

**ChE 436**  
**Sample Problem on Block Diagram Algebra**

For the following block diagram, find the expression for the servo problem (setpoint change, or  $Y/Y_{sp}$ ).

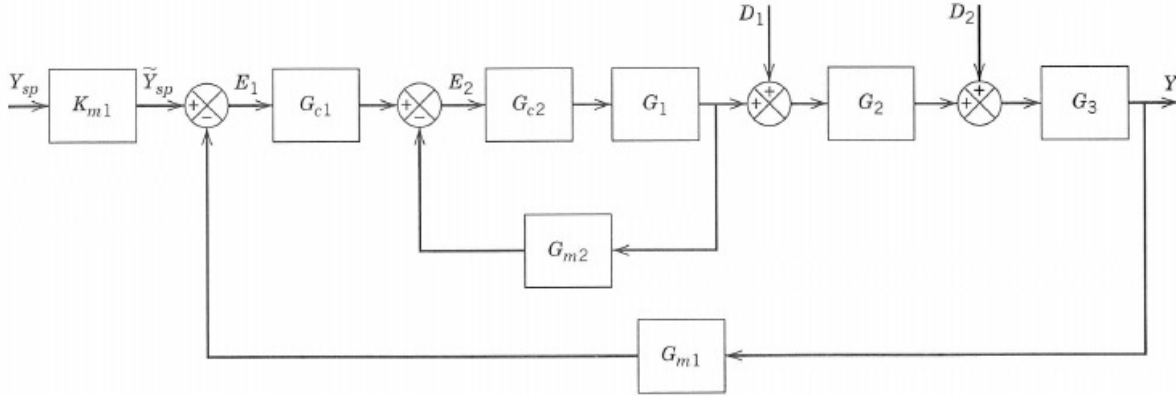


Figure 11.12 Complex control system.

- (a) Define the inner loop on the diagram, and make a new variable  $Y_1$  just before  $G_2$ .
- (b) Find the transfer function for  $Y_1/E_1$  using the shortcut method. Call this  $G_{IL}$ .

(c) Now find the transfer function for  $Y/Y_{sp}$  using the shortcut method and  $G_{IL}$ .

(d) Next substitute for  $G_{IL}$

(e) Rearrange to have one polynomial on the top and one polynomial on the bottom.