The f-wave method

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Outline

What is the f-wave method?

Idea is simple. Wave-propagation form

$$Q^{n+1} = Q^n - \frac{\Delta t}{\Delta x}(\sum s^p W^p)$$

we call the wave W w-waves. If instead we decompose f, we get f-waves.

Implementation

1.2..3...

Why f-waves?

Approximate Riemann solver. Conservation. Roe condition

1D Elastic wave equations

$$\epsilon(x,t)_t - u(x,t)_x = 0 \tag{1}$$

$$\rho(x)u(x,t)_t - \sigma(\epsilon,x)_x = 0 \tag{2}$$

first equation is definition of strain while the second one is the the newton's second law.

Structure of solution to the Riemann problem

Jacobian, eigenvalues and eigenvectors physical meaning of the variables, maybe the effect of continuous impedance and discontinuous impedance

Approximate Riemann solver

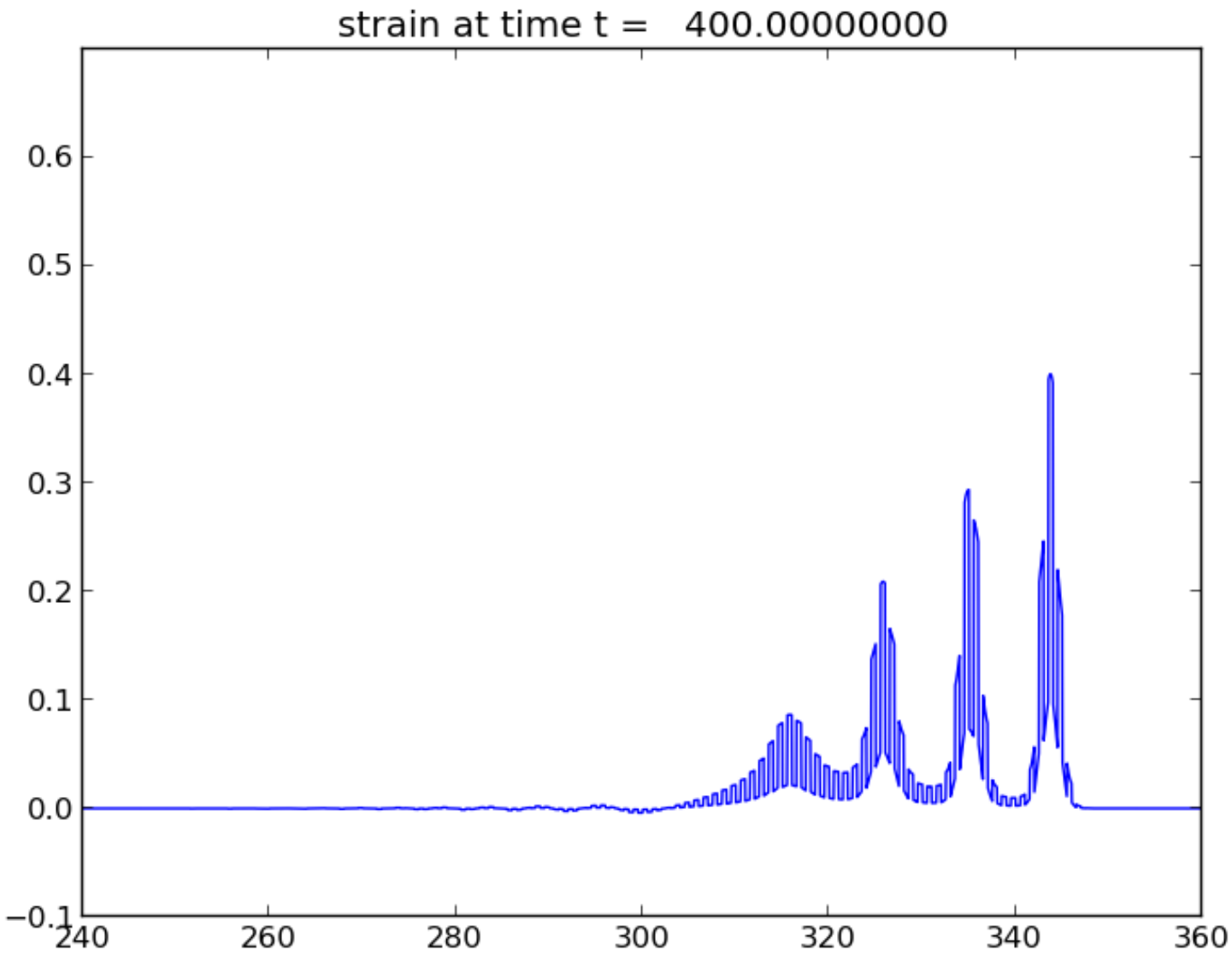

Figure: stegoton

Stegotons

References I

- D. S. Bale, R. J. LeVeque, S. Mitran, and J. A. Rossmanith, SIAM J. Sci. Comput 24 (2002), 955-978.
- Finite Volume Methods for Nonlinear Elasticity in Heterogeneous Media by R. J. LeVeque, Int. J. Numer. Meth. Fluids 40 (2002), pp. 93-104.
- Randall J. LeVeque and Darryl H. Yong, SIAM J. Appl. Math., 63 (2003), pp. 1539-1560.
- David I Ketcheson, Randall J. LeVeque Comm. Math. Sci. 10 (2012), pp. 859-874.