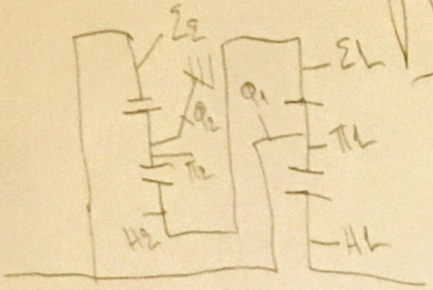


V5

$T_1: H_1 - \Pi_1 - \Sigma_1$ | $\omega_{q_2} = 0$

$T_2: \Pi_1 - q_1 - \Sigma_1$ | $\omega_{q_1} = \omega_{\Sigma 2}$

$T_3: H_2 - \Pi_2 - \Sigma_2$ | $\omega_{\Sigma 1} = \omega_{H 2}$

$T_4: \Pi_2 - q_2 - \Sigma_2$ | $\omega_{\Pi_1} = \omega_{q_1} = \omega_{\Sigma 2}$

Σχόλιο: $\frac{\omega_{H1}}{\omega_{\Sigma 2}}$

T_1:

$$\omega_{H1} + \frac{Z_{\Pi 1}}{Z_{H1}} \omega_{\Pi 1} - \left(1 + \frac{Z_{\Pi 1}}{Z_{H1}}\right) \omega_{q_1} = 0 \Rightarrow$$

T_2:

$$\omega_{\Pi 1} + \frac{Z_{\Sigma 1}}{Z_{\Pi 1}} \omega_{\Sigma 1} - \left(1 + \frac{Z_{\Sigma 1}}{Z_{\Pi 1}}\right) \omega_{q_1} = 0 \Rightarrow \boxed{\omega_{\Pi 1} = \left(1 + \frac{Z_{\Sigma 1}}{Z_{\Pi 1}}\right) \omega_{q_1} - \frac{Z_{\Sigma 1}}{Z_{\Pi 1}} \omega_{\Sigma 1}}$$

$$\omega_{H1} + \frac{Z_{\Pi 1}}{Z_{H1}} \left(1 - \frac{Z_{\Sigma 1}}{Z_{\Pi 1}}\right) \omega_{q_1} - \frac{Z_{\Sigma 1}}{Z_{H1}} \omega_{\Sigma 1} - \left(1 + \frac{Z_{\Pi 1}}{Z_{H1}}\right) \omega_{q_1} = 0 \quad (1)$$

T_3:

$$\omega_{Hq} + \frac{Z_{\Pi 2}}{Z_{H2}} \omega_{\Pi 2} - \left(1 - \frac{Z_{\Pi 2}}{Z_{H2}}\right) \omega_{q_2}^{0} = 0 \Rightarrow \boxed{\omega_{\Pi 2} = -\frac{Z_{H2}}{Z_{\Pi 2}} \omega_{H2}}$$

T_4:

$$\omega_{\Pi 2} + \frac{Z_{\Sigma 2}}{Z_{\Pi 2}} \omega_{\Sigma 2} - \left(1 - \frac{Z_{\Sigma 2}}{Z_{\Pi 2}}\right) \omega_{q_2}^{0} = 0 \Rightarrow -\frac{Z_{H2}}{Z_{\Pi 2}} \omega_{H2} + \frac{Z_{\Sigma 2}}{Z_{\Pi 2}} \omega_{\Sigma 2} = 0$$

$$I_2 = \frac{\omega_{H2}}{\omega_{\Sigma 2}} = \frac{Z_{\Sigma 2}}{Z_{H2}} \Rightarrow \boxed{I_2 = \frac{Z_{\Sigma 2}}{Z_{H2}}}$$

$$(1) \Rightarrow \omega_{H1} + \left(\frac{Z_{\Pi 1}}{Z_{H1}} - \frac{Z_{\Sigma 1}}{Z_{H1}}\right) \omega_{q_1} - \frac{Z_{\Sigma 1}}{Z_{H1}} \omega_{\Sigma 1} - \left(1 - \frac{Z_{\Pi 1}}{Z_{H1}}\right) \omega_{q_1} = 0$$

$$\omega_{H1} + \left(\frac{Z_{\Pi 1} - Z_{\Sigma 1}}{Z_{H1}}\right) \omega_{\Sigma 2} - \frac{Z_{\Sigma 1}}{Z_{H1}} \frac{Z_{\Sigma 2}}{Z_{H2}} \omega_{\Sigma 2} - \left(1 - \frac{Z_{\Pi 1}}{Z_{H1}}\right) \omega_{\Sigma 2} = 0$$

$$\omega_{H1} + \omega_{\Sigma 2} \left[\frac{Z_{\Pi 1} - Z_{\Sigma 1}}{Z_{H1}} - \frac{Z_{\Sigma 1} Z_{\Sigma 2}}{Z_{H1} Z_{H2}} - 1 + \frac{Z_{\Pi 1}}{Z_{H1}} \right] = 0$$

$$\frac{\omega_{H1}}{\omega_{E2}} = \frac{Z_{E1}}{Z_{H1}}\left(\frac{Z_{E2}}{Z_{H2}} - 1\right) + 1 = I_{AB} > 0$$

1.2 Anodutes taxódotes

$$\omega_{H1} = \omega_A > 0$$

$$\omega_{\Pi 1} = \left(1 + \frac{Z_{E1}}{Z_{\Pi 1}}\right)\omega_{q_2} - \frac{Z_{E1}}{Z_{\Pi 1}}\omega_{E1} < 0$$

$$\omega_{E1} = \omega_{H2} \uparrow\downarrow \omega_A < 0 \quad / \omega_{q_2} = 0$$

$$\omega_{q_1} = \omega_{E2} = \frac{\omega_{H1}}{I_{AB}} > 0$$

$$\omega_{\Pi 2} = -\frac{Z_{H2}}{Z_{\Pi 2}}\omega_{H2} > 0$$

1.3 Exetikes Taxóseis

$$\omega_{H1 q_2} = \omega_{H1} - \omega_{q_1} = \omega_A - \frac{\omega_A}{I_{AB}} = \left(1 - \frac{1}{I_{AB}}\right)\omega_A > 0$$

$$\omega_{\Pi 1 q_2} = \omega_{\Pi 1} - \omega_{q_1} < 0$$

$$\omega_{E1 q_1} = \omega_{E1} - \omega_{q_1} < 0$$

$$\omega_{H2 q_2} = \omega_{H2} < 0$$

$$\omega_{\Pi 2 q_1} = \omega_{\Pi 2} > 0$$

$$\omega_{E2 q_2} = \omega_{E2} > 0$$

1β Ισορροπία Ροπών

$$\Sigma P_{\varepsilon\xi} = 0 \Rightarrow P_A + P_B + P_C = 0 \Rightarrow \omega_A T_A + \omega_B T_B + \overset{0}{\cancel{\omega_{q_2}}} T_C$$

$$\Rightarrow \boxed{T_B = -\frac{\omega_A}{\omega_B} T_A < 0}$$

Πλανητικό 2 :

$$\omega_{H2} T_{A2} + \overset{0}{\cancel{\omega_{q_2}}} T_{q_2} + \omega_{\Sigma 2} T_{\Sigma 2} = 0 \Rightarrow T_{H2} = -\frac{\omega_{\Sigma 2}}{\omega_{H2}} T_{\Sigma 2}$$

$$\Rightarrow \boxed{T_{A2} = -\frac{Z_{H2}}{Z_{\Sigma 2}} T_{\Sigma 2}} < 0 \text{ αφού } T_B = T_{\Sigma 2} < 0$$

Πλανητικό 1 :

$$\omega_{A1} T_{H1} + \omega_{q_1} T_{q_1} + \omega_{\Sigma 1} T_{\Sigma 1} \quad , T_{A1} > 0 \ , T_{\Sigma 1} = T_{H2} < 0$$

$$\Rightarrow T_{q_1} = \frac{-(\omega_{A1} T_{H1} + \omega_{\Sigma 1} T_{\Sigma 1})}{\omega_{q_1}} < 0 \qquad \begin{matrix} \omega_{\Sigma 1} < 0 \\ \omega_{q_1} > 0 \end{matrix}$$

Συνολικά : $\Sigma T_{\varepsilon\xi} = 0 \Rightarrow T_A + T_B + T_{q_2} = 0 \Rightarrow T_{q_2} = -(T_A + T_B)$

$$\Rightarrow T_{q_2} = -(T_A - i_{AB} T_A) \Rightarrow \boxed{T_{q_2} = T_A(i_{AB} - 1)} > 0$$

Πλανητικό 2

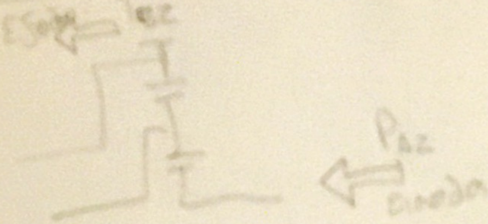
$$T_{A2} + T_{q_2} + T_{\Sigma 2} = 0 \Rightarrow \boxed{T_{\Sigma 2} = \frac{i_{AB} - 1}{\left(1 - \frac{Z_{H2}}{Z_{\Sigma 2}}\right) i_{AB}} T_B} < 0$$

Άρα $T_{H2} < 0 \Rightarrow T_{A2} = \dfrac{i_{AB} - 1}{\left(1 - \frac{Z_{\Sigma 2}}{Z_{A2}}\right) i_{AB}} T_B < 0$

$$T_{\Sigma o 2} = \frac{1 - i_{AB}}{\frac{Z_{\Sigma 2}}{Z_{A2}} - 1} T_A > 0$$

3. Ροή Ισχύος [2]

1η Βαθμίδα



$\eta_{\ldots}\eta_{\ldots} P_{A2} + P_{C2} = 0$

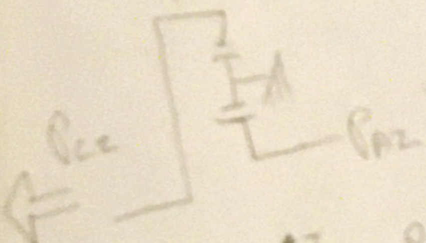
$P_{A2} = \omega_{A/\varphi_1} T_A = \left(1 - \frac{1}{i_{AB}}\right) P_A$

$P_{C2} = T_C\, \omega_{\Sigma_1/\varphi_1} = T_C(\omega_{\Sigma 1} - \omega_{\varphi 1}) \Rightarrow P_{C2} = \left(1 - \frac{z_{H1}}{z_{\Sigma 2}}\right) P_{\Sigma 2}$

Άρα $\eta_{\ldots}\eta_{\ldots}\left(1 - \frac{1}{i_{AB}}\right) P_A + \left(1 - \frac{z_{H1}}{z_{\Sigma 2}}\right) P_{\Sigma 2}$ (1)

$\downarrow \eta_1 \quad \downarrow \eta_2$

2η Βαθμίδα



$\eta_{\ldots}\eta_{\ldots} P_{A2} + P_{C2} = 0$

$\eta_3 \quad \eta_4$

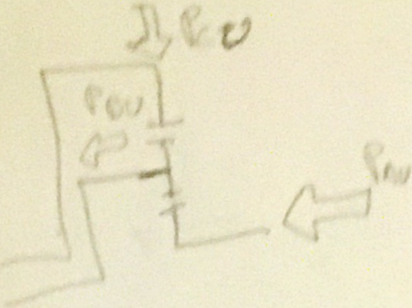
$\eta_{\ldots}\eta_{\ldots} P_{\Sigma 2} + P_{C2}$ (2)

$P_{A2} = \omega_{\Sigma 2/\varphi_2} T_{A2} = P_{\Sigma 2} = P_{\Sigma 2}$

$P_{C2} = T_B\, \omega_{\Sigma 2} = P_B$

(1) (2) $\Rightarrow \eta_1\eta_2\left(1 - \frac{1}{i_{AB}}\right) P_A + \left(1 - \frac{z_{H2}}{z_{\Sigma 2}}\right)\left(-\frac{P_B}{\eta_3\eta_4}\right) = 0$

[U] Όλα με τον φορέα



$P_{A\upsilon} + P_{B\upsilon} + P_{K\upsilon} = 0$

$$P_{A\upsilon} = T_1 \omega_{\varphi_1} = \frac{1}{\frac{z_{\Sigma1}}{z_{A1}}\left(\frac{z_{\Sigma2}}{z_{A2}}-1\right)+1} P_A$$

$$P_{C\upsilon} = \frac{z_{A1}}{z_{\Sigma2}} P_{\Sigma1}$$

$$P_{B\upsilon} = P_{\varphi_1}$$

$$\rightarrow \frac{1}{\frac{z_{\Sigma1}}{z_{A1}}\left(\frac{z_{\Sigma2}}{z_{A2}}-1\right)+1} P_A + P_{\varphi_1} + \frac{z_{A1}}{z_{\Sigma1}} P_{\Sigma1} = 0$$

ΟΛΑ ΜΑΖΙ $\longrightarrow \eta_{AB}$

$$\eta_{AB} = -\frac{P_B}{P_A} = \frac{1 - \frac{z_{\Sigma1}}{z_{A1}}\eta^2 + \frac{z_{\Sigma1}}{z_{A1}}\frac{z_{\Sigma1}}{z_{A1}}\eta^4}{1 - \frac{z_{\Sigma1}}{z_{A1}} + \frac{z_{\Sigma1}}{z_{A1}}\frac{z_{\Sigma2}}{z_{A2}}}$$

$, \eta^2 = \eta_{H1\Pi1}\eta_{\Pi1\Sigma1} = \eta_{H2\Pi2}\eta_{\Pi2\Sigma2}$

Ροπές στις εμπλοκές

περ. ταχ. | n: Αρ. πλανητών

$H_1 - \Pi_1 : T_{A1} \frac{1}{n} k_\gamma$ $\omega_{H1} - \omega_{\varphi1}$

$\Pi_1 - \Sigma_1 : T_A \frac{1}{n} k_\gamma \cdot \frac{z_{\Pi1}}{z_{H1}}$ $\omega_{\Pi1} - \omega_{\varphi1}$

$H_2 - \Pi_2 : T_{H2} \frac{1}{n} k_\gamma \frac{z_{\Pi2}}{z_{H2}}$ $\omega_{\Pi2} - \omega_{\varphi2}$

$\Pi_2 - \Sigma_2 : T_{A2} \frac{1}{n} k_\gamma \frac{z_{\Pi2}}{z_{A2}}$ $\omega_{\Pi2} - \omega_{\varphi2}$