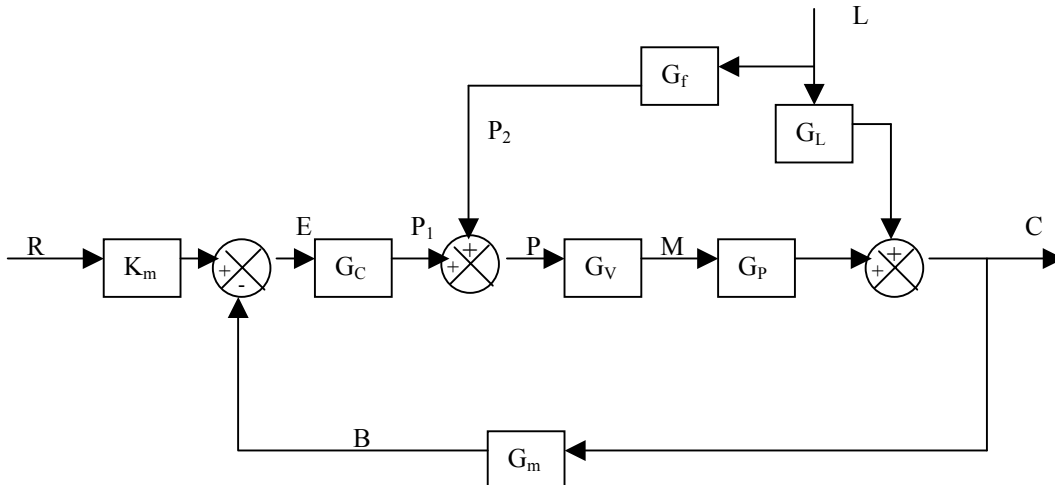


ChEE 413
Homework Handout 8
2005

1) Problem 10.5 from first edition -

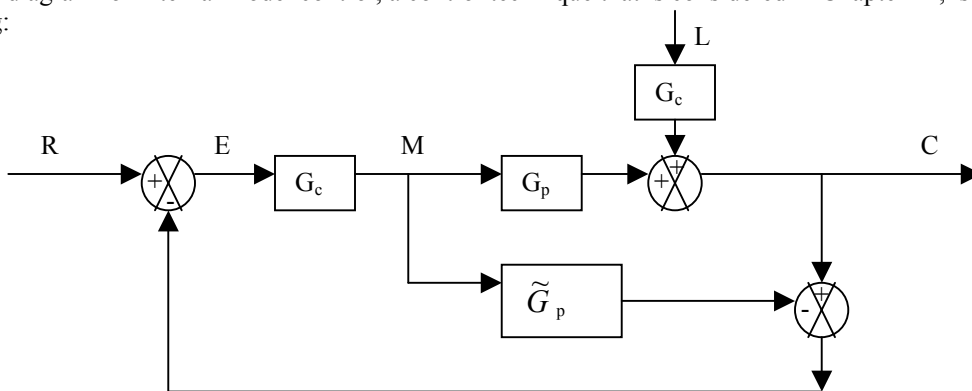
A block diagram of a feedforward-feedback control system is shown in the drawing where G_f is the feedforward controller transfer function.



- a) derive an expression for the closed-loop transfer function for load changes, $C(s)/L(s)$.
- b) Assume that perfect control is desired for load changes, that is $C(s) = 0$ when $L(s)$ is not zero. Derive an expression for the ideal feedforward controller transfer function G_f that will theoretically provide perfect control.

2) Problem 10.8 from first edition -

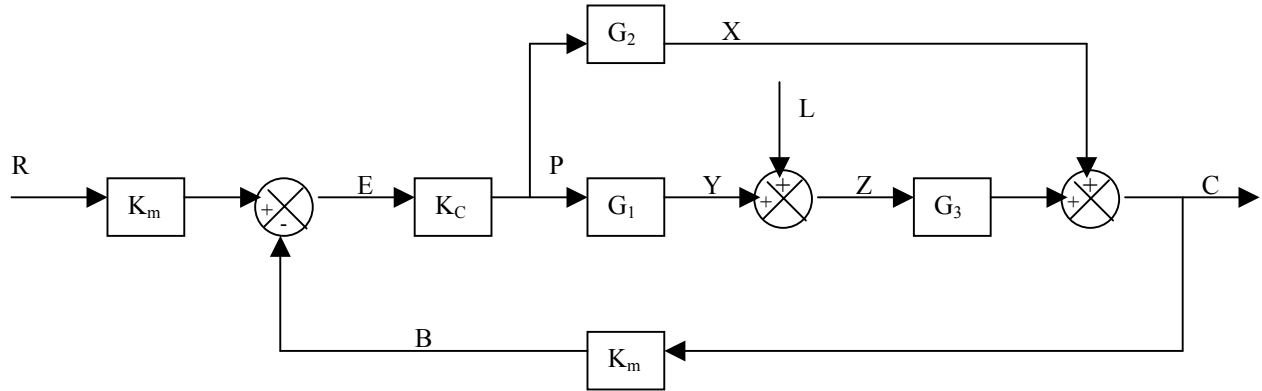
A block diagram for internal model control, a control technique that is considered in Chapter 12, is shown in the drawing:



Transfer function \tilde{G}_p denotes the process model, while G_p denotes the actual process transfer function. It has been assumed that $G_v = G_m = 1$ for simplicity. Derive closed loop transfer functions for both servo and regulator problems.

3) Problem 10.12 from first edition -

For the block diagram shown here:



- a) derive an expression for the closed loop transfer function, $C(s)/L(s)$.
 b) for the transfer functions given below, what is the smallest value of K_c that can be used and have an offset of not more than 0.4 after a step change of -2 in the load variable. The following information is available:

$$G_1(s) = \frac{0.3}{s+1} \quad G_2(s) = \frac{1}{10s+1} \quad G_3(s) = \frac{0.9e^{-s}}{12s+1} \quad K_m = 0.6$$

State any additional assumptions that you make.