Teaching and Learning with MATLAB and Simulink

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Overview

- What is MATLAB Grader?
- Who benefits from autograding MATLAB code?
- What can instructors use MATLAB Grader for?
- How it works (Product Demo)
- User Stories and Case Studies
- Teaching and Learning Resources
- How to get started using MATLAB Grader
What is MATLAB Grader?

Traditional Grading

Submit homework

Wait 1-2 weeks

Get feedback

Read it??

Work on next homework

Autograding

Submit homework

Instant feedback

Work on next assignment

Resubmit

Improve and Learn
Transitioning from traditional assignments
MATLAB Grader

Create interactive course assignments

Automatically grade student work and provide feedback

Run your assignments in any learning environment
Who will benefit from autograding MATLAB code?

- **Instructors** teaching large and/or introductory level courses
  - Off the shelf content and assessment examples to accelerate course development
  - Include MATLAB assignments for homework, exercises, and formative assessment

- **Teaching Assistants and Graders** for MATLAB-based courses
  - Less time spent grading code == more contact time with students

- **Students** get immediate feedback while mastering MATLAB skills and concepts
What can customers use MATLAB Grader for?

- Create and store **MATLAB based assignments** in a repository for later use.
- Provide students with **additional practice problems** in the LMS.
- Use MATLAB Grader for **in-class coding exercises** and quizzes.
- View **student performance analytics** at the individual and aggregate levels.

Educators and Instructors are Teaching with MATLAB Grader

- **1,000+ instructors**
- **100,000+ students**
- **Over 6 million** student submissions
What is LTI?

- **LTI**: Learning Tool Interoperability
- It’s the widely adopted, industry standard that lets our application integrate with major LMS platforms.
- Nearly every LMS supports it
Hello, Jeff Alderson

Get Started
- Guided Tour (3-minute video)
- Documentation

Courses

Introduction to Numerical Methods (Instructor)
Created By: Balaji Sharma (balaji.sharma@mathworks.com)
Duration (EDT): 01 Jan 2018 - 03 Sep 2018
3 Problems 3 Students

Copy of Introduction to Programming (Instructor)
Created By: Eric Davidshank (edavids@seventhcc.edu)
Duration (PDT): 03 Apr 2016 - 15 Sep 2018
94 Problems 0 Students

Example Problems (Instructor)
Created By: Aditya Jain (aditya.jain@mathworks.com)
Duration (UTC): Not Specified - Not Specified
11 Problems 0 Students

Add Course

Content
Create problems outside of a course, storing them in collections. You can later use these problems in courses.

Add Problem
Instructor Workflow

Create Content
Add a problem from Examples
Create a problem from scratch
Add to course syllabus

Share Content / Courses
Invite TAs/graders/instructors
Invite students

Assess Learning
Download submissions or view in LMS
Create grading rubrics

Student Workflow

Develop Solutions
Write MATLAB solutions in the browser
Use MATLAB desktop to develop solutions

Test and Submit
Submit solutions for assessment
Get instant feedback from test suites

Refine Solutions
Use Solution Map to write better code
Compare solutions to peers
User Stories

Teaching Computational Methods to Second-Year Engineering Students at Virginia Tech

By Dr. Robert A. Canfield, Virginia Tech

Virginia Tech AOE 2074 Computational Methods
Homework #8

Problems

- Problem 14.7
- Problem 14.6
- Problem 15.2 (Generalized)

“The approach enables students to learn more quickly from their mistakes on their own.

The move to MATLAB Grader (Cody Coursework) has proven to be beneficial from a teaching perspective, and student feedback has been positive.”

- Dr. Canfield, Virginia Tech

“I live for green check marks.”

- Student at Virginia Tech
User Quotes

“the lab time required was reduced by more than 50% because the students knew what to expect…”

- Angelique Janse van Rensburg, Professor, North-West University (Linear Systems course)

“I want to use this in all of my courses that involve MATLAB.”

- Peter Corke, Queensland University of Technology (Robotics Professor & Blackboard LMS user)
Teaching and Learning Resources

**Deans**

**Faculty**

“I want graduate students to learn MATLAB for research.”

**Instructors**

**TAs**

“I want students to know basic MATLAB & Simulink before they come to my class.”

“I am spending way too much time writing and grading programming assignments.”

“I can’t engage my students with a static textbook. I need something interactive.”

**Deans**

**Admins**

“I want students to graduate with proof of mastery of MATLAB skills.”

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**Self-Paced Online Courses**

**Onramps and Comp Math Courses**

**MATLAB Grader and MATLAB Courseware**

**Interactive Publisher Content / Books**

**Certification**
Self-Paced, Online Training for MATLAB & Simulink

Campus-Wide Online Training

Hands-on MATLAB and Simulink experience

Measurable progress report and completion certificate

Interactive lessons with immediate feedback

24/7 availability
Self-Paced Online Courses

Get Started
- MATLAB Onramp
- Deep Learning Onramp
- Simulink Onramp

5 free courses – available for everyone
- + Machine Learning Onramp
- + Stateflow Onramp

Computational Mathematics
- Solving Nonlinear Equations with MATLAB
- Solving Ordinary Differential Equations with MATLAB
- Introduction to Linear Algebra with MATLAB
- Introduction to Statistical Methods with MATLAB

4 courses targeting MATLAB skills needed in the classroom

Core MATLAB Functionality
- MATLAB Fundamentals
- MATLAB Programming Techniques

Data Analytics
- MATLAB for Financial Applications
- MATLAB for Data Processing and Visualization
- Machine Learning with MATLAB
- Deep Learning with MATLAB

6 in-depth courses for enhancing MATLAB skills
MATLAB and Simulink Based Books

- More than 2000 titles in 26 languages for educational and professional use
- Subjects include:
  - Biosciences and Biomedical
  - Chemistry and Chemical Engineering
  - Control Systems
  - Digital Signal Processing
  - Earth Sciences
  - Economics and Computational Finance
  - Image and Video Processing
  - Mathematics
  - Mechanical Engineering
  - Neural Networks and Fuzzy Logic
  - Physics
  - Programming and Computer Science
  - Robotics
  - System Modeling and Simulation
Teach with MATLAB Live Editor

MATLAB in an Executable Notebook

Use live scripts to create engaging lectures that combine explanatory text, mathematical equations, code and results.

Share live scripts directly with colleagues or students.

Work in a single environment to eliminate context switching.
MATLAB Courseware

Downloadable sets of curriculum materials for educators based on MATLAB and Simulink.

- Video lectures
- Classroom materials
- Textbook references
- Homework assignments
- MATLAB and Simulink code examples

Topics Include:

- Introduction to Programming
- Introduction to Engineering
- Bioengineering and Biological Sciences
- Chemistry
- Earth, Ocean and Atmospheric Sciences
- Economics and Finance
- Electrical and Computer Engineering
- Mechanical and Aerospace Engineering
- Mathematics
- Physics and Astronomy

**Mathematics**

- Applied Numerical Methods with MATLAB
  - Professor Steven C. Chapra
  - Tufts University

- Numerical Computing with MATLAB
  - Cleve Moler
  - MathWorks

- Differential Equations and Linear Algebra
  - Professor Gilbert Strang
  - Massachusetts Institute of Technology

- Teaching Calculus with MATLAB
  - Integrating MATLAB into a Calculus Curriculum

**Electrical and Computer Engineering**

- Control of Mobile Robots
  - Professor Magnus Egerstedt
  - J.P. de la Croix
  - Georgia Institute of Technology

- Introduction to Model-Based System Design
  - Professor Marc Hermiter
  - Professor Zachariah Chambers
  - Rose-Hulman Institute of Technology

- Control Tutorials for MATLAB and Simulink
  - Professor Bill Messner
  - Professor Dawn Tilbury
  - Professor Rick Hill

- Advanced Model-Based System Design
  - Professor Zachariah Chambers
  - Professor Marc Hermiter
  - Rose-Hulman Institute of Technology

**Introduction to Programming**

- Introduction to MATLAB Programming
  - Professor Kathleen Ossman
  - Professor Gregory Bucks
  - University of Cincinnati

- Introduction to MATLAB
  - Professor William J. Palm, Ill
  - University of Rhode Island
Low-Cost Hardware Curriculum Support for MATLAB

Arduino Engineering Kit
Includes Arduino MKR1000 board and all components to create three engaging, hands-on projects:
- self-balancing motorcycle
- mobile rover
- drawing robot

Online learning materials that facilitate project-based learning
Project-Based Learning with Low-Cost Hardware

MATLAB and Simulink speak hardware
Treat engineering students like engineers with real projects
Easy-to-learn syntax and block diagrams
Increase student interest and improve learning
https://www.mathworks.com/hardware-support/home.html
Get started on MATLAB Grader for free today!

https://grader.mathworks.com/

For more information about Teaching and Learning with MATLAB and Simulink:

https://www.mathworks.com/academia.html
Q&A