

MAE 107
Computational Methods in Engineering (4 units)

Class/Laboratory Schedule: Four hours of lecture, eight hours outside preparation, 12 hours/week total

Course Coordinator(s): Prabhakar Bandaru, William McEneaney, Marko Lubarda

Textbooks/Materials:

1. Chapra and Canale, Numerical Methods for Engineers, (8th ed.). McGraw-Hill, 2020

Catalog Description: Introduction to scientific computing and algorithms; iterative methods, systems of linear equations with applications; nonlinear algebraic equations; function interpolation and differentiation and optimal procedures; data fitting and least-squares; numerical solution of ordinary differential equations.

Prerequisites: MAE 8 or 9, and MATH 18 or 20F or 31AH.

Course type: Required.

Course Objectives:

1. To teach numerical methods for solving engineering problems involving linear and nonlinear algebraic systems, differentiation and integration, and differential equations.
2. To teach numerical analysis for assessing accuracy, stability, convergence, and numerical error, to ensure reliable computation.
3. To demonstrate computational modeling and numerical solution of engineering problems from various mechanical engineering disciplines.
4. To enable students to analyze and interpret data using numerical methods such as curve fitting, regression, and optimization.

Course Topics:

1. Introduction to numerical computation using MATLAB
2. Numerical methods for systems of linear algebraic equations
3. Numerical methods for systems of nonlinear algebraic equations
3. Interpolation and function approximation
4. Numerical differentiation and integration
5. Regression and least-squares methods
6. Numerical methods for ordinary differential equations

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