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Multicomponent reactive flows : symmetrization and the low Mach number limit

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We consider the equations governing multicomponent reactive flows derived from the kinetic theory of dilute polyatomic reactive gas mixtures. It was shown in [2] that there exists a generalized entropy which allows to derive a symmetric conservative form of the system. In the framework of Kawashima's and Shizuta's theory, we had recast the resulting system into a normal form, that is, in the form of a symmetric hyperbolic-parabolic composite system, which allowed us to establish global existence and asymptotic stability around the constant equilibrium state in all space dimensions and we obtain decay estimates [2]. It was shown recently that such an approach can still be used when fast reactions are present in the system and constrain the system on a partial equilibrium manifold [1].

The purpose of the present communication is to study such an approach within the framework of the low Mach number limit. It turns out that the this asymptotics breaks the link between the conservative and the entropic variables and thus prevents the symmetrization process. We show how a partial symmetrization can still be conducted, its relation with the entropy production, and derive some mathematical properties of the resulting system.

References

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