

Matrix Methods of Linear Algebra

Curriculum Module

Created with R2020b. Compatible with R2020b and later releases.

Description

This curriculum module contains interactive *live scripts* that teach fundamental matrix methods commonly taught in introductory linear algebra courses. In the first part of each live script, students learn standard definitions, visualize concepts, and perform exercises on paper. Afterward, students practice complementary MATLAB methods. These methods reinforce the discussed concepts and help students to develop an early familiarity with computational software. Each lesson concludes with an illustrative application. These live scripts can be used as part of a lecture, as activities in an instructional setting, or as an interactive assignment to be completed outside of class.

Details

`matrixOperations.mlx`

Products: MATLAB, Symbolic Math Toolbox, Image Processing Toolbox

Contents: An interactive lesson that explores basic matrix operations.

Learning Goals:

- Define matrices and their basic arithmetic operations
- Calculate the result of matrix operations on paper and in MATLAB
- Explain the size requirements of matrix operations
- Compare symbolic and numeric matrix operations in MATLAB
- Apply matrix methods to modify grayscale images

`linearSystems.mlx` | `linearSystemsApplications.mlx`

Products: MATLAB, Symbolic Math Toolbox

Contents: An interactive lesson that explores matrix representations of linear systems and their solutions.

Learning Goals:

- Write a linear system in matrix form
- Relate solutions of linear systems in 3-dimensions to their visualizations
- Solve systems of linear equations using row-reduction
- Solve systems of linear equations using matrix inverses
- Explain the solvability of a linear system in terms of the matrix determinant
- Use MATLAB to solve linear systems
- Apply matrix methods to linear regression and linear circuit analysis

`eigenAnalysis.mlx` | `eigenAnalysisApplications.mlx`

Products: MATLAB, Symbolic Math Toolbox

Contents: An interactive lesson that explores eigenvectors, eigenvalues, and their applications.

Learning Goals:

- Visualize eigenvectors in 2-dimensions
- Solve for the eigenvalues and eigenvectors of a 2x2 matrix on paper and larger matrices using MATLAB
- Diagonalize 2x2 matrices on paper and larger matrices in MATLAB
- Explain linear system solvability in terms of eigenvalues
- Discuss defective matrices
- Use eigenanalysis to understand vibrations and the long term behavior of a Markov chain

`matrixOperationsSoln.mlx` | `linearSystemsSoln.mlx` | `eigenAnalysisSoln.mlx` `linearSystemsApplicationsSoln.mlx` | `eigenAnalysisApplicationsSoln.mlx` |

Products: MATLAB, Symbolic Math Toolbox, Image Processing Toolbox

Contents: Completed solutions for the live script lessons and accompanying applications.