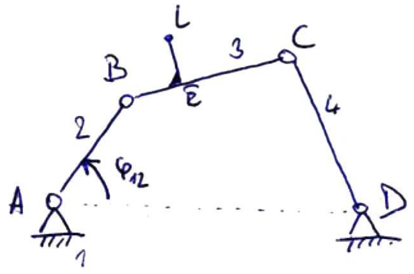


Vektorovou metodou řešte polohu, rychlost, zrychlení všech členů mechanismu a bodu L.

D: $\overline{AB} = l_2 = 0{,}3\,m$, $\overline{BC} = l_3 = 0{,}6\,m$, $\overline{CD} = l_4 = 0{,}7\,m$

$\overline{AD} = l_1 = 0{,}9\,m$, $\overline{BE} = x_{3L} = 0{,}2\,m$, $EL = y_{3L} = 0{,}15\,m$

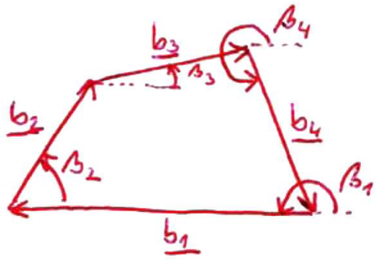
$\varphi_{12} = \varphi_{120} + \omega_{120} t + \frac{1}{2}\alpha_{12} t^2$, $\varphi_{120} = \frac{\pi}{3}$ rad

$\omega_{120} = 3\,s^{-1}$, $\alpha_{12} = 15\,s^{-2}$

Řešení:

$$n = 3(u-1) - 3v_p - 2(r+p+v) - 1\sigma$$
$$= 3\cdot(4-1) - 3\cdot 0 - 2(4+0+0) - 1\cdot 0 = \underline{1^\circ} \text{ volnosti}$$

$$l = d + m - u + 1 = 4 + 0 - 4 + 1 = 1 \text{ nezávislá smyčka}$$



$$\underline{b_1} + \underline{b_2} + \underline{b_3} + \underline{b_4} = \underline{0}$$

$$x:\ b_1\cos\beta_1 + b_2\cos\beta_2 + b_3\cos\beta_3 + b_4\cos\beta_4 = 0 \quad (1)$$

$$y:\ b_1\sin\beta_1 + b_2\sin\beta_2 + b_3\sin\beta_3 + b_4\sin\beta_4 = 0 \quad (2)$$

Souřadnice: nezávislé $\underline{q} = [\beta_2]$

závislé $\underline{z} = \begin{bmatrix}\beta_3\\ \beta_4\end{bmatrix}$

$$\underline{F}(\underline{z},\underline{q}) = \underline{0}$$

$$\frac{\partial \underline{F}}{\partial \underline{z}}\dot{\underline{z}} + \frac{\partial \underline{F}}{\partial \underline{q}}\dot{\underline{q}} = \underline{J_z}\,\dot{\underline{z}} + \underline{J_q}\,\dot{\underline{q}} = \underline{0}$$

$$\rightarrow\ \dot{\underline{z}} = -\underline{J_z}^{-1}\underline{J_q}\,\dot{\underline{q}}$$

$$\dot{\underline{J_z}}\,\dot{\underline{z}} + \underline{J_z}\,\ddot{\underline{z}} + \dot{\underline{J_q}}\,\dot{\underline{q}} + \underline{J_q}\,\ddot{\underline{q}} = \underline{J_z}\,\ddot{\underline{z}} + \underline{J_q}\,\ddot{\underline{q}} + \underline{j_{qz}} = \underline{0}$$

$$\rightarrow\ \ddot{\underline{z}} = -\underline{J_z}^{-1}\left(\underline{J_q}\,\ddot{\underline{q}} + \underline{j_{qz}}\right)$$

$$\dot{(1)}\quad -b_2\sin\beta_2\,\dot\beta_2 - b_3\sin\beta_3\,\dot\beta_3 - b_4\sin\beta_4\,\dot\beta_4 = 0$$

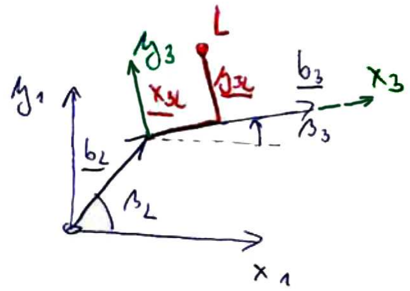
$$\dot{(2)}\quad b_2\cos\beta_2\,\dot\beta_2 + b_3\cos\beta_3\,\dot\beta_3 + b_4\cos\beta_4\,\dot\beta_4 = 0$$

$$\underbrace{\begin{bmatrix}-b_3\sin\beta_3 & -b_4\sin\beta_4\\ b_3\cos\beta_3 & b_4\cos\beta_4\end{bmatrix}}_{\underline{J_z}}\underbrace{\begin{bmatrix}\dot\beta_3\\ \dot\beta_4\end{bmatrix}}_{\dot{\underline{z}}} + \underbrace{\begin{bmatrix}-b_2\sin\beta_2\\ b_2\cos\beta_2\end{bmatrix}}_{\underline{J_q}}\underbrace{\begin{bmatrix}\dot\beta_2\end{bmatrix}}_{\dot{\underline{q}}} = \begin{bmatrix}0\\ 0\end{bmatrix}$$

$$\ddot{(1)}\quad -b_2\cos\beta_2\,\dot\beta_2^2 - \underline{b_2\sin\beta_2\,\ddot\beta_2} - b_3\cos\beta_3\,\dot\beta_3^2 - \underline{b_3\sin\beta_3\,\ddot\beta_3} - b_4\cos\beta_4\,\dot\beta_4^2 - \underline{b_4\sin\beta_4\,\ddot\beta_4} = 0$$

$$\ddot{(2)}\quad -b_2\sin\beta_2\,\dot\beta_2^2 + \underline{b_2\cos\beta_2\,\ddot\beta_2} - b_3\sin\beta_3\,\dot\beta_3^2 + \underline{b_3\cos\beta_3\,\ddot\beta_3} - b_4\sin\beta_4\,\dot\beta_4^2 + \underline{b_4\cos\beta_4\,\ddot\beta_4} = 0$$

$$\underbrace{\begin{bmatrix}-b_3\sin\beta_3 & -b_4\sin\beta_4\\ b_3\cos\beta_3 & b_4\cos\beta_4\end{bmatrix}}_{\underline{J_z}}\underbrace{\begin{bmatrix}\ddot\beta_3\\ \ddot\beta_4\end{bmatrix}}_{\ddot{\underline{z}}} + \underbrace{\begin{bmatrix}-b_2\sin\beta_2\\ b_2\cos\beta_2\end{bmatrix}}_{\underline{J_q}}\underbrace{\begin{bmatrix}\ddot\beta_2\end{bmatrix}}_{\ddot{\underline{q}}} + \underbrace{\begin{bmatrix}-b_2\cos\beta_2\,\dot\beta_2^2 - b_3\cos\beta_3\,\dot\beta_3^2 - b_4\cos\beta_4\,\dot\beta_4^2\\ -b_2\sin\beta_2\,\dot\beta_2^2 - b_3\sin\beta_3\,\dot\beta_3^2 - b_4\sin\beta_4\,\dot\beta_4^2\end{bmatrix}}_{\underline{j_{qz}}} = \begin{bmatrix}0\\ 0\end{bmatrix}$$



$$ {}_1\underline{r}_{1L} = \underline{b_2} + \underline{x_{3L}} + \underline{y_{3L}} $$

$$ x_{1L} = b_2 \cos\beta_2 + x_{3L} \cdot \cos\beta_3 - y_{3L} \sin\beta_3 $$

$$ y_{1L} = b_2 \sin\beta_2 + x_{3L} \cdot \sin\beta_3 + y_{3L} \cos\beta_3 $$

$$ v_{1Lx} = -b_2 \cdot \sin\beta_2 \cdot \dot{\beta}_2 - x_{3L} \cdot \sin\beta_3 \cdot \dot{\beta}_3 - y_{3L} \cdot \cos\beta_3 \cdot \dot{\beta}_3 $$

$$ v_{1Ly} = b_2 \cdot \cos\beta_2 \cdot \dot{\beta}_2 + x_{3L} \cdot \cos\beta_3 \cdot \dot{\beta}_3 - y_{3L} \cdot \sin\beta_3 \cdot \dot{\beta}_3 $$

$$ a_{1Lx} = -b_2 \cos\beta_2 \cdot \dot{\beta}_2^2 - b_2 \cdot \sin\beta_2 \cdot \ddot{\beta}_2 - x_{3L} \cdot \cos\beta_3 \cdot \dot{\beta}_3^2 - x_{3L} \cdot \sin\beta_3 \cdot \ddot{\beta}_3 + y_{3L} \cdot \sin\beta_3 \cdot \dot{\beta}_3^2 - y_{3L} \cdot \cos\beta_3 \cdot \ddot{\beta}_3 $$

$$ a_{1Ly} = -b_2 \cdot \sin\beta_2 \cdot \dot{\beta}_2^2 + b_2 \cdot \cos\beta_2 \cdot \ddot{\beta}_2 - x_{3L} \cdot \sin\beta_3 \cdot \dot{\beta}_3^2 + x_{3L} \cdot \cos\beta_3 \cdot \ddot{\beta}_3 - y_{3L} \cdot \cos\beta_3 \cdot \dot{\beta}_3^2 - y_{3L} \cdot \sin\beta_3 \cdot \ddot{\beta}_3 $$