In a recent paper, stable large solutions were proven to arise from small amplitude data for certain conservation laws with a parabolic term possessing the identity as viscosity matrix. The initial data analyzed therein lies outside the Majda-Pego instability region. This region coincides with the elliptic region if the viscosity matrix is the identity.

The large viscous solutions are related to a bifurcation of planar vector fields with nilpotent singularities studied by Dumortier, Sotomaier and Roussarie. The DRS bifurcation also appears for non-identity viscosity matrices. Because the stability proof does not easily generalize for other viscosity matrices, in this work this issue is studied using numerical simulation. We use a new high-performance parallel Newton solver for the non–linear system arising from the Crank-Nicolson finite difference discretization.

We present numerical evidence that large stable shocks also arise for small data with non-identity viscous matrices. This happens even when the initial data are inside Majda-Pego’s instability region, which is larger than the elliptic region in this more general case.