

Drexel University  
Office of the Dean of the College of Engineering  
ENGR 232 – Dynamic Engineering Systems

---

**Week 9 – Pre Lab**

**MATLAB Primer**

```
%% ENGR 232 - symbolic forcedwIC
clear all
close all
clc
%% Define for each Matrix and IC
x0 = [1;2]
% stable system
A = [0 1; -2 -3]
B = [0; 1]
%% symbolic solution
syms s
Us = 1/s; % step input
Xs = inv(s*eye(2)-A)*x0+ inv(s*eye(2)-A)*B*Us
% to get each component
X1s = simplify(Xs(1,1))
X2s = simplify(Xs(2,1))

% now invert
x1t = ilaplace(X1s)
x2t = ilaplace(X2s)

%% plot results
IC = x0;
ep = inv(A)*-B;
x1 = matlabFunction(x1t) % make functions to plot
x2= matlabFunction(x2t)

t = 0:0.01:10;
subplot(2,2,1)
plot(t,x1(t),'r', 'linewidth', 2)
grid on; ylabel('x_1(t)')
title('Component Plots')

subplot(2,2,3)
plot(t,x2(t), 'linewidth', 2)
grid on; ylabel('x_2(t)')
xlabel('t')

subplot(1,2,2)
plot(x1(t),x2(t),'g', 'linewidth', 2)
hold on, plot(IC(1),IC(2),'b*',ep(1),ep(2),'k*')
plot(ep(1),ep(2),'ko')
hold off
xlabel('x_1(t)'), ylabel('x_2(t)')
title('Phase Plot')
legend('Analytical Trajectory','Initial Condition',...
      'Eq Point','Location','best')
grid on
```