Approximation of a class of two-fluid models by acoustic/transport splitting methods

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We are interested in approximating the solution of two-fluid models involving two distinct pressures and velocities that are often referred to are derived after the work of Baer and Nunziato [1]. We consider the simplified case of fluids that are equipped with a barotropic Equation of State (EOS) $\rho_k \mapsto p_k(\rho_k)$ so that the system reads

$$\begin{cases} \partial_t \alpha_1 + u_I \partial_x \alpha_1 = 0, & \\ \partial_t(\alpha_k \rho_k) + \partial_x(\alpha_k \rho_k u_k) = 0, & k = 1, 2 \\ \partial_t(\alpha_k \rho_k u_k) + \partial_x(\alpha_k \rho_k u_k^2 + \alpha_k p_k), -p_I \partial_x \alpha_k = 0, & k = 1, 2, \end{cases}$$

with $\alpha_1 + \alpha_2 = 1$. We propose in this work to investigate colocated finite-volume methods that enable a separate treatment of the terms related to the acoustic phenomena and the transport phenomena. The idea is to mimic algorithms like Lagrange-Remap methods without using moving meshes following the lines of [3, 4].

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References

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