

Convergence of an implicit scheme for diagonal non-conservative hyperbolic systems

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In this work, we consider diagonal non-conservative hyperbolic systems in one space dimension with monotone and large Lipschitz continuous data. Under a certain nonnegativity condition on the Jacobian matrix of the velocity of the system, global existence and uniqueness results of a Lipschitz solution for this system, which is not necessarily strictly hyperbolic, was proved in El Hajj, Monneau (2013). We propose a natural implicit scheme satisfying a similar Lipschitz estimate at the discrete level. This property allows us to prove the convergence of the scheme without assuming it strictly hyperbolic.

More precisely, we present a convergence result for an implicit Upwind scheme considering the framework of hyperbolic systems, which are not necessarily strictly hyperbolic. Related to this work, it is worth noting that, in Monasse, Monneau (2014) the authors have proved a similar result for a semi-explicit scheme in the case of non-conservative strictly hyperbolic systems. Moreover, their result was only valid in the class of vanishing viscosity solutions, introduced by Bianchini and Bressan (2005). Here, we show the convergence taking only Lipschitz continuous solutions, without any other restriction concerning the class of solutions.

Note that we choose the implicit scheme since it naturally preserves the Lipschitz estimates, proved in El Hajj, Monneau (2013), at the discrete level, which is neither the case of the explicit scheme nor that of the semi-explicit scheme.

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