ASEN 4057 - Midterm

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I. Default Error Tolerances

Running the simulate_particle function with the default relative and absolute error tolerances for $\sigma = 10$, $\rho = 28$, $\beta = 8/3$, tspan=[0,20], and r0=[-8,8,27] returned the following 3 dimensional trajectory plot.

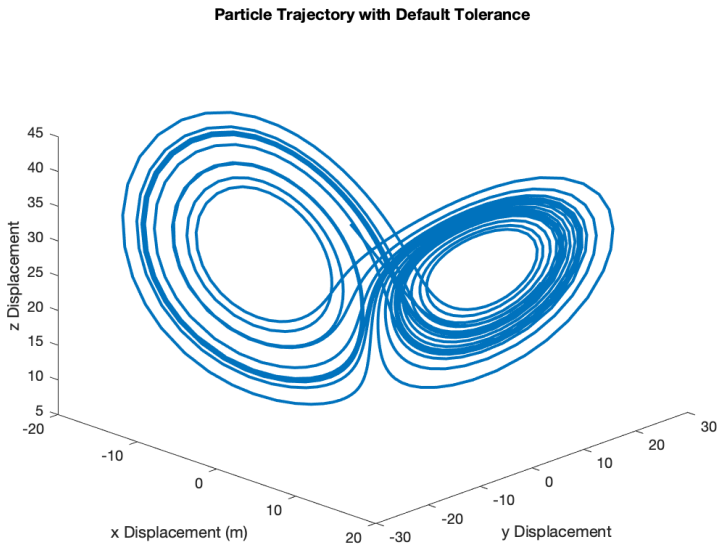

Figure 1: 3D plot showing particle trajectory

The function was timed using tic toc, returning an elapsed time of 0.072246 seconds.

II. Doubled Error Tolerances

Next, the relative and absolute error tolerances in the simulate_particle function were doubled to $1*10^{-6}$ and $1 * 10^{-12}$, respectively. This resulted in the following trajectory plot:

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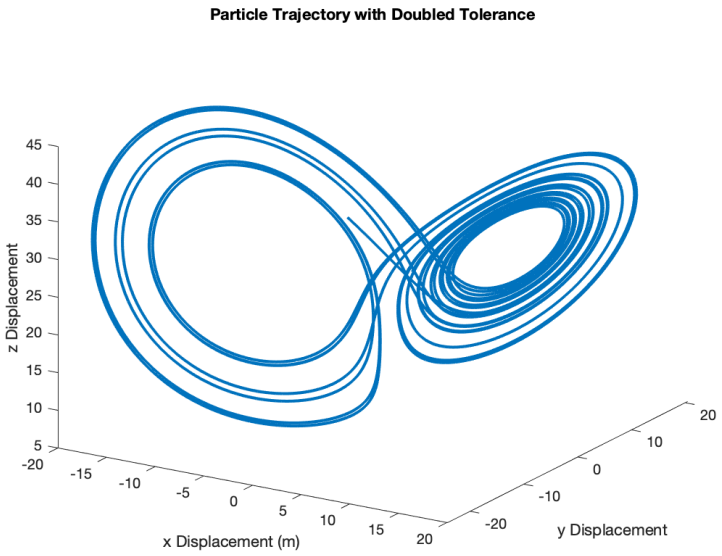

Figure 2: 3D plot showing particle trajectory

The function was again timed using tic toc, this time returning an elapsed time of 0.130695 seconds.

III. Comparison

Through the simulation, there is not much difference in the particle's trajectory based on the tolerances, but the default tolerance case does appear to have more noise. This makes sense because a more precise tolerance should result in a more precise trajectory simulation. Additionally, doubling the tolerances nearly doubled the runtime.