Examples and Experiences in Teaching a Modeling-Based Differential Equations Course
28 July 2017, Friday, 1:00 – 2:20 p.m., Mobley Room

Organized by: Rosemary Farley, Manhattan College; Therese Shelton, Southwestern University; Patrice Tiffany, Manhattan College; and Brian Winkel, SIMIODE

Outline and Flow of the session

(1) (5 minutes) - Therese - Introduction – Overview of source material in SIMIODE

(2) (25 minutes) – Rosemary and Patrice - m&m with migration activity, really milking it for all its worth, having discussions about issues raised, e.g., modeling both difference and differential equation approaches along with conversions between the two, parameter estimation, equilibrium value, solution strategies, technology use (EXCEL and CAS, in my case Mathematica, perhaps with Rosemary and Patrice offering Maple versions in fitting model to data), etc.

- one page hand out for instructions and data collection – previously prepared by Rosemary and Patrice and worked up for this workshop
- offer supplies – one small 5 oz cup, half-filled from big bag, e.g., 25 m&m’s, one empty cup, one plate for tossing.
- take time for many iterations
- discussion of model – both discrete and continuous – and conversion
- participants solve continuous model (take time to solve by hand – separation of variables or integrating factors) - discuss pre or post solution strategy use
- do parameter estimation with solved in SSE approach
- have prepared Mma or Maple source to show in PowerPoint.
- do parameter estimation on EXCEL with iterations and Solver.

(3) (25 minutes) – Brian - Derivation of Torricelli’s Law from first principles in great detail, collection of data from online SIMIODE YouTube videos or screen shots we put up from which the can "collect" data.

- quickly go over derivation – in PowerPoint – introduce kinetic, potential, and total energy as well as Conservation of Energy Principle.
- participants solve analytically – again pre or post solution strategy use
- collect data from SIMIODE YouTube or Screen shots
- use Solver in Excel – real time to estimate parameters
- show Mma SSE commands and convincing plots with best parameters.
- discuss other variations, e.g., water clock – SIMIODE resources.
(4) (15 minutes) – Therese - Ant Tunnel Building
• pose the problem
• begin modeling process by trying to guess a time “solution”, i.e., T(x), the time it takes the ant to build a tunnel of length x is_____
• move to how long it takes to build a tunnel of length h once at distance x.
• consider several models – some from class, some from “previous” classes and learn how to reject a bad model.
• arrive at consensus model and solve.
• play some “what if” games, e.g, if we double the tunnel length from x to 2x what happens to T(x).

(5) (10 minutes) – Brian - Overview and discussion on using modeling in teaching differential equations. Plug SCUDEM at www.simiode.org/scudem .