CS510 Midterm Project

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This is an application for integration using Euler Method, Second Order Runge-Kutta, Third Order Runge-Kutta, and Fourth Order Runge-Kutta Methods as applied to the Lorenz Attractor system. The following components are included:

attractor.py - The attractor.py is a python class for calculating the Euler, Second Order Runge-Kutta, Third Order Runge-Kutta, and Fourth Order Runge-Kutta.

attractor_final.ipynb - The attractor_final.ipynb is a python notebook otherwise identical to the attractor.py file.

ExploreAttractor.ipynb - The ExploreAttractor.ipynb is a Python notebook which uses attractor.py to explore the differences between Euler, Second Order Runge-Kutta, Third Order Runge-Kutta, and Fourth Order Runge-Kutta using various initial inputs.

test_attractor.py - The test_attractor.py is the nosetests file for attractor.py.

self.solution.csv - When run, the attractor.py application will create and save this file to disk.

Initial Values:

Prandtl Number (s) - The ratio of momentum diffusivity and thermal diffusivity (default value = 10.0).

Rayleigh Number (p) - Determine whether the heat transfer is primarily in the form of conduction of convection (default value = 28.0)

Geometric Factor (b) default value = 8.0/3.0

Starting point (start) default value = 0.0

Ending point (end) default value = 80.0

Number of intervals between start and end (points) default value = 10,000

$x_0 = 0.1$

$y_0 = 0.0$

$z_0 = 0.0$

Equations:

$dx(t)/dt = s[y(t) - x(t)]$

$dy(t)/dt = x(t)[p - z(t)] - y(t)$

$dz(t)/dt = x(t)y(t) - bz(t)$