Vector Arithmetic

Curriculum Module

Created with R2020b. Compatible with R2020b and later releases.

Description

This curriculum module contains interactive *live scripts* that teach the fundamental concepts of vectors, such as vector magnitude and addition. These methods are motivated by an application: calculating the orientation of a cell phone using the built-in accelerometer and magnetometer. Throughout the module, students apply the mathematical techniques to computing meaningful values, such as pitch and yaw. These lessons 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

`vectorBasics.mlx`

Products: MATLAB, Symbolic Math Toolbox
Contents: An interactive lesson that teaches the basics of individual vectors, such as vector components, magnitude, and orientation. These concepts are applied to compute the pitch of a cell phone using accelerometer readings.
Learning Goals:

- Relate the components of a vector to its visualization in 2- and 3-dimensions
- Compute the magnitude of a vector in 2- and 3-dimensions
- Compute the orientation of a vector in 2-dimensions
- Discuss the meaning of the magnitude of an accelerometer reading
- Relate the pitch of a cell phone to accelerometer readings

`vectorArithmetic.mlx`

Products: MATLAB, Symbolic Math Toolbox
Contents: An interactive lesson that teaches vector arithmetic. Vector addition, scalar multiplication, dot product, and cross product are discussed. These concepts are applied to compute the yaw of a cell phone using magnetometer readings.
Learning Goals:

- Add and subtract vectors
- Compute scalar, dot, and cross products of vectors
- Relate arithmetic vector operations to visual representations
- Identify the physical meaning of the results of arithmetic vector operations
- Apply vector arithmetic to compute the yaw of a cell phone

`vectorBasicsSoln.mlx`

Products: MATLAB, Symbolic Math Toolbox
Contents: Completed solution for `vectorBasics.mlx`.

`vectorArithmeticSoln.mlx`

Products: MATLAB, Symbolic Math Toolbox
Contents: Completed solution for `vectorArithmetic.mlx`.

`accelerometerReadings.mp4`

Products: MATLAB, Symbolic Math Toolbox
Contents: An example of the accelerometer readings used in `vectorBasics.mlx`.

`magnetometerReadings.mp4`

Products: MATLAB, Symbolic Math Toolbox
Contents: An example of the accelerometer and magnetometer readings used in `vectorArithmetic.mlx`.