Instant Feedback in a Computer Modeling Course

Using MATLAB Grader as a platform for student engagement in computer modeling
To address the need for immediate feedback to students in an entry level MATLAB based computer simulation course to mechanical and electrical engineering students, the online platform MATLAB Grader was utilized. Different types of structures within the Grader platform were developed based on the focus of the activity or problem being posed, and both formative and summative "code tests" have been developed to lead the students to accurate modeling techniques. Guided questions for the students also were developed to provide mechanisms for students to reflect on the results of their simulations, and communicate understanding of the material covered. Strengths and weaknesses of this type of application will be discussed, with the goal of engaging conversation about this and other platforms for immediate feedback for students when programming.
EGE331: Computer Simulations

- Mechanical and Electrical Engineering
- Electrical Engineering course
- Taught by Mechanical Engineering Professor

- Third time teaching the course
  - Fall 2020 – Online Async with 3 hrs week Scheduled remote ‘office hours’
  - Fall 2021 – Hybrid
  - Spring 2020 – Hybrid with 1.25 hrs week Scheduled remote ‘office hours’
Content of the course

Course Student Learning Outcome #1: Develop computer algorithms using MATLAB.

Students will demonstrate the ability to analyze, synthesize, and design computer algorithms of basic numerical methods using MATLAB.

Course Student Learning Outcome #2: Using Computer Methods to Solve Problems in Engineering Applications.

Students will apply computer simulation and numerical method techniques using MATLAB to develop solutions to problems in engineering applications.

- Unit 0 – Preliminary
- Unit 1 – Introduction to MATLAB: January 26 – February 7
- Unit 2 – Solving Systems of Linear Equations / Curve fitting: February 8 – February 21
- Unit 3 – Integration: February 22 – March 7
- Unit 4 – Root Finding: March 8 – March 28 (Spring Break)
- Midterm Tuesday March 22
- Unit 5 – Derivatives: March 29 – April 11
- Unit 6 – Intro to ODEs: April 12 – April 25
- Unit 7 – Ordinary Differential Equations: April 26 – May 9
Benefits of using MATLAB Grader

- Students have online access to MATLAB without needing to remote login.
- I can write problems with images, links and equations (either in Grader or in MATLAB Live Script) which makes the problems more engaging.
- I can embed data without students needing to worry about file management.
- Instant feedback throughout the modeling process.
Unit 2: Homework Fall 2022

Visible: Not Specified  Due: No due date  Submissions Per Problem: 3

Assignment Description

Problems

2.1 Defining matrices
2.2. Accessing matrix elements using indexes
2.3. Matrix operators
2.4 Solving a system of equations: Electrical Circuit
2.5.a Interpolating Strength vs. Temperature Data When the index is known (linear interpolation)
2.5.b Interpolating Strength vs. Temperature Data When the index is known (quadratic interpolation)
2.6 Curvefitting: Best fit quadratic line through dataset
2.7 Linear Curve Fit: Strength vs. Temperature Data
2.8 Case Study: Particle with a Constant Acceleration (Polynomial Regression using polyfit command)
2.1 Defining matrices

The problem is saved as Final. It is now visible to learners when the course section is published. To edit this problem, click Set to Draft.

Title

2.1 Defining matrices

Problem Description and Instructions

Define the A matrix and b vector of the coefficients of the following systems of equations.

Note: when defining your matrices, always choose the LHS for the coefficients of the variable (it will affect the sign of the terms in the row).

a.

\[\begin{align*}
5x_1 + x_2 - 4x_3 &= 7 \\
x_1 + 6x_3 &= 3 \\
x_2 - 4x_3 &= 2
\end{align*}\]

b.

\[\begin{align*}
3y_4 + y_1 + 12 &= -y_2 + 4y_3 \\
8y_3 + 7y_1 &= -4y_3 - y_4 \\
6y_3 + y_3 &= 5(1 - y_1) \\
2y_4 + 7y_1 - 1 &= 3y_3 - 9y_2
\end{align*}\]
<table>
<thead>
<tr>
<th>Test 1</th>
<th>A_a (Pretest)</th>
<th>A_a = Reference Solution?</th>
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</thead>
<tbody>
<tr>
<td>Test 2</td>
<td>b_a (Pretest)</td>
<td>b_a = Reference Solution?</td>
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<tr>
<td>Test 3</td>
<td>A_b (Pretest)</td>
<td>A_b = Reference Solution?</td>
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<td>Test 4</td>
<td>b_b (Pretest)</td>
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