Introduction to Modeling and Simulation

CSE 2021

Credit Hours:
3.00

Course Levels:
Undergraduate (1000-5000 level)

Course Components:
Lecture

Course Description:
Concepts of modeling and simulation; develop MATLAB skills to explore modeling concepts; project: design, implementation, verification/validation of model; oral and written project report.

Prerequisites and Co-requisites:
Prereq: Math 1151 (152) or equivalent, and Physics 1250 (131).
**Course Goals / Objectives:**
- Be competent with discussing the importance of modeling to science and engineering, the history and need for modeling, the cost effectiveness of modeling, the time-effect of modeling;
- Be familiar with defining modeling terms, listing questions that would check/validate model results, describing future trends and issues in science and engineering, and identifying specific examples of modeling in science and engineering;
- Be familiar with utilizing the Modeling Process to identify key parameters of a model, estimating model outcomes, and utilizing MATLAB to implement the mathematical representation of the model;
- Be familiar with constructing difference-based computer models, conducting and explaining the transformation of continuous functions and dynamics equations into discrete computer representations;
- Be competent with writing simple MATLAB programs performing numerical calculations as needed for modeling and simulation; be competent with implementing finite difference modeling equations and creating simulations in MATLAB;
- Be familiar with visualizing empirical data and the fitting function using MATLAB;
- Be familiar with identifying different types of models and simulations; describing iterative development of a model; explaining use of models & simulations for hypothesis testing;
- Be familiar with discussing methods for reviewing models, their verification and validation; differences between predictions of model, actual results and relevance of these differences to the problem; suitability/limits of model;
- Be familiar with documenting the development and implementation of a model and presenting it in oral and written form.

**Course Topics:**
- Introduction to modeling; modeling concepts and definitions
- Introduction to MATLAB, scripts
- MATLAB arrays, array math
- MATLAB programming mechanisms (conditionals, loops, etc.)
- MATLAB i/0
- Advanced graphing in MATLAB; curve fitting
- Linear models
- Nonlinear functions; modeling examples
- Stochastic models
- Final project overview and Requirements
- Accuracy and precision in modeling; verification and validation; project plan
- Project implementation; Project presentations
- Review/exams

**Designation:**
Elective