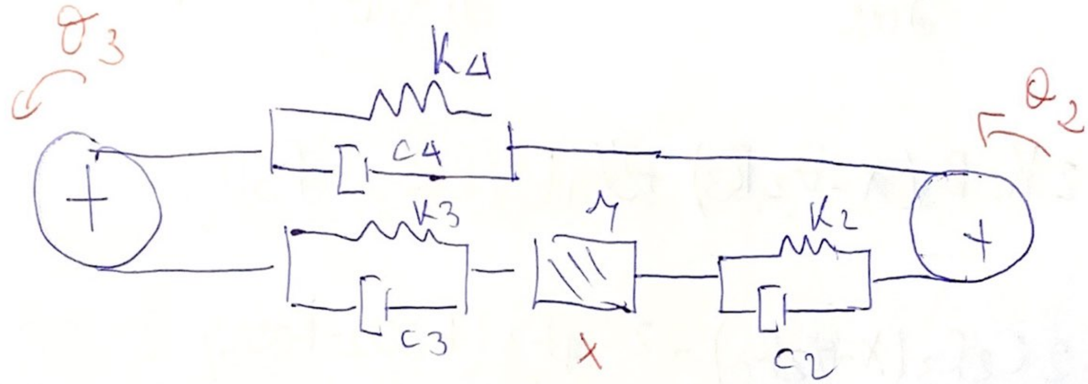
MODELLO ASSEY 4-GDL

①

SIMILE ALL'ASSEX... ⇒ 2ª PARTE



$$T = J_{p3}\dot\theta_2^2 + J_{p3}\dot\theta_3^2 + \frac{1}{2}M\dot x^2$$

$$U = K_2(x)\cdot(x-\theta_2 R_3)^2 + K_3(x)\cdot(x-\theta_3 R_3)^2 + K_4(R_3\theta_2 - R_3\theta_3)^2$$

$$D = C_2(x)(\dot x - \dot\theta_2 R_3)^2 + C_3(x)(\dot x - \dot\theta_3 R_3)^2 + C_4(R_3\dot\theta_2 - R_3\dot\theta_3)^2$$

$$\frac{\partial T}{\partial x} = 0 \quad , \frac{\partial T}{\partial \dot x} = M\dot x \quad , \frac{d}{dt}\left(\frac{\partial T}{\partial \dot x}\right) = M\ddot x$$

$$\frac{\partial U}{\partial x} = 2K_2(x-\theta_2 R_3) + 2K_3(x-\theta_3 R_3)$$

$$\frac{\partial D}{\partial x} = 2C_2(\dot x - \dot\theta_2 R_3) + 2C_3(\dot x - \dot\theta_3 R_3)$$

$$M\ddot{X} + 2\left[K_3(X-\theta_3 R_3) + K_2(X-\theta_2 R_3) + C_3(\dot{X}-\dot{\theta}_3 R_3) + C_2(\dot{X}-\dot{\theta}_2 R_3)\right.$$

$$\frac{\partial T}{\partial \theta_2} = 0 \quad , \quad \frac{\partial T}{\partial \dot{\theta}_2} = 2J_{p3}\dot{\theta}_2 \quad , \quad \frac{d}{dt}\left(\frac{\partial T}{\partial \dot{\theta}_2}\right) = 2J_{p3}\ddot{\theta}_2$$ ②

$$\frac{\partial U}{\partial \theta_2} = -2K_2 R_3(X-\theta_2 R_3) + 2K_4 R_3(R_3\theta_2 - R_3\theta_3)$$

$$\frac{\partial D}{\partial \dot{\theta}_2} = -2C_2 R_3(\dot{X}-\dot{\theta}_2 R_3) + 2C_4 R_3(R_3\dot{\theta}_2 - R_3\dot{\theta}_3)$$

$$2J_{p3}\ddot{\theta}_2 + 2\cdot\begin{bmatrix} -K_2 R_3(X-\theta_2 R_3) + K_4 R_3(R_3\theta_2 - R_3\theta_3) \\ -C_2 R_3(\dot{X}-\dot{\theta}_2 R_3) + C_4 R_3(R_3\dot{\theta}_2 - R_3\dot{\theta}_3) \end{bmatrix} = 0$$

$$\frac{\partial T}{\partial \theta_3} = 0 \quad , \quad \frac{\partial T}{\partial \dot{\theta}_3} = 2J_{p3}\dot{\theta}_3 \quad , \quad \frac{d}{dt}\left(\frac{\partial T}{\partial \dot{\theta}_3}\right) = 2J_{p3}\ddot{\theta}_3$$

$$\frac{\partial U}{\partial \theta_3} = -2K_3 R_3(X-\theta_3 R_3) - 2K_4(R_3\theta_2 - R_3\theta_3)$$

$$\frac{\partial D}{\partial \dot{\theta}_3} = -2C_3 R_3(\dot{X}-\dot{\theta}_3 R_3) - 2C_4 R_3(R_3\dot{\theta}_2 - R_3\dot{\theta}_2)$$

$$2J_{p3}\ddot{\theta}_3 + 2\cdot\begin{bmatrix} -K_3 R_3(X-\theta_3 R_3) - K_4 R_3(R_3\theta_2 - R_3\theta_3) \\ -C_3 R_3(\dot{X}-\dot{\theta}_3 R_3) - C_4 R_3(R_3\dot{\theta}_2 - R_3\dot{\theta}_3) \end{bmatrix} = 0$$

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$$\ddot{\theta}_1 (J_{p1}+J_m) - R_1 [2k_1(\theta_2 R_2 - \theta_1 R_1) + 2c_1(\dot{\theta}_2 R_2 - \dot{\theta}_1 R_1)] = 0$$

$$J_{p2}\ddot{\theta}_2 + R_2 [2k_1(\theta_2 R_2 - \theta_1 R_1) + 2c_1(\dot{\theta}_2 R_2 - \dot{\theta}_1 R_1)] = 0$$

UNISCO I 2 MODELLI.

$$\ddot{\theta}_1 (J_{p1}+J_m) - 2R_1 [\underline{k_1(\theta_2 R_2 - \theta_1 R_1)} + c_1(\dot{\theta}_2 R_2 - \dot{\theta}_1 R_1)] = 0$$

$$\ddot{\theta}_2 (2J_{p3}+J_{p2}) + 2\cdot\left[\frac{-k_2 R_3(x-\theta_2 R_3) + k_4 R_3(R_3\theta_2 - R_3\theta_3)}{-c_2 R_3(\dot{x}-\dot{\theta}_2 R_3) + c_4 R_3(R_3\dot{\theta}_2 - R_3\dot{\theta}_3)}\right]$$

$$+2R_2\cdot[\underline{k_1(\theta_2 R_2 - \theta_1 R_1)} + c_1(\dot{\theta}_2 R_2 - \dot{\theta}_1 R_1)] = 0$$

$$\ddot{\theta}_3 (2J_{p3}) + 2\cdot\left[\frac{-k_3 R_3(x-\theta_3 R_3) - k_4 R_3(R_3\theta_2 - R_3\theta_3)}{-c_3 R_3(\dot{x}-\dot{\theta}_3 R_3) - c_4 R_3(R_3\dot{\theta}_2 - R_3\dot{\theta}_3)}\right] = 0$$

$$\ddot{X}(M) + 2\cdot\left[\frac{k_3(x-\theta_3 R_3) + k_2(x-\theta_2 R_3)}{+c_3(\dot{x}-\dot{\theta}_3 R_3) + c_2(\dot{x}-\dot{\theta}_2 R_3)}\right] = C_m$$

FORMA MATRICIALE

$$
M = \begin{array}{cc}
\begin{bmatrix}
J_{p1} + J_{m} & 0 & 0 & 0 \\
0 & 2J_{p3} + J_{p2} & 0 & 0 \\
0 & 0 & 2J_{p3} & 0 \\
0 & 0 & 0 & M
\end{bmatrix}
&
\begin{array}{c}
\vartheta_1 \\
\vartheta_2 \\
\vartheta_3 \\
x
\end{array}
\end{array}
$$

$$
K = \begin{bmatrix}
+2R_1^2 K_1 & -2R_1 K_1 R_2 & 0 & 0 \\
-2R_2 K_1 R_1 & 2K_2 R_3^2 + 2K_4 R_3^2 + 2R_2^2 K_1 & -2K_4 R_3^2 & -2K_2 R_3 \\
0 & -2K_4 R_3^2 & 2K_3 R_3^2 + 2K_4 R_3^2 & -2K_3 R_3 \\
0 & -2K_2 R_3 & -2K_3 R_3 & 2K_3 + 2K_2
\end{bmatrix}
$$