GEOS 397/597

Lecture #18: Curve fitting

use **practical_18.m**

1) Update from github

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2) polyfit, polyval, corrcoef, roots

MATLAB provides several built-in functions to fit curves

- Many require the “Curve Fitting Toolbox”, or other toolboxes.
- We will only use the basic curve fitting functions that are part of standard MATLAB
- We will focus on:

1) polyfit

2) polyval

3) corrcoef

4) roots

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3) Review polynomials

Polynomials come in different **orders** or **degrees**.

- 0^{th} order: a single constant value

Examples:

$$y = 4$$
$$y = 2.75$$
$$y = -12.1$$

- 1^{st} order: a linear equation (i.e. independent variable is to 1^{st} power)

Examples:

$y = 4x$
$y = 2.75x + 7$
$y = -12.1x - 21.3$

- 2^{nd} order: a quadratic equation

Examples:

$y = 4x^2$
$y = 2.75x^2 + 7$
$y = -12.1x^2 - 21.3x + 1.4$

- 3^{rd} order: a cubic equation

Examples:

$y = 4x^3$
$y = 2.75x^3 + 7$
$y = -12.1x^3 - 21.3x + 1.4$
$y = 12x^3 + 3x^2 - 11x + 2$

- n^{th} order: a polynomial where n is the largest exponent on the independent variable
- Can be represented in MATLAB as a row vector of the coefficients in front of the independent variable of decreasing order

[3, 2.7, 1, -5.7] $\rightarrow 3x^3 + 2.7x^2 + x - 5.7$

The polynomial **order** is always

```
1 | n = numel(vector) - 1
```

Remember the 0^{th} order term! Also remember that the equation order doesn't matter, but the vector order does! (It is a good habit to organize the terms based on reducing order though.)

x - 5.7 + $3x^3 + 2.7x^2 \rightarrow$ [3, 2.7, 1, -5.7]

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polyval() -- evaluate polynomial

These vectors can be interpreted by **polyval()** as coefficients of a polynomial and used to make a curve.

Try first practical exercise.

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polyfit() -- fit polynomial to data

This function can be used to estimate the coefficients from an existing curve.

Try second practical exercise.

Linear least-squares fitting

Goodness of fit

4) Student exercises in class