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Exercício aula 03/11/2020

① $(I+GH)^{-1}G = G(I+HG)^{-1}$

$(I+GH)(I+GH)^{-1}G(I+HG) = (I+GH)G(I+HG)^{-1}(I+HG)$

$G(I+HG) = (I+GH)G$

$G+GHG = G+GHG$

$\therefore (I+GH)^{-1}G = G(I+HG)^{-1}$

② $Z = HG(R-Z) \Rightarrow (I+HG)Z = HGR$

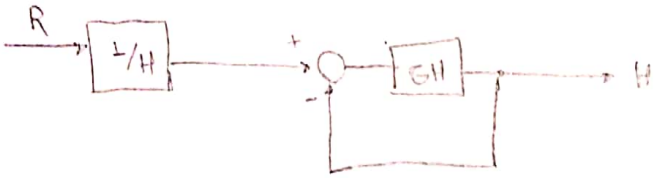
$Z = (I+HG)^{-1}HGR$

$HG(I+GH)^{-1} = (I+HG)^{-1}HG$

$(I+HG)HG = HG(I+GH)$

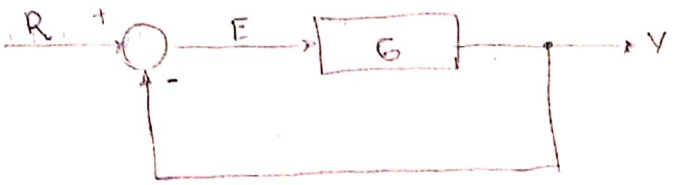
$HG+HGHG = HG+HGHG$

③



$Y = GH\left(\frac{R}{H} - Y\right) \Rightarrow Y = GR - GHY \Rightarrow (I+GH)Y = GR$

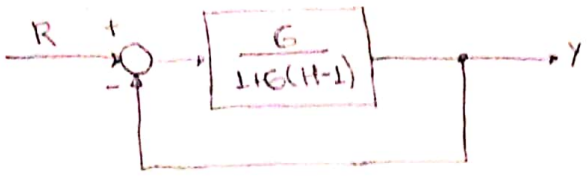
$\frac{Y}{R} = \frac{G}{I+GH}$



$Y = GH\left(\frac{1}{H}R - Y\right) \Rightarrow (I+GH)Y = GR \Rightarrow \frac{Y}{R} = \frac{G}{(I+GH)}$

Portanto, como as expressões são iguais os circuitos são equivalente

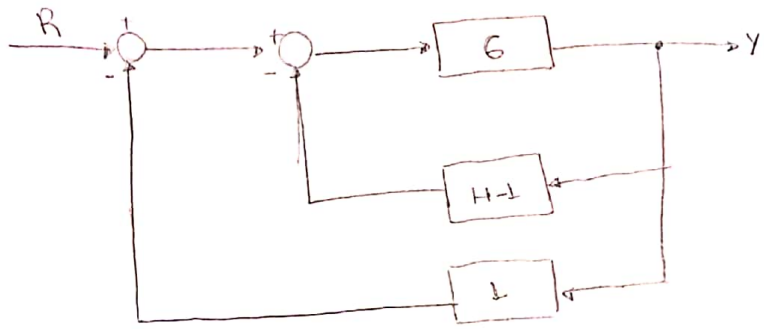
④



$$Y = \frac{G}{1+G(H-1)}(R-1) \Rightarrow \left[1 + \frac{G}{1+G(H-1)}\right] Y = \frac{GR}{1+G(H-1)}$$

$$\frac{Y(1+GH-G+G)}{1+G(H-1)} = \frac{GR}{1+G(H-1)} \Rightarrow \frac{Y}{R} = \frac{G}{1+GH}$$

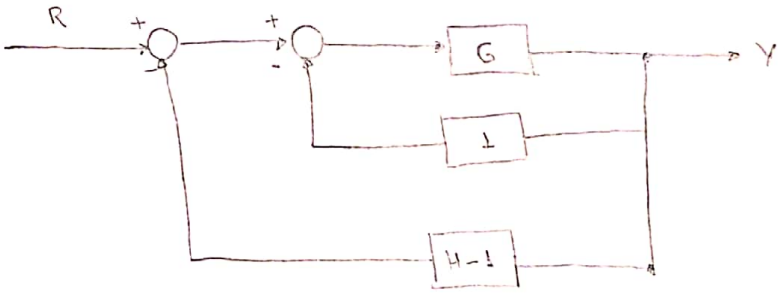
⑤



$$G\left[(R-Y) - (H-1)Y\right] = Y \Rightarrow G(R-Y-HY+Y) = Y \Rightarrow GR - GHY = Y$$

$$Y(1+GH) = GR \Rightarrow \frac{Y}{R} = \frac{G}{1+GH}$$

⑥

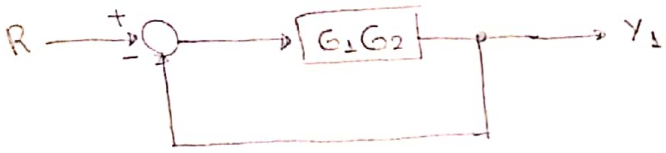


$$G\left[R - (H-1)Y - Y\right] = Y \Rightarrow G(R - HY + Y - Y) = Y \Rightarrow GR - GHY = Y$$

$$Y(1+GH) = GR \Rightarrow \frac{Y}{R} = \frac{G}{1+GH}$$

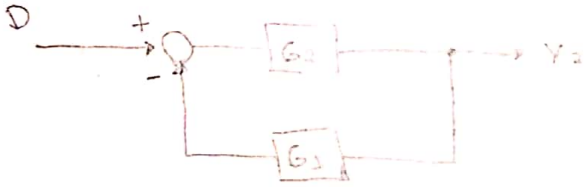
(7) Com $D=0$, o diagrama é dado por

Para o caso escalar temos $G_2G_1 = G_1G_2$ com isso ficamos com.



$$(R-Y_1)G_1G_2 = Y_1 \Rightarrow G_1G_2R = Y_1(1+G_1G_2) \Rightarrow Y_1 = \frac{G_1G_2R}{1+G_1G_2}$$

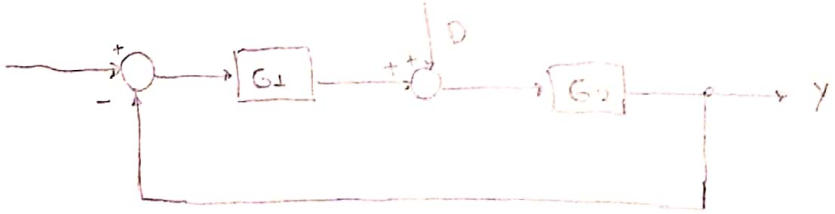
(8) Com $R=0$, o diagrama é dado por.



$$G_2(D-G_1Y_2) - Y_2 \Rightarrow G_2D - G_2G_1Y_2 = Y_2 \Rightarrow Y_2(1+G_2G_1) = G_2D$$

$$\Rightarrow Y_2 = \frac{G_2D}{1+G_1G_2}$$

(9)



$$G_2\left[G_1(R-Y)+D\right] = Y$$

$$G_2G_1R - G_2G_1Y + G_2D = Y$$

$$Y(1+G_1G_2) = G_2G_1R + G_2D$$

$$Y = \underbrace{\frac{G_1G_2R}{1+G_1G_2}}_{Y_1} + \underbrace{\frac{G_2D}{1+G_1G_2}}_{Y_2} = Y_1 + Y_2$$

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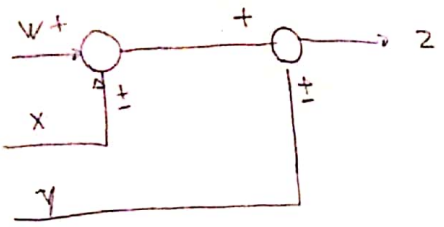
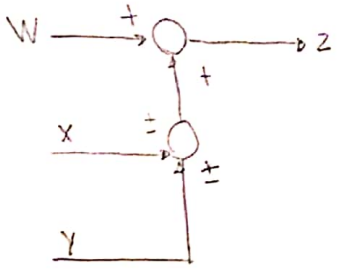


$$(W \pm X) \pm Y = Z$$

$$Z = W \pm X \pm Y$$



$$(\pm X \pm Y) + W = Z$$

$$Z = W \pm X \pm Y$$

Portanto, os diagramas são equivalentes

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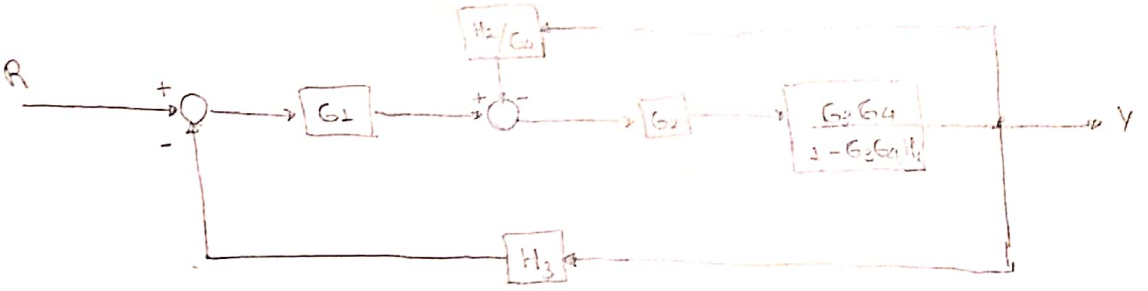


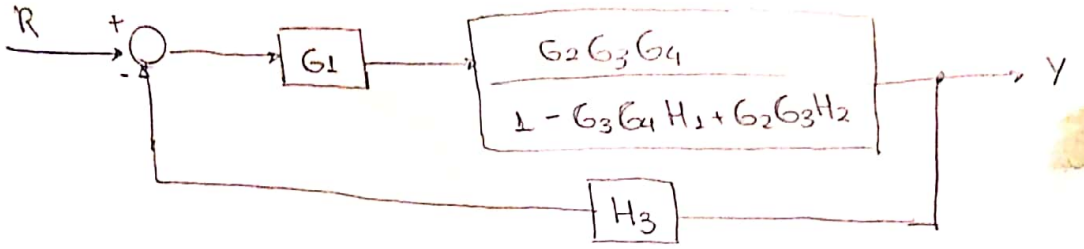
$$\left[G_2 \left[G_1(R - H_3Y) - \frac{H_2Y}{G_4} \right] \right] \frac{G_3G_4}{1 - G_3G_4H_2} = Y$$

$$\frac{G_1G_2G_3G_4}{1 - G_3G_4G_1} \cdot R = Y \left[1 + \frac{G_2G_3G_4}{1 - G_3G_4H_2} \left(G_1H_3 + \frac{H_2}{G_4} \right) \right]$$

$$G_1G_2G_3G_4R = Y \left(1 - G_3G_4H_2 + G_1G_2G_3G_4H_3 + G_2G_3H_2 \right)$$

$$\frac{Y}{R} = \frac{G_1G_2G_3G_4}{\left(1 - G_3G_4H_2 + G_2G_3H_2 + G_1G_2G_3G_4H_3 \right)}$$

(12)



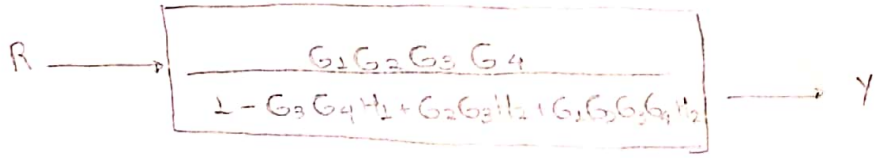
$$\frac{G_2G_3G_4}{1 - G_3G_4H_1 + G_2G_3H_2}\left[G_1(R - H_3Y)\right] = Y$$

$$G_1G_2G_3G_4(R - H_3Y) = Y(1 - G_3G_4H_1 + G_2G_3H_2)$$

$$G_1G_2G_3G_4R = Y(1 - G_3G_4H_1 + G_2G_3H_2 + G_1G_2G_3G_4H_3)$$

$$\frac{Y}{R} = \frac{G_1G_2G_3G_4}{1 - G_3G_4H_1 + G_2G_3H_2 + G_1G_2G_3G_4H_3}$$

(13)



$$\frac{Y}{R} = \frac{G_1G_2G_3G_4}{1 - G_3G_4H_1 + G_2G_3H_2 + G_1G_2G_3G_4H_3}$$