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

Instructor : Professor Randall Leveque
Student: Hai Zhu(zhuh1106@uw.edu), Xin Yang (yangxin@uw.edu)
Due date: Wednesday, Feb. 18, 2015

February 17, 2015

1 Abstract

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

2 Introduction and Overview

Objective:

1. Implement the f-wave 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. p. 314 & p. 333 in the 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? p. 328 in the textbook), 2) non-autonomous systems with "Roe average" Rieman solver.
   - The slight difference of using $\mathcal{Z} = s\mathcal{W}$ in the limiter to get high-resolution methods. [1, p. 964] 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.