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PHYS 129L

Milestone Report 2

Methodology

1D Diffusion Equation Simulation The diffusion of a given set of initial conditions (step function and real data) was done via a finite differences method as outlined in reference [1].

Progress Summary

This week, I took a model step function as well as data I extracted from .tif movies last week and simulated the diffusion using a finite differences method.

Challenges and Solutions

The biggest challenge I had this week was figuring out how to simulate the 1D diffusion equation. Initially, I assumed that I would have to do fourier analysis to find the coefficients from initial conditions and go from there.

Through some research I did online, it seems like the best way to go about simulating PDEs like this is by using a finite differences method, which is essentially Euler's method but extended to higher-order derivatives and other differential operators.

Future Work

Next week, I would like to fix a bug that I'm having with my real data. It seems that either the noise in my system or the boundary conditions that I am using is incorrect, and simply causing my real data to smooth over as it diffuses. I am not seeing this issue with the model data.

I would also like to extend this methodology to 2-D and simulate a reaction-diffusion / condensation reaction.

References

[1] 12.4. simulating a partial differential equation - reaction-diffusion systems and Turing patterns [Internet]. IPython Cookbook, Second Edition. [cited 2023 Nov 26]. Available

from:

https://ipython-books.github.io/124-simulating-a-partial-differe

ntial-equation-reaction-diffusion-systems-and-turing-patterns/