Recent Developments in Entropy Viscosity

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Abstract:

Maximum principle, entropy stability and convergence of viscosity approximations for scalar conservation laws have been established a long time ago. However, on discrete level the same questions sometimes are a lot harder and in most cases the results are proven on uniform/restricted meshes and only for first order schemes. In the case of nonlinear systems, the scalar maximum principle is no longer valid and depending on the nonlinear problem one has different stability properties, for example invariant domain and entropy dissipation.
In this talk, we will present two recent results. In the scalar case, we will derive a maximum principle preserving second order scheme based on entropy viscosity. The new method preserves maximum principle on a variety of finite element spaces. In the case of the Euler system of gas dynamics, we will present a class of viscosity approximations and prove that they have an invariant domain property. Moreover, we will identify subclasses of these approximations which are consistent with some or all entropy inequalities. This is the analog of maximum principle for systems. Numerical results obtained with entropy viscosity schemes based on this type of approximations will be presented. This is a joint work with Jean-Luc Guermond.