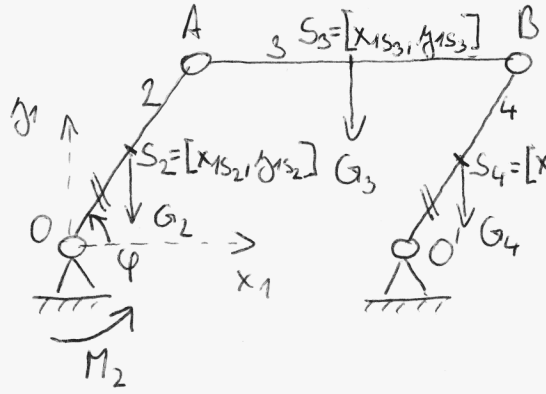
LR II. druhu ... $\frac{d}{dt}\left(\frac{\partial E_k}{\partial \dot{q}}\right) - \frac{\partial E_k}{\partial q} = Q$ (pro 1° volnosti)



D: m_2, m_3, m_4

$I_{2S_2}, I_{3S_3}, I_{4S_4}$

$|AB| = l, |OA| = |O'B| = r$

(paralelogram)

U: V.P.R.

$$E_k = \frac{1}{2} I_{2O} \cdot \dot{\varphi}^2 + \frac{1}{2} m_3 \left(\dot{x}_{1S_3}^2 + \dot{y}_{1S_3}^2 \right) + \frac{1}{2} I_{4O'} \cdot \dot{\varphi}^2$$

$$\left(I_{2O} = I_{2S_2} + m_2 \left(\frac{r}{2}\right)^2, \; I_{4O'} = I_{4S_4} + m_4 \left(\frac{r}{2}\right)^2 \right)$$

$$x_{1S_3} = r \cdot \cos\varphi + \frac{l}{2} \rightarrow \dot{x}_{1S_3} = -r \cdot \sin\varphi \cdot \dot{\varphi}$$

$$y_{1S_3} = r \cdot \sin\varphi \rightarrow \dot{y}_{1S_3} = r \cdot \cos\varphi \cdot \dot{\varphi}$$

$$\dot{x}_{1S_3}^2 + \dot{y}_{1S_3}^2 = r^2 \cdot \dot{\varphi}^2 \left(\sin^2\varphi + \cos^2\varphi \right) = r^2 \cdot \dot{\varphi}^2$$

$$E_k = \frac{1}{2} I_{2O} \cdot \dot{\varphi}^2 + \frac{1}{2} m_3 \cdot r^2 \cdot \dot{\varphi}^2 + \frac{1}{2} I_{4O'} \cdot \dot{\varphi}^2 = \frac{1}{2} \left(I_{2O} + m_3 r^2 + I_{4O'} \right) \cdot \dot{\varphi}^2$$

$$\frac{\partial E_k}{\partial \dot{\varphi}} = \left(I_{2O} + m_3 r^2 + I_{4O'} \right) \cdot \dot{\varphi}$$

$$\frac{d}{dt}\left(\frac{\partial E_k}{\partial \dot{\varphi}} \right) = \left(I_{2O} + m_3 r^2 + I_{4O'} \right) \cdot \ddot{\varphi}$$

$$\frac{\partial E_k}{\partial \varphi} = \emptyset$$

$$Q \delta q = -G_2 \delta y_{S_2} - G_3 \delta y_{S_3} - G_4 \delta y_{S_4} + M_2 \delta\varphi$$

$$y_{1S_2} = y_{1S_4} = \frac{r}{2} \cdot \sin\varphi \rightarrow \delta y_{1S_2} = \delta y_{1S_4} = \frac{r}{2} \cos\varphi \, \delta\varphi$$

$$y_{1S_3} = r \cdot \sin\varphi \rightarrow \delta y_{1S_3} = r \cdot \cos\varphi \, \delta\varphi$$

$$Q \delta\varphi = -G_2 \frac{r}{2} \cos\varphi \, \delta\varphi - G_3 \cdot r \cdot \cos\varphi \, \delta\varphi - G_4 \frac{r}{2} \cos\varphi \, \delta\varphi + M_2 \delta\varphi$$

$$Q = \left(M_2 - G_2 \frac{r}{2} \cos\varphi - G_3 \cdot r \cdot \cos\varphi - G_4 \frac{r}{2} \cos\varphi \right)$$

$$\left[\left(I_{2O} + m_3 r^2 + I_{4O'} \right) \ddot{\varphi} = M_2 - G_2 \frac{r}{2} \cos\varphi - G_3 \cdot r \cos\varphi - G_4 \frac{r}{2} \cdot \cos\varphi \right] \text{ V.P.R.}$$