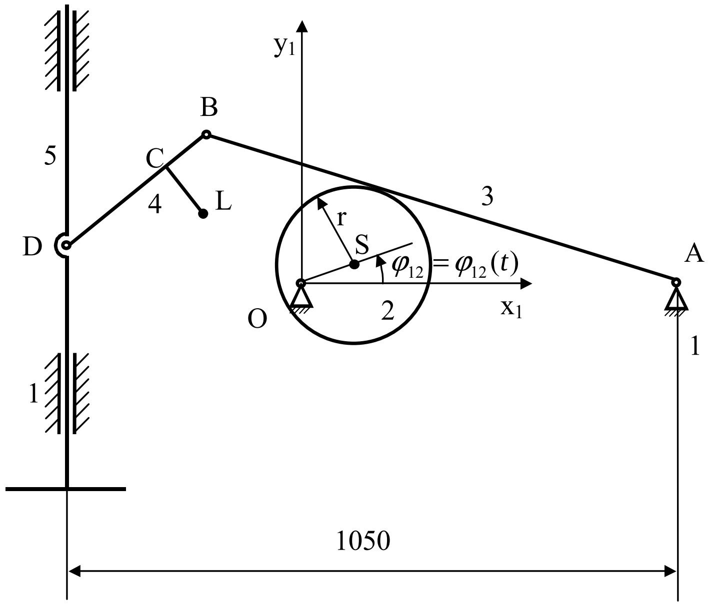
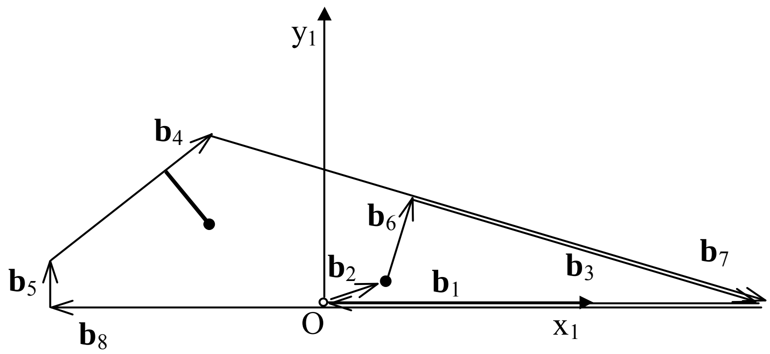


D: $\overline{OS} = 100$ mm, r = 130 mm, $\overline{OA} = 650$ mm, $\overline{AB} = 850$ mm, $\overline{BD} = 300$ mm,
$\overline{DC} = 200$ mm, $\overline{CL} = 100$ mm, $\varphi_{12} = \Phi_0 + \Phi \sin(\Omega t)$, $\Phi_0 = 20^o$; $\Phi = 360^o$; $\Omega = \pi/50$ s^{-1};

$n = 3\,(u - 1) - 3\,vp - 2\,(r + p + v) - 1\,o = 3\,(5 - 1) - 3.0 - 2\,(4 + 1 + 0) - 1.1 = 1$
$l = d + m - u + 1 = 6 + 0 - 5 + 1 = 2$

Soustava má 1 stupeň volnosti a obsahuje dvě nezávislé smyčky.
Poznámka: Úhly β_i jsou úhly, které svírají jednotlivé vektory $\mathbf{b}_i$ s osou x_1. V následujících obrázcích nejsou zakresleny. Ve svých domácích úkolech je však **zakreslete**!



$\mathbf{b}_1 + \mathbf{b}_2 + \mathbf{b}_6 + \mathbf{b}_3 = \mathbf{0}$ nezávislá souřadnice: β_2

$\mathbf{b}_4 + \mathbf{b}_7 + \mathbf{b}_8 + \mathbf{b}_5 = \mathbf{0}$ závislé souřadnice: b_3 , β_3 , β_4 , b_5

dále platí: $\beta_6 = \beta_3 + \pi/2$, $\beta_7 = \beta_3$

Rozepsáno skalárně:

1. smyčka: $b_1.\cos(\beta_1) + b_2.\cos(\beta_2) + b_6.\cos(\beta_6) + b_3.\cos(\beta_3) = 0$ ... průmět do x

$b_1.\sin(\beta_1) + b_2.\sin(\beta_2) + b_6.\sin(\beta_6) + b_3.\sin(\beta_3) = 0$ ... průmět do y

2. smyčka: $b_4.\cos(\beta_4) + b_7.\cos(\beta_7) + b_8.\cos(\beta_8) + b_5.\cos(\beta_5) = 0$ ... průmět do x

$b_4.\sin(\beta_4) + b_7.\sin(\beta_7) + b_8.\sin(\beta_8) + b_5.\sin(\beta_5) = 0$ ... průmět do y

Rychlosti: (první derivace)

$$-b_2.\sin(\beta_2).\dot{\beta}_2 - b_6.\sin(\beta_6).\dot{\beta}_6 + \dot{b}_3.\cos(\beta_3) - b_3.\sin(\beta_3).\dot{\beta}_3 = 0$$

$$b_2.\cos(\beta_2).\dot{\beta}_2 + b_6.\cos(\beta_6).\dot{\beta}_6 + \dot{b}_3.\sin(\beta_3) + b_3.\cos(\beta_3).\dot{\beta}_3 = 0$$

$$-b_4.\sin(\beta_4).\dot{\beta}_4 - b_7.\sin(\beta_7).\dot{\beta}_7 + \dot{b}_5.\cos(\beta_5) = 0$$

$$b_4.\cos(\beta_4).\dot{\beta}_4 + b_7.\cos(\beta_7).\dot{\beta}_7 + \dot{b}_5.\sin(\beta_5) = 0$$

Zrychlení: (druhé derivace)

$$-b_2.\cos(\beta_2).\dot{\beta}_2^2 - b_2.\sin(\beta_2).\ddot{\beta}_2 - b_6.\cos(\beta_6).\dot{\beta}_6^2 - b_6.\sin(\beta_6).\ddot{\beta}_6 + \ddot{b}_3.\cos(\beta_3) - 2\dot{b}_3.\sin(\beta_3).\dot{\beta}_3 - b_3.\cos(\beta_3).\dot{\beta}_3^2 - b_3.\sin(\beta_3).\ddot{\beta}_3 = 0$$

$$-b_2.\sin(\beta_2).\dot{\beta}_2^2 + b_2.\cos(\beta_2).\ddot{\beta}_2 - b_6.\sin(\beta_6).\dot{\beta}_6^2 + b_6.\cos(\beta_6).\ddot{\beta}_6 + \ddot{b}_3.\sin(\beta_3) + 2\dot{b}_3.\cos(\beta_3).\dot{\beta}_3 - b_3.\sin(\beta_3).\dot{\beta}_3^2 + b_3.\cos(\beta_3).\ddot{\beta}_3 = 0$$

$$-b_4.\cos(\beta_4).\dot{\beta}_4^2 - b_4.\sin(\beta_4).\ddot{\beta}_4 - b_7.\cos(\beta_7).\dot{\beta}_7^2 - b_7.\sin(\beta_7).\ddot{\beta}_7 + \ddot{b}_5.\cos(\beta_5) = 0$$

$$-b_4.\sin(\beta_4).\dot{\beta}_4^2 + b_4.\cos(\beta_4).\ddot{\beta}_4 - b_7.\sin(\beta_7).\dot{\beta}_7^2 + b_7.\cos(\beta_7).\ddot{\beta}_7 + \ddot{b}_5.\sin(\beta_5) = 0$$

Bod L: (viz obrázek na další straně)

$$x_L = b_2.\cos(\beta_2) + b_6.\cos(\beta_6) + b_3.\cos(\beta_3) + b_8.\cos(\beta_8) + b_5.\cos(\beta_5) + x_{4L}.\cos(\beta_4) - y_{4L}.\sin(\beta_4)$$

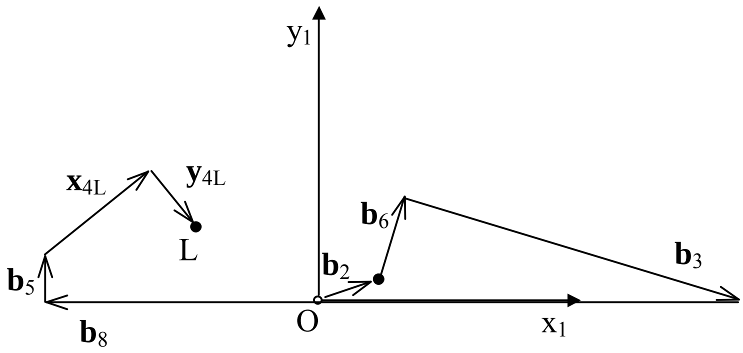
$$y_L = b_2.\sin(\beta_2) + b_6.\sin(\beta_6) + b_3.\sin(\beta_3) + b_8.\sin(\beta_8) + b_5.\sin(\beta_5) + x_{4L}.\sin(\beta_4) + y_{4L}.\cos(\beta_4)$$

$$v_{x_L} = -b_2.\sin(\beta_2).\dot{\beta}_2 - b_6.\sin(\beta_6).\dot{\beta}_6 + \dot{b}_3.\cos(\beta_3) - b_3.\sin(\beta_3).\dot{\beta}_3 + \dot{b}_5.\cos(\beta_5) - x_{4L}.\sin(\beta_4).\dot{\beta}_4 - y_{4L}.\cos(\beta_4).\dot{\beta}_4$$

$$v_{y_L} = b_2.\cos(\beta_2).\dot{\beta}_2 + b_6.\cos(\beta_6).\dot{\beta}_6 + \dot{b}_3.\sin(\beta_3) + b_3.\cos(\beta_3).\dot{\beta}_3 + \dot{b}_5.\sin(\beta_5) + x_{4L}.\cos(\beta_4).\dot{\beta}_4 - y_{4L}.\sin(\beta_4).\dot{\beta}_4$$

$$a_{x_L} = -b_2.\cos(\beta_2).\dot{\beta}_2^2 - b_2.\sin(\beta_2).\ddot{\beta}_2 - b_6.\cos(\beta_6).\dot{\beta}_6^2 - b_6.\sin(\beta_6).\ddot{\beta}_6 + \ddot{b}_3.\cos(\beta_3) - 2\dot{b}_3.\sin(\beta_3).\dot{\beta}_3 - b_3.\cos(\beta_3).\dot{\beta}_3^2 - b_3.\sin(\beta_3).\ddot{\beta}_3 + \ddot{b}_5.\cos(\beta_5) - x_{4L}.\cos(\beta_4).\dot{\beta}_4^2 - x_{4L}.\sin(\beta_4).\ddot{\beta}_4 + y_{4L}.\sin(\beta_4).\dot{\beta}_4^2 - y_{4L}.\cos(\beta_4).\ddot{\beta}_4$$

$$a_{y_L} = -b_2.\sin(\beta_2).\dot{\beta}_2^2 + b_2.\cos(\beta_2).\ddot{\beta}_2 - b_6.\sin(\beta_6).\dot{\beta}_6^2 + b_6.\cos(\beta_6).\ddot{\beta}_6 + \ddot{b}_3.\sin(\beta_3) + 2\dot{b}_3.\sin(\beta_3).\dot{\beta}_3 - b_3.\sin(\beta_3).\dot{\beta}_3^2 + b_3.\cos(\beta_3).\ddot{\beta}_3 + \ddot{b}_5.\sin(\beta_5) - x_{4L}.\sin(\beta_4).\dot{\beta}_4^2 + x_{4L}.\cos(\beta_4).\ddot{\beta}_4 - y_{4L}.\cos(\beta_4).\dot{\beta}_4^2 - y_{4L}.\sin(\beta_4).\ddot{\beta}_4$$



$$\mathbf{r}_{1L} = \mathbf{b}_2 + \mathbf{b}_6 + \mathbf{b}_3 + \mathbf{b}_8 + \mathbf{b}_5 + \mathbf{x}_{4L} + \mathbf{y}_{4L}$$
