Feedback on Exercise 4

August 10, 2012

Right hand side for exact solution

\[ y = \varepsilon(x + 5.0) - t \]
\[ f(x, t) = \frac{2 \sinh(y)}{\cosh(y)^2} (1 - \varepsilon(\cosh(y)^{-2} + 1)) \]

Running the code -

✓ N=6 - completes, but poor quality
✓ N=10 - considerably better - but not ‘pretty’
✓ N=16 - looks good

Aliasing
✓ Removing LF dissipation makes things worse - N=6 crashes
✓ Increasing eps makes it worse

Consider

\[ \frac{\partial u}{\partial t} + \frac{1}{2} \frac{\partial u^2}{\partial x} = g(x, t), \quad x \in [-10, 50] \]

Exact solution

\[ u(x, t) = \frac{1}{\cosh^2(\varepsilon(x + 5.0) - t)} + 1. \]

✓ Exact integration
✓ Does the job
✓ Still Gibbs oscillations
✓ Expensive

✓ Filtering
✓ Does the job at limited cost
✓ Degree of filtering is sensitive

✓ Limiting
✓ Severe dissipation
✓ Works best with N=1