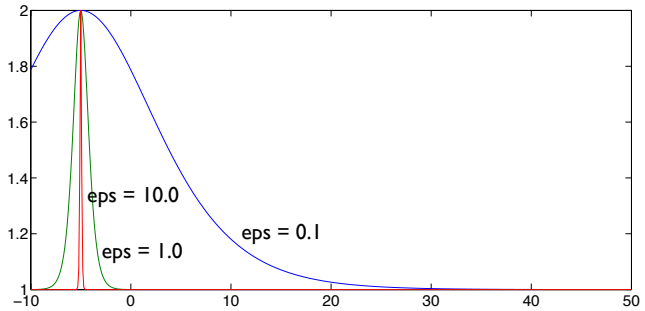
Feedback on Exercise 4

August 10, 2012

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 $u(x,t) = \dfrac{1}{\cosh^2(\varepsilon(x+5.0)-t)} + 1.$



Right hand side for exact solution

$$y = \varepsilon(x+5.0) - t \qquad f(x,t) = \frac{2\sinh(y)}{\cosh(y)^3}(1 - \varepsilon(\cosh(y)^{-2} + 1))$$

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

- ✓ 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