Faculty of Engineering, Cairo University
Electronics and Communication Department
Third Year, Spring 2011
Continuous-Time Control Systems (ELC327)

MATLAB Assignment

Consider the following open-loop systems (plants).

a) $\frac{4}{s(s+2)(s^2+2s+2)}$

b) $\frac{\frac{2}{3}(s+3)}{s(s+2)(s+1)}$

c) $\frac{9(s^2+0.2s+1)}{s(s^2+1.2s+9)}$

d) $\frac{20(s^2+s+0.5)}{s(s+1)(s+10)}$

For each open-loop T.F

1) Plot the root locus.
   - Find the condition on the loop gain to have $\eta \geq 0.5$.
2) Get the Bode plot.
   - Get all the stability margins.
   - Get the open-loop bandwidth.
3) Plot the Nyquist diagram.

If these systems where used in a unity feed-back

4) plot the impulse response.
5) plot the unit step response.
   - find t_r, t_p, M_p, t_s.
6) plot the unit ramp response.

Choose one of the above systems and use the ***sisotool*** command to design

7) Lead compensator to have $\eta \geq 0.5$ and decrease the settling time by at least 20% without affecting the steady state error for a unit ramp input.
8) Lag compensator to have steady state error for a unit ramp less than 0.2 without affecting the settling time or M_p.
9) PID controller to eliminate the steady state error for a ramp input, have $\eta \geq 0.5$, and decrease the settling time by 20%.

For each compensator/controller, plot the unit step and unit ramp response of the closed loop system after compensation.

Notes:

- This assignment should be done individually (no groups).
- Duplicated assignments will get **ZERO**
- All the plots must be done using MATLAB
- The MATLAB code used must be included in the report
- In the compensator deign part (7, 8 & 9), you can use the ***sisotool*** command to get the compensator parameters by ***trial and error***.
- You should try to be as close as possible to the requirements, even if you can't completely achieve the requirements.