example, density is highly dependent on the chemical pathway since it is determined by the local and instantaneous production of chemical species, and so its value affects many other quantities through the equation of state and the balances of mass, momentum, and energy.

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