Maxie Dion Schmidt | mschmidt34@gatech.edu

Math 6307 (ODEs) Project Proposal – Fall 2021

Overview:

I write a lot of open source software. One of my favorite languages to do fast prototyping in is Python. While exact ODE solutions are nice with *Mathematica* when you can obtain them, numerically exploring families of solutions to interesting solutions is key. My aim is to use this project as a opportunity to familiarize myself with methods, libraries and available software in Python to do experimental mathematics with solutions to ODES. Note that I will appreciate some input from the professor (AB) about some interesting problem types that can be used as examples to facilitate discussion of these topics. I am open minded about the applications.

The Project Will Include:

- A GA Tech (or public) GitHub repository to hold documentation and source code for demos for this project;
- Demos of the functionality of a few Python libraries for visualizing and computing ODE solutions. This will come in the form of Markdown documentation to run prepared Python scripts;
- Documentation of a few problem types to show concretely how to get from a posed problem to the nitty-gritty solution level details using these methods in Python;
- Beamer presentation slides to give the final presentation over BlueJeans (with explicit demos).

List of Prospective Software to Check Out in Python:

- **SageMath** - Open-Source Mathematical Software System
  https://www.sagemath.org
- **SciPy -** A Python-based ecosystem of open-source software for mathematics, science, and engineering.
  https://www.scipy.org
- **ODE-explorer package** – A small Python package for ODE solving and mathematical modeling.
  https://pypi.org/project/ode-explorer/
- **GEKKO** - *GEKKO* is an optimization and simulation environment for Python that is different than packages such as Scipy.integrate.ODEINT. In addition to simulation, *GEKKO* is an optimization platform for dynamic systems.
  https://apmonitor.com/pdc/index.php/Main/PythonDifferentialEquations
- **Mousai -** A Set of Harmonic Balance Solvers
  https://josephcslater.github.io/mousai/