Session 1. Getting started with MATLAB/ Simulink

Lecture notes for Advanced modeling and Control

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| Table 1: Useful functions   |  |  | | --- | --- | | **General functions**: |  | | cd | Change subdirectory | | demo | Launch the demo (introduction) | | dir (what) | Listof files in currentdirectory (or only M-files) | | help, helpwin | Help! Help window | | load | Load workspace | | lookfor | Keyword search | | print | Printgraph; can use pull-down menu | | quit | Quit! | | save | Save workspace | | who, whos | Listof variables in workspace | | **Calculation functions**: |  | | conv | Convolution function to multiply polynomials | | size, length | Size of an array, length of a vector | | **Plotting functions**: |  | | axis | Override axis defaultof plot | | grid | Add grid to plot | | hold | Hold a figure to add more plots (curves) | | legend | Add legend to plot | | plot | Make plots | | text (gtext) | Add text (graphical control) to plot | | title | Add title to plot | | xlabel, ylabel | Add axis labels to plot | | **Partial fraction and transfer functions**: |  | | poly | Construct a polynomial from its roots | | residue | Partial-fraction expansion | | roots | Find the roots to a polynomial | | tf2zp | Transfer function to zero-pole form conversion | | zp2tf | Zero-pole form to transfer function conversion | | tf | Create a transfer function object | | get | Listthe objectproperties | | pole | Find the poles of a transfer function | | zpk | Create a transfer function in pole-zero-gain form | |

# 1. Activities

1. Explore MATLAB user interface
2. Define a vector x = [1 2 3 4 5 6 7 8 9 10].

* What are different ways you can define x? What happens when you put ; at the end?

1. Convert vector x into a column vector.
2. Create vector y = [0, 0.1, 0.2, ...., 2.0]
3. Create a 3 x 3 matrix.
4. Print the size of the matrix and lengths of vectors defined so far.
5. Define 3 polynomials

1. Calculate
2. Perform some mathematical computations on the vectors, matrices, and polynomials defined so far.
3. Solve **Ax = b**

* A = [ 4 -2 -10; 2 10 -12; -4 -6 16];
* b = [-10; 32; -16];

1. Check the solution
2. Calculate eigenvalues and eigenvectors.
3. Consider data:

* x = [ 0 1 2 4 6 10];
* y = [ 1 7 23 109 307 1231];
* Fit a third-order polynomial. Plot the results

1. Explore MATLAB plotting capabilities
2. Create a MATLAB script, save, and load it to plot data in item 13.
3. Find roots of polynomial defined by p = [1 5 4]
4. Search for a function to find roots of a nonlinear equation.
5. Find polynomial for the roots (-4, -1)
6. For the following transfer functions find partial fractions.

1. Have fun with zp2tf, tf2zp, and tf commands
2. Response of first order system: Compute and plot step response of following first order systems

1. Response of second order system: Compute and plot step response of following second order system. Show effect of on response.

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1. Solve differential equations using Simulink
2. An object falling under gravity

* Compare the result with analytical solution

1. Systems of ODEs