Modeling and Control of Mechatronic Systems

# Exercise 4: Design of Control Systems - Direct Analytical Method

*Dr Jayantha Katupitiya*

# Exercise 4

# Design of Control Systems - Direct Analytical Method

A system plant transfer function is given as,

$$G_p(s) = \frac{1}{s(s+1)}$$

A controller needs to be designed to satisfy the following conditions;

1. Time to peak $t_p$ = 0.2s.
2. Damping ration $\zeta$=0.8.
3. Zero steady state error to a step input.
4. Zero steady state error to a ramp input.

Do the following:

a). Determine a suitable sampling interval $T$.

b). Obtain $G_p(z)$ assuming the plant is proceeded by a ZOH.

c). Propose $F(z)$ ignoring the ringing effects.

d). Give the controller that corresponds to the $F(z)$ above.

e). Build a Simulink block diagram using your controller, ZOH and the continuous plant. Obtain a plot of step response and ramp response.

f). Propose an $F(z)$ to eliminate the ringing effects.

g). Give a controller that corresponds to $F(z)$ in f).

h). Replace the controller in item e). above with the controller obtained in item g). Obtain a plot of step response and ramp response

i). Discuss the effect of the presence and absence of ringing in the two plots you generated.