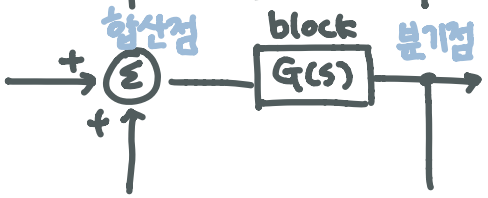
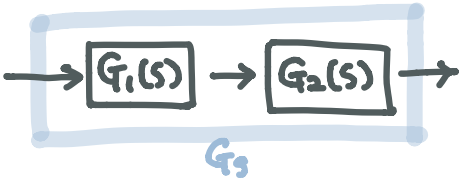
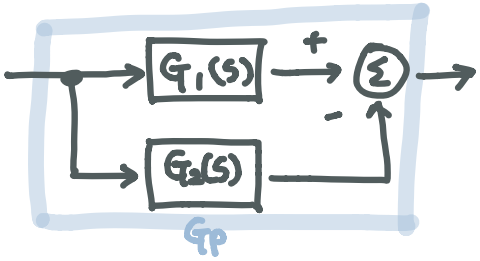
4 Block diagram

: 전체 system을 여러 system으로 나누어 표현하는 방법

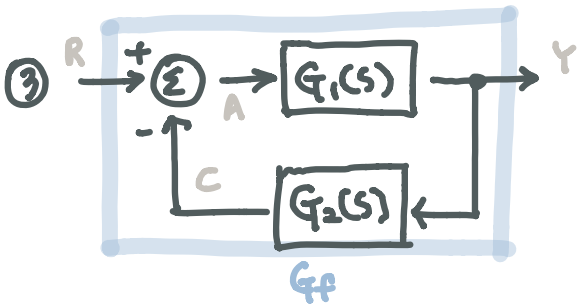


① 

$$G_s(s) = G_1(s)G_2(s)$$

② 

$$G_p(s) = G_1(s) + G_2(s)$$

③ 

$$G_f(s) = \frac{G_1(s)}{1 + G_1(s)G_2(s)}$$

$A = R - C$

$Y = G_1 A$

$C = Y G_2$

$\Rightarrow Y = G_1(R - C)$

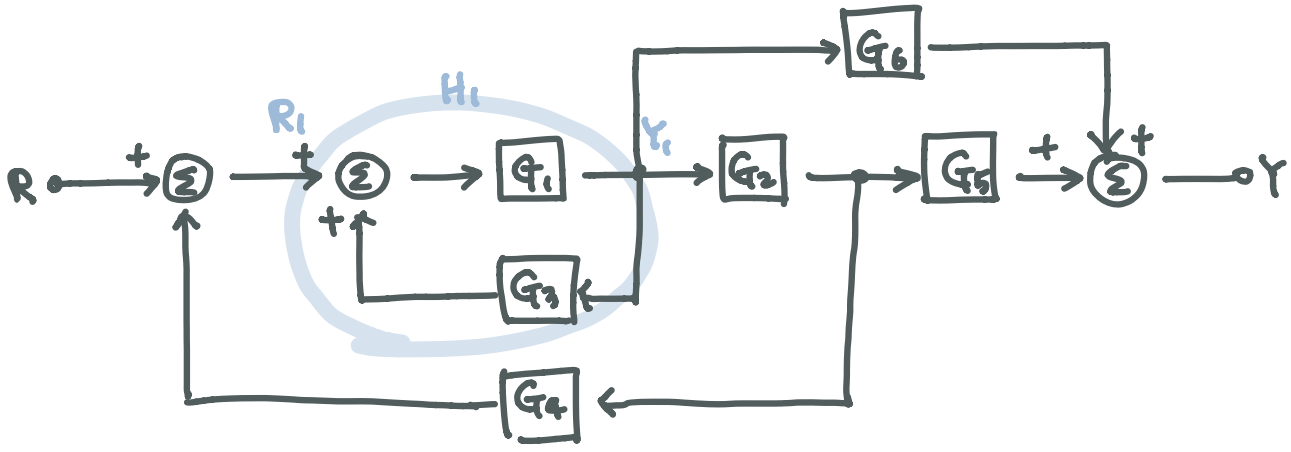
$Y = G_1(R - YG_2)$

$= G_1 R - Y G_1 G_2$

$(1 + G_1 G_2) Y = G_1 R$

$$G_f = \frac{Y}{R} = \frac{G_1}{1 + G_1 G_2}$$

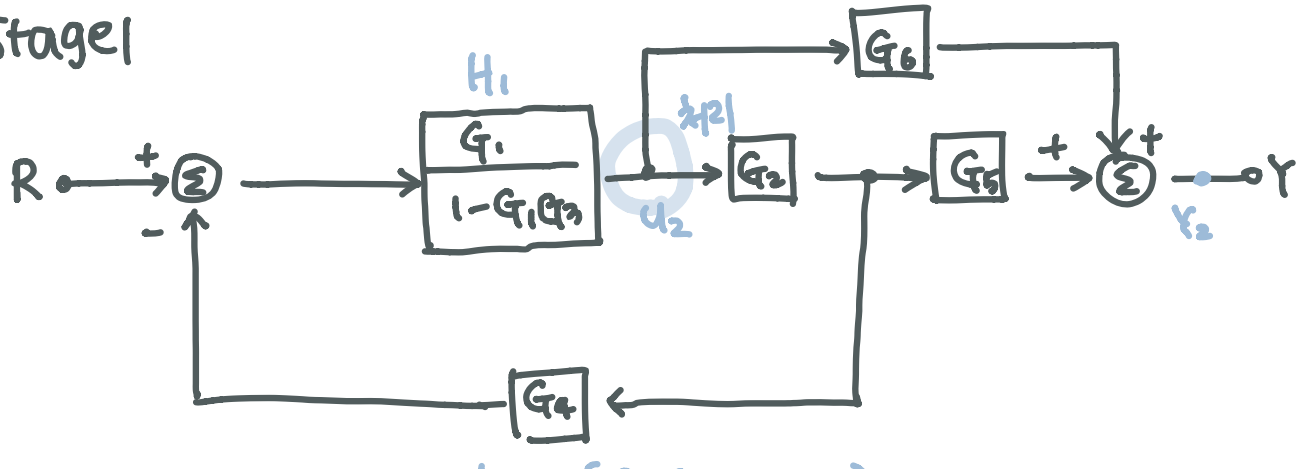
예제 3.23) 블럭선도로 전달함수



Tip) 작은 loop 부터 처리

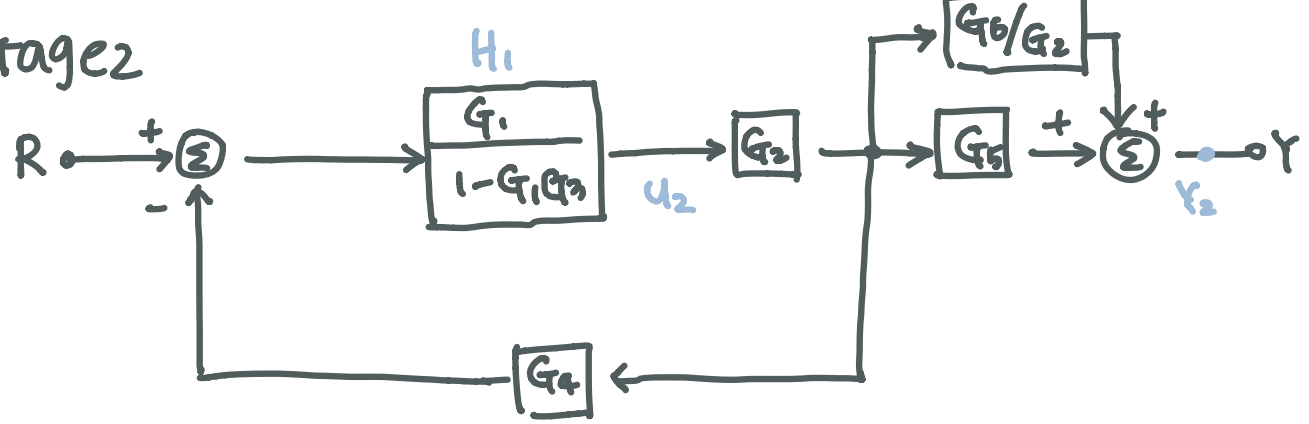
$$H_1 = \frac{Y_1}{R_1} = \frac{G_1}{1 - G_1 G_3}$$

Stage1



$$Y_2 = (G_2 G_5 + G_6) U_2$$

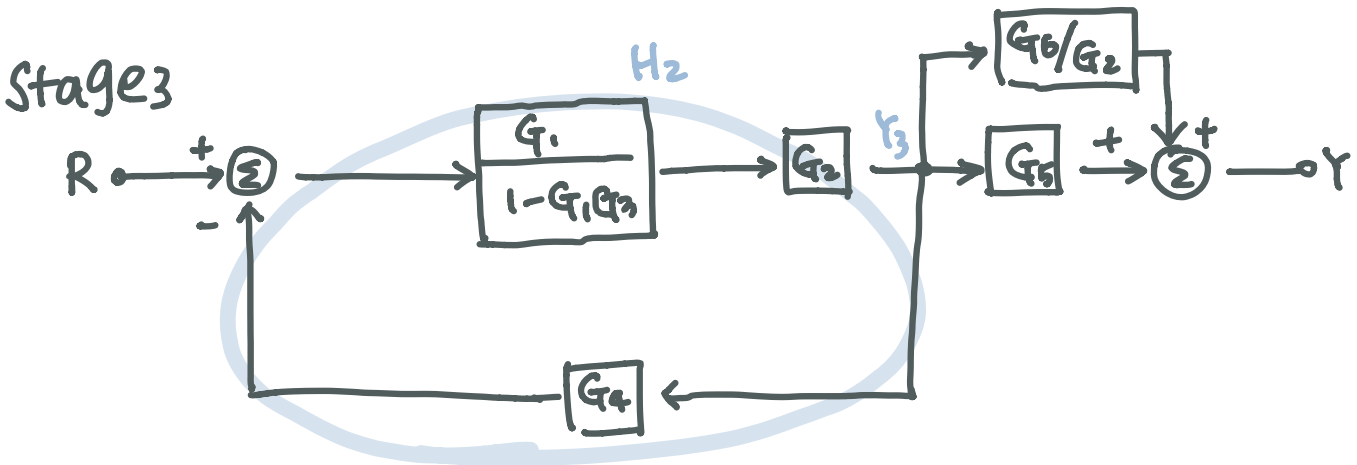
Stage 2



$$Y_2 = \left(G_2 \cdot \frac{G_6}{G_2} + G_2G_5\right)U_2$$

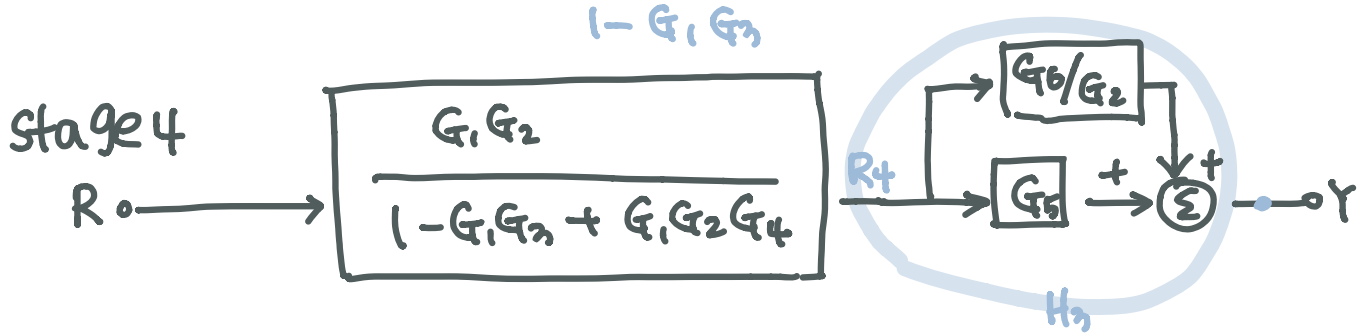
$$= (G_2G_5 + G_6)\,U_2$$

Stage 3



$$H_2 = \frac{Y_3}{R} = \frac{\dfrac{G_1G_2}{1-G_1G_3}}{1 + \dfrac{G_1G_2G_4}{1-G_1G_3}} = \frac{G_1G_2}{1-G_1G_3+G_1G_2G_4}$$

Stage 4

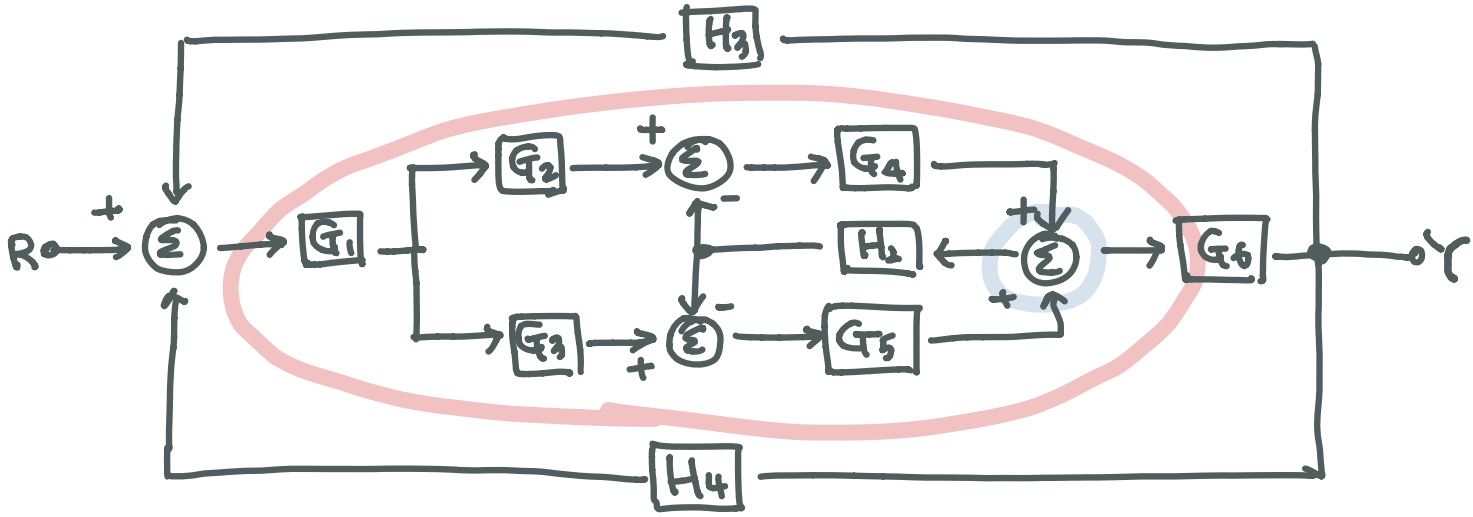


$$H_3 = \frac{Y}{R_4} = \frac{G_6}{G_2} + G_5$$

$$\therefore H = \frac{Y}{R} = \left(\frac{G_1G_2}{1-G_1G_3+G_1G_2G_4}\right)\left(\frac{G_6}{G_2} + G_5\right)$$

$$= \frac{G_1G_6 + G_1G_2G_5}{1-G_1G_3+G_1G_2G_4}$$

Problem 3.22)



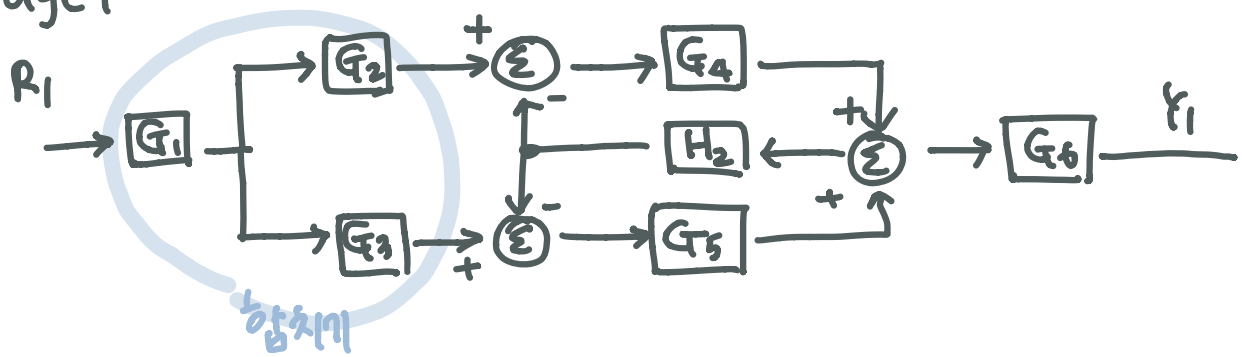
이 문제 point

① 가운데를 기준으로 위 아래가 대칭

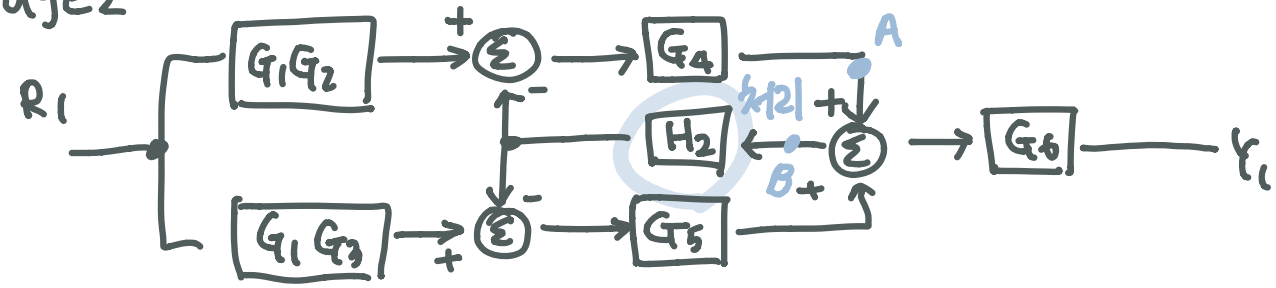
② Σ 입력 2개 출력 2개

③ 안쪽부터 해석

stage 1



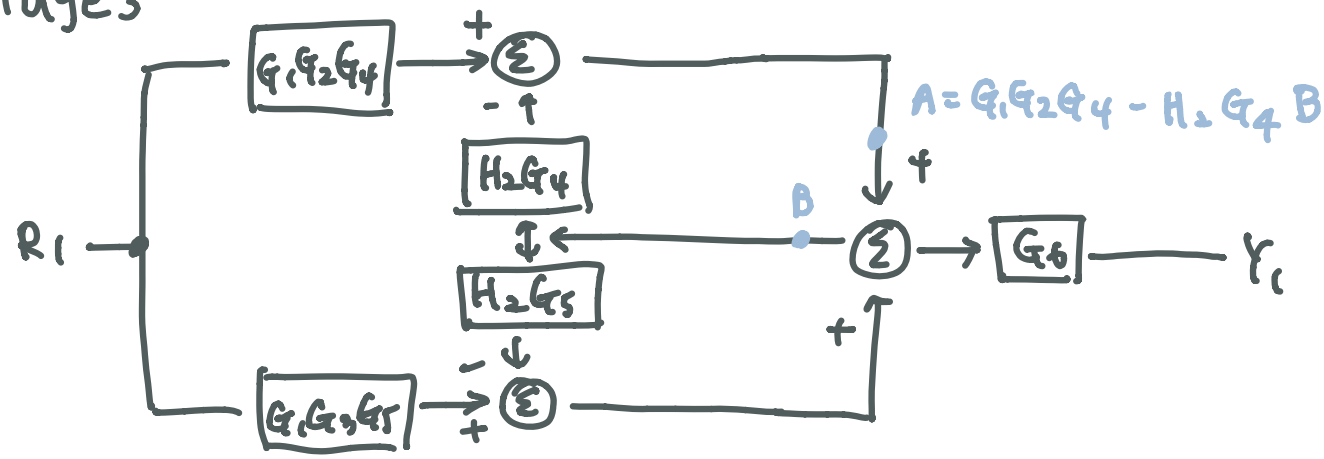
stage 2



피드백을 H_2를 처리하기 위해선 node A 에서의 값을 알아야함

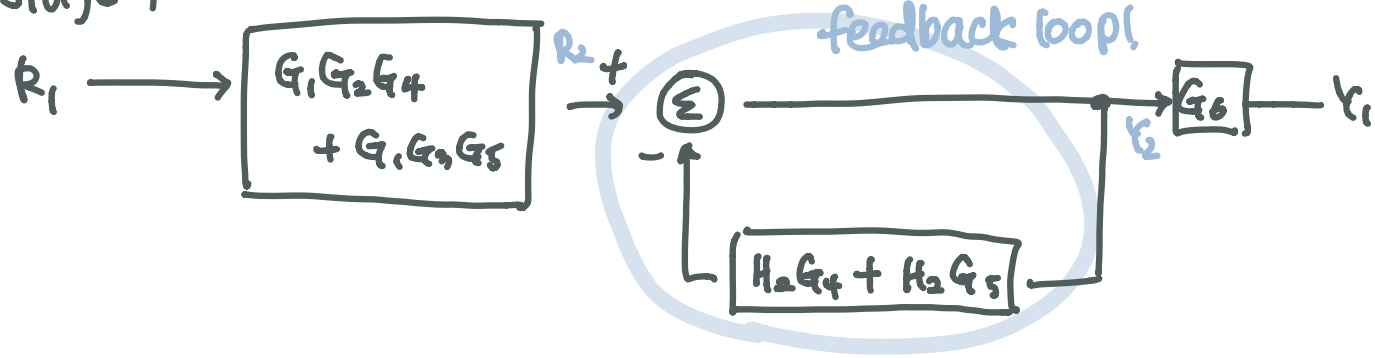
$A = G_1G_2G_4 - H_2G_4B$ ← node A의 signal은 그대로 유지하면서 block 정리

stage3



※ R1 아래 접어버려 ※

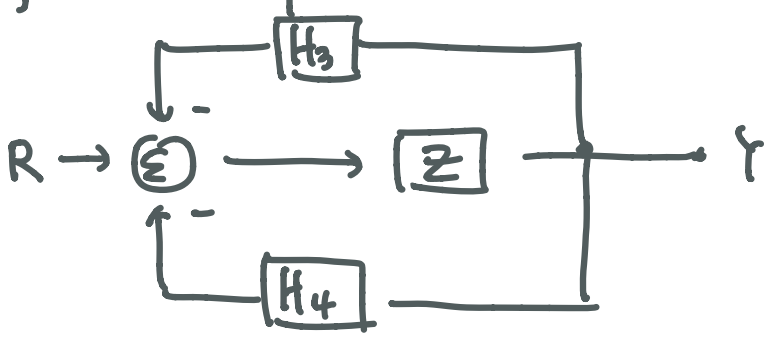
stage 4



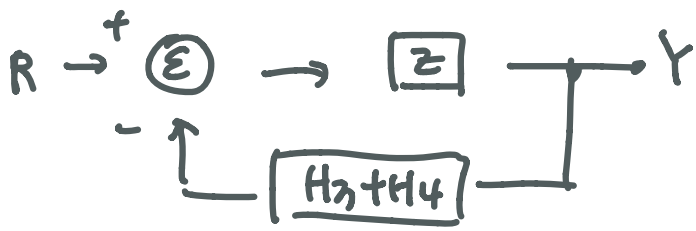
$$\frac{Y_2}{R_2} = \frac{1}{1 + (H_2G_4 + H_2G_5)}$$

$$Z = \frac{Y_1}{R_1} = (G_1G_2G_4 + G_1G_3G_5)\left(\frac{1}{1 + (H_2G_4 + H_2G_5)}\right)G_6$$

stage 5 : 전체 system



↓ 정리



$$\frac{Y}{R} = \frac{Z}{1 + Z(H_3 + H_4)}$$