CS 370 - Numerical Computation **Fall 2018**

Stability and Truncation Error

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6.1 Stability of Time-Stepping Schemes

1. Apply a given time stepping scheme to out test equation.
2. Find the closed form of its numerical solution.
3. Find the conditions on the timestep h that ensures stability (error approaching zero)

6.2 Determining Local Truncation Error

Recall that local truncation error is

$$LTE = y(t_{n+1}) - y_{n+1}$$

where $y(t_{n+1})$ is exact solution and y_{n+1} is approximate solution.
Assuming exact right-hand-side data, this is the error from taking one step.

6.2.1 Process

Given a time-stepping scheme, $y_{n+1} = RHS$

1. Replace approximations on RHS with exact versions
2. Taylor expand all RHS quantities about time t_n (if necessary)
3. Taylor expand the exact solution $y(t_{n+1}$ to compare against.
4. Compute difference $y(y_{n+1}) - y_{n+1}$. Lowest degree non-cancelling power of h gives the local truncation error