

# Escola Politécnica da USP

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## PNE 3380 - Modelagem de Sistemas Dinâmicos - Exercício 3/11

1)  $Y = (I + GM)^{-1} GR$ ,  $Y = \tau R \rightarrow \tau = (I + GM)^{-1} G$

Pela lógica de blocos:  $Z = MY \rightarrow R - E = MY \rightarrow R - G^{-1}Y = MY$

$R = (I + MG)G^{-1}Y \rightarrow (I + MG)^{-1}R = G^{-1}Y$

i.  $\tau = G(I + MG)^{-1}$   
 $G(I + MG)^{-1} = (I + GM)^{-1}G = G(I + L)^{-1}$  Assumindo  $L = MG$

2)  $Z = MY \rightarrow Z = MG E = MG(R - Z)$

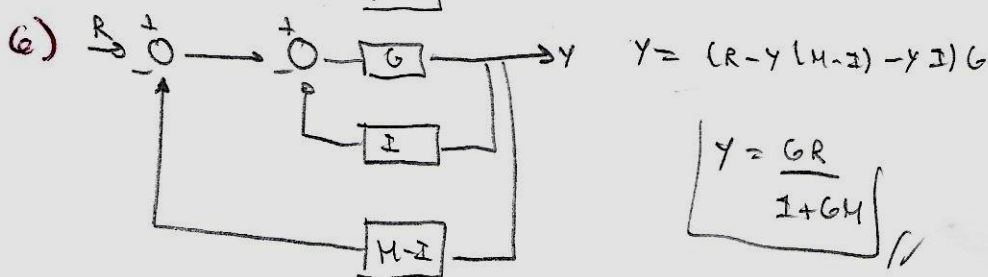
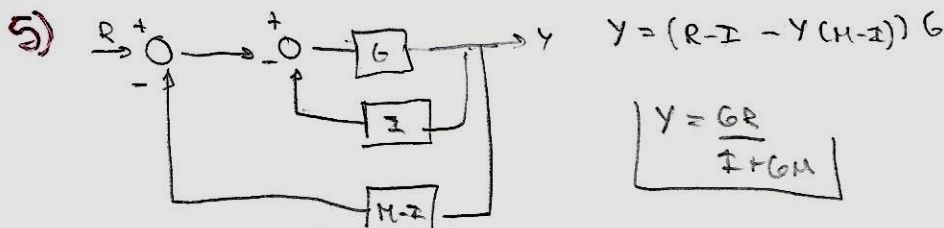
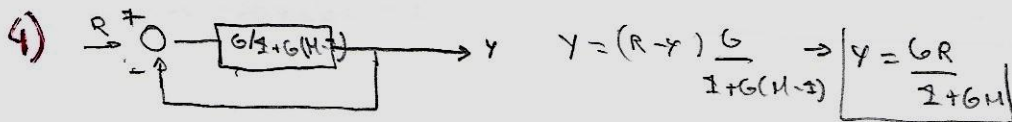
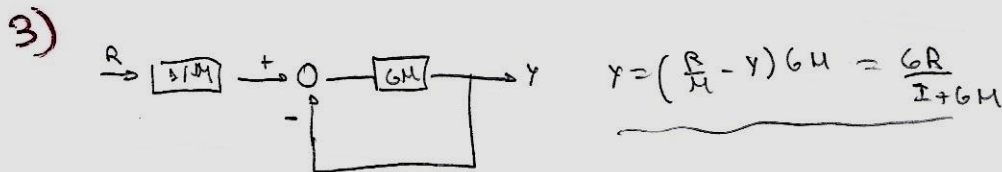
$MGR = (I + MG)Z \rightarrow (I + MG)^{-1}MG = ZR^{-1}$

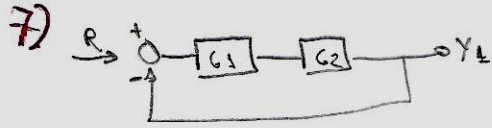
$Y = GE \rightarrow M^{-1}Z = G(R - Z) \rightarrow (I + GM)M^{-1}Z = (M^{-1} + G)Z$

i.  $ZR^{-1} = M(I + GM)^{-1}G$

Assumindo  $L = MG$

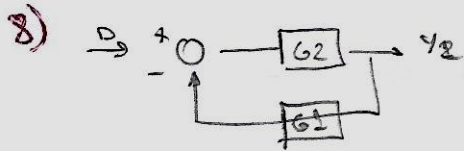
$\frac{Z}{R} = \frac{L}{I + L} = \frac{GM}{I + GM} = \frac{MG}{I + MG}$





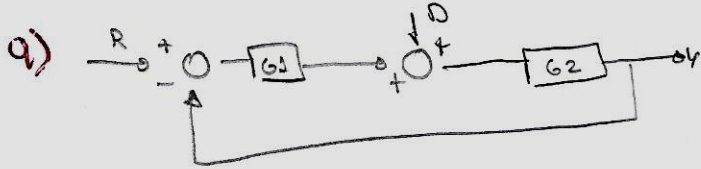
$$Y_1 = (R - Y_1)G_1G_2$$

$$Y_1 = \frac{RG_1G_2}{1 + G_1G_2}$$



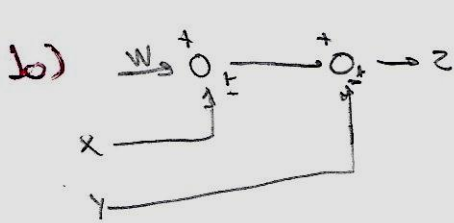
$$Y_2 = (D - Y_2G_2)G_2$$

$$Y_2 = \frac{DG_2}{1 + G_1G_2}$$



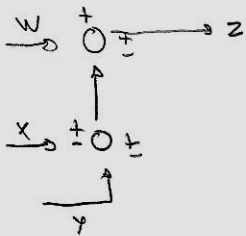
$$Y = (R - Y)G_1 + D)G_2$$

$$Y = \frac{(RG_1 + D)R}{1 + G_1G_2}$$

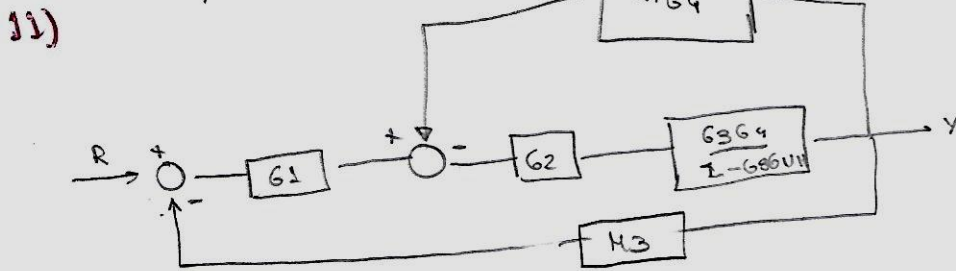


$$Z = W \pm X \pm Y$$

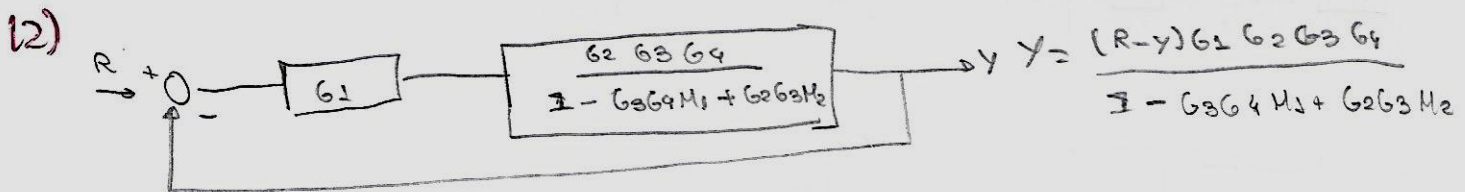
(=)



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



$$Y = \frac{RG_1G_2G_3G_4}{1 - H_1G_3G_4 + H_2G_2G_3 + H_3G_1G_2G_3G_4}$$



$$Y = \frac{(R - Y)G_1G_2G_3G_4}{1 - G_3G_4M_1 + G_2G_3M_2}$$

$$Y = \frac{RG_1G_2G_3G_4}{1 - H_1G_3G_4 + H_2G_2G_3 + H_3G_1G_2G_3G_4}$$