Asymptotic-preserving well-balanced scheme for the electronic M_1 model in the diffusive limit.

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This work is devoted to the derivation of an asymptotic-preserving scheme for the electronic M_1 model in the diffusive regime. The derivation of the scheme is based on an approximate Riemann solver where the intermediate states are chosen consistent with the integral form of the approximate Riemann solver. This choice enables the derivation of a numerical scheme which also satisfy the admissible conditions and is well-suited for capturing steady states. Moreover, it enjoys asymptotic-preserving properties and handle the diffusive limit recovering the correct diffusion equation. A main difficulty comes from the mixed derivatives which arise in the diffusive limits. The numerical scheme can be modified in order to take into account the mixed derivatives and the contribution of the source term in the electronic M_1 model. Numerical tests cases are presented, in each case, the asymptotic-preserving scheme is compared to the classical HLL [1] scheme usually used for the electronic M_1 model. It is shown that the new scheme gives close results compared to the HLL scheme in the classical regime. On the contrary, in the diffusive regime, the asymptotic-preserving scheme coincides with the expected diffusion equation, while the HLL scheme suffers from a severe lack of accuracy because of its unphysical numerical viscosity.

Références

[1] A. Harten, P.D. Lax and B. Van Leer, *On upstream differencing and Godunov-type schemes for hyperbolic conservation laws.*, SIAM Review 25, 35-61, 1983.

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