4th order Runge-Kutta Implementation

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The Matlab files `rg4_implementation`, `rg4_step` and `lorenz` together implement the fourth-order Runge-Kutta to simulate a trajectory of points from the Lorenz system of differential equations:

$$\begin{aligned}\frac{\mathrm{d}Y_1}{\mathrm{d}t} &= \sigma(Y_2 - Y_1)\\ \frac{\mathrm{d}Y_2}{\mathrm{d}t} &= Y_1(\rho - Y_3) - Y_2\\ \frac{\mathrm{d}Y_3}{\mathrm{d}t} &= Y_1 \cdot Y_2 - \beta Y_3\end{aligned}$$

The nature of the simulated trajectory is different for different sets of parameter values. The system exhibits a butterfly effect when the parameter values are $\sigma = 10, \rho = 28$ and $\beta = 8/3$.

However, the simulated trajectory looks completely different for a different set of parameter values - $\sigma = 5, \rho = 8$ and $\beta = 3$. See the next page for figures.

Reference

Wikipedia article on Lorenz Systems: `https://en.wikipedia.org/wiki/Lorenz_system`

Figure 1: Lorenz system trajectory for $\sigma = 10, \rho = 28$ and $\beta = 8/3$ using RG4

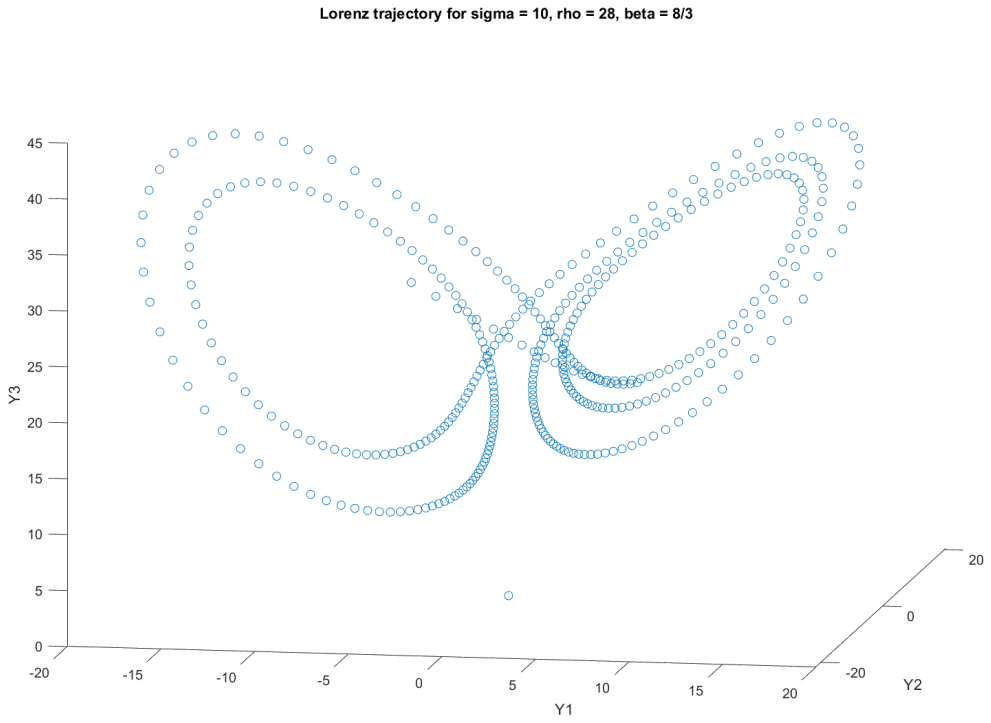

Figure 2: Lorenz system trajectory for $\sigma = 5, \rho = 8$ and $\beta = 3$ using RG4