Mimetic Relaxation Runge Kutta Methods

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Abstract:

Linear hyperbolic partial differential equations (PDEs) are known to conserve energy in the absence of a source term. For example, the solution of the advection equation at time t is the time-shifted function of the initial condition. The numerical solutions of hyperbolic PDEs obtained using the traditional Runge Kutta temporal schemes do not conserve the numerical energy at each time step of integration. The recently-introduced Relaxation Runge-Kutta schemes utilize the relaxation parameter γ, which ensure energy conservation at each time step. Mimetic methods satisfy a discrete form the extended Gauss's divergence theorem and therefore satisfy a global conservation law. In this talk, we ipresent the application of the high order Mimetic spatial discretization methods in combination with the Relaxation Runge-Kutta schemes for hyperbolic PDEs. Numerical examples are shown to illustrate the energy preservation of these schemes.