Delyan Kalchev

Accuracy of Least Squares Finite Element Methods for Hyperbolic Conservation Laws

Department of Applied Mathematics
University of Colorado at Boulder
526 UCB
Boulder
Colorado 80309-0526
delyan.kalchev@colorado.edu
Christopher Leibs
Thomas Manteuffel
Steffen Mnzenmaier

Little is currently known about the nature of the numerical error in least-squares approximations of conservation laws. In particular, we are interested in how accurately the dispersive properties of the continuous equations are represented. Excessive error in dispersion relations, introduced by the numerical approximation, leads to incorrect wave propagation speeds. This may result in phase error, possible spurious oscillations of non-physical nature, and incorrect representations of wave packets. Proper understanding of dispersive errors would serve as a foundation for improving the shock capturing capabilities of least-squares methods. However, proper analysis is more challenging in the context of least-squares methods than in finite-difference methods. The purpose of this study is to reasonably quantify the capabilities of least-squares methods to correctly capture the dispersive relations in hyperbolic conservation laws.