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ON THE MULTIDIMENSIONAL ROE-LIKE LINEARIZATION FOR NON-EQUILIBRIUM MULTI-SPECIES GAS MIXTURES: APPLICATION TO RESIDUAL DISTRIBUTION SCHEMES (YOUNG INVESTIGATORS MINISIMPOSIUM – AVENUE 2)

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The most widespread Residual Distribution methods [1], namely the N and the LDA schemes, can be understood as multidimensional generalizations of approximate Riemann solvers [2]. As such, whenever a flow field including discontinuities is considered, it is necessary to perform a conservative linearization of the advective flux functions.

How such linearization is actually computed depends on the thermo-chemical description used to model the flow. In the Perfect Gas case, the multidimensional linearization is a mere extension [2] of the dimensionally splitted Roe linearization [3] employed in the context of Finite Volume schemes.

However, if one is interested in modelling richer physics, i.e. describing a hypersonic flow field under thermo-chemical non-equilibrium conditions (but still fulfilling the continuum regime assumption), a more complicated thermo-chemical model is required. In this contribution we will consider a standard two-temperature model for gas mixtures consisting of an arbitrary number $n_S \geq 2$ of species, see [4].

Liu and Vinokur presented in [5] a strategy to derive a conservative linearization for the n_S species, two-temperature model. This approach has been validated in the context of dimensionally splitted Finite Volume techniques in [6]. Later on, Degrez and van der Weide proposed in [7] a multidimensional generalization of Liu and Vinokur's approach.

In this contribution the multidimensional linearization of Degrez and van der Weide is reconsidered, and a thorough analysis of its performance and its limits of validity is conducted. Situations where the linearization may potentially break are identified, and alternatives for those situations are proposed.

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