AMATH574 Conservation Laws and Finite Volume Methods
Winter Quarter 2015
Project Proposal: F-wave method for nonlinear equations with spatially varying fluxes.

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1   Abstract

We study the f-wave method for elastic waves in heterogeneous media.

2   Introduction and Overview

Objective:

1. Implement the f-method for nonlinear elastic waves in heterogeneous media. Reproduce some of the figures in [1] [2] and [3].

2. Have a more comprehensive discussion of the f-wave method and problem. Mostly on the verifications of the details of the method mentioned in the paper and textbook. Some aspects include:

   - The disadvantages of using cell-edge flux functions in wave-propagation algorithm metioned in [1, p. 957]
   - Justification of the Riemann solver used in [1, p. 967]
   - The non-conservation when using w-wave in wave-propagation algorithm for 1) nonlinear autonomous systems with simple Riemann solver (HLL?), 2) non-autonomous systems with "Roe average" Rieman solver.
   - The slight difference of using $w = z/s$ in the limiter. p. 335 in the textbook.
   - The new line of discontinuities caused by the discontinuities of the coefficient. [1, p. 960]
   - The breakdown of f-wave method in the case of singular flux (delta distribution). [1, p. 961]

3. If possible, have some discussion on the dispersive properties of layered media i.e, solitons and shocks.

The importance of the goals is decreasing in the order.

3 Theoretical Background

4 Computational Results

5 Summary and Conclusions

References

[1] D. S. Bale, R. J. LeVeque, S. Mitran, and J. A. Rossmanith, SIAM J. Sci. Comput 24 (2002), 955-978.

[2] Randall J. LeVeque and Darryl H. Yong, SIAM J. Appl. Math., 63 (2003), pp. 1539-1560.

[3] David I Ketcheson, Randall J. LeVeque Comm. Math. Sci. 10 (2012), pp. 859-874.