RESPOSTAS DOS EXERCÍCIOS PROPOSTOS

CAPÍTULO 2

CINEMÁTICA DO CORPO RÍGIDO

2.1:	**a)** $\vec{v}_A = 0,10\vec{i}\ [\text{m/s}]$; $\vec{v}_B = -0,10\vec{i} + 0,20\vec{j}\ [\text{m/s}]$; **b)** $\vec{a}_A = 0,20\vec{i} - 0,20\vec{j}\ [\text{m/s}^2]$; $\vec{a}_B = 0,20\vec{i} + 0,60\vec{j}\ [\text{m/s}^2]$
2.3:	**a)** $\vec{v}_B = -18,0\vec{i}\ [\text{m/s}]$; $\vec{a}_B = -90,0\vec{i}\ [\text{m/s}^2]$; **b)** $\vec{\omega} = -400\vec{k}\ [\text{rad/s}]$; $\vec{\alpha} = -2000\vec{k}\ [\text{rad/s}^2]$; **c)** $\vec{v}_P = 18\vec{j}\ [\text{m/s}]$; $\vec{a}_P = 7200\vec{i} + 90\vec{j}\ [\text{m/s}^2]$
2.4:	$x_B = x_P = r\,sen\,\theta$; $v_B = v_P^x = \omega r \cos\theta$; $a_B = a_P^x = \alpha r \cos\theta - \omega^2 r\,sen\,\theta$
2.6:	**a)** $\vec{v}_B = -0,45\vec{i}\ [\text{m/s}]$; **b)** $\vec{a}_B = -1,80\vec{i} - 2,25\vec{j}\ [\text{m/s}^2]$
2.7:	$\omega = \dfrac{r/s}{\sqrt{s^2 - r^2}} v_B$
2.8:	$\omega_{AB} = \dfrac{v_B}{\sqrt{L^2 - s^2}} = \dfrac{0,4}{\sqrt{L^2 - s^2}}$; $\dot{\omega}_{AB} = \dfrac{v_B^2 s}{\left(L^2 - s^2\right)^{3/2}} = \dfrac{0,16s}{\left(L^2 - s^2\right)^{3/2}}$
2.9:	**a)** $v_B = \lVert\vec{v}_B\rVert = 8,94$ m/s; **b)** $v_B = 8,94$ m/s
2.10:	**a)** $\vec{a}_B = -304,0\vec{i} - 32,0\vec{j}\ [\text{m/s}^2]$; **b)** $\vec{a}_C = 160,0\vec{j}\ [\text{m/s}^2]$
2.11:	**a)** $\vec{\omega}_B = -14,450\vec{k}\ [\text{rad/s}]$; **b)** $\vec{\omega}_C = 10,04\vec{k}\ [\text{rad/s}]$
2.12:	**a)** $\vec{\omega}_B = -14,450\vec{k}\ [\text{rad/s}]$; **b)** $\vec{\omega}_C = 10,04\vec{k}\ [\text{rad/s}]$
2.13:	**a)** $\vec{\omega}_C = 6,283\vec{k}\ [\text{rad/s}]$; **b)** $\lVert\vec{v}_P\rVert = 1,777\ [\text{m/s}]$
2.14:	**a)** $\omega_C = 6,283$ rad/s; **b)** $v_P = 1,177$ m/s
2.15:	**a)** $\vec{\alpha}_C = 80\vec{k}\ [\text{rad/s}^2]$; **b)** $\vec{a}_P = -23,019\vec{i} - 30,038\vec{j}\ [\text{m/s}^2]$
2.16:	**a)** $\omega_{haste} = \dfrac{\omega}{4}$; **b)** $\omega_B = \omega_C = \omega_D = \dfrac{\omega}{2}$
2.17:	**a)** $\vec{\omega}_{BD} = \vec{0}$; $\vec{\omega}_{DE} = -1,2\vec{k}\ [\text{rad/s}]$ **b)** $\vec{v}_B = -0,450\vec{i}\ [\text{m/s}]$; $\vec{v}_D = -0,450\vec{i}\ [\text{m/s}]$

2.18:	**a)** $\vec{\omega}_{BD} = \vec{0}$; $\omega_{DE} = 1{,}125\,\text{rad/s}$ (sentido horário) **b)** $v_B = 0{,}450\,\text{m/s}$ (para a esquerda); $v_D = 0{,}450\,\text{m/s}$ (para a esquerda)
2.19:	**a)** $\vec{\alpha}_{BD} = 6{,}187\vec{k}\left[\text{rad/s}^2\right]$; $\vec{\alpha}_{DE} = 14{,}789\vec{k}\left[\text{rad/s}^2\right]$ **b)** $\vec{a}_B = 3{,}75\vec{i} - 1{,}35\vec{j}\ \left[\text{m/s}^2\right]$; $\vec{a}_D = 5{,}916\vec{i} + 0{,}506\vec{j}\ \left[\text{m/s}^2\right]$
2.20:	**a)** $\vec{\omega}_{AB} = -1{,}470\vec{k}\ \left[\text{rad/s}\right]$ (sentido horário); $\vec{\omega}_{BC} = -0{,}621\vec{k}\ \left[\text{rad/s}\right]$ (sentido horário); **b)** $\vec{v}_M = 0{,}110\vec{i}\ \left[\text{m/s}\right]$; $\vec{v}_N = 0{,}201\vec{i} - 0{,}052\vec{j}\ \left[\text{m/s}\right]$
2.21:	**a)** $\vec{\alpha}_{AB} = 13{,}312\vec{k}\ \left[\text{rad/s}^2\right]$; $\vec{\alpha}_{BC} = 3{,}722\vec{k}\ \left[\text{rad/s}^2\right]$ **b)** $\vec{a}_M = -0{,}998\vec{i} - 0{,}162\vec{j}\ \left[\text{m/s}^2\right]$; $\vec{a}_N = -1{,}913\vec{i} + 0{,}002\vec{j}\ \left[\text{m/s}^2\right]$
2.22:	**a)** $\omega_{BD} = 44{,}88\ \text{rad/s}$ (sentido horário); **b)** $v_P = 8{,}976\ \text{m/s}$ (para a esquerda)
2.25:	**a)** $\vec{\omega}_D = -20{,}0\vec{j} - 25{,}0\vec{k}\ \left[\text{rad/s}\right]$; **b)** $\vec{\alpha}_D = -500{,}0\vec{i} - 10{,}0\vec{j} - 15{,}0\vec{k}\ \left[\text{rad/s}^2\right]$; **c)** $\vec{v}_P\big\vert_{OXYZ} = 3{,}5\vec{i}\ \left[\text{m/s}\right]$; **d)** $\vec{a}_P\big\vert_{OXYZ} = 2{,}0\vec{i} - 112{,}5\vec{j} + 20{,}0\vec{k}\ \left[\text{m/s}^2\right]$
2.26:	**a)** $\vec{\omega}_D = -\omega_2\vec{i} - \omega_1\vec{j}$; **b)** $\vec{\alpha}_D = -\alpha_2\vec{i} - \omega_1\omega_2\vec{k}$; **c)** $\vec{v}_P\big\vert_{OXYZ} = (r + b_2)\omega_1\vec{i} - r\omega_2\vec{j} + b_1\omega_1\vec{k}$; **d)** $\vec{a}_P\big\vert_{OXYZ} = -b_1\omega_1^2\vec{i} - r\alpha_2\vec{j} + \left[(r + b_2)\omega_1^2 + r\omega_2^2\right]\vec{k}$
2.27:	**a)** $\vec{\omega}_D = 10{,}0\vec{j} + 5{,}0\vec{k}\ \left[\text{rad/s}\right]$; **b)** $\vec{\alpha}_D = 50{,}0\vec{i}\ \left[\text{rad/s}\right]$; **c)** $\vec{v}_B\big\vert_{OXYZ} = 3{,}0\vec{j} - 6{,}0\vec{k}\ \left[\text{m/s}\right]$; **d)** $\vec{a}_B\big\vert_{OXYZ} = -75{,}0\vec{i}\ \left[\text{m/s}^2\right]$
2.28:	**a)** $\vec{v}_B = -5{,}00\vec{k}\ \left[\text{m/s}\right]$; **b)** $\vec{\omega}_{AB} = 7{,}35\vec{i} - 4{,}41\vec{j} - 7{,}35\vec{k}\ \left[\text{rad/s}\right]$
2.29:	$\vec{v}_D = b\omega_1\vec{i} + r(\omega_1 + \omega_2)\vec{k}$; $\vec{a}_D = \left[b\dot{\omega}_1 - r(\omega_1 + \omega_2)^2\right]\vec{i} + \left[b\omega_1^2 + r(\dot{\omega}_1 + \dot{\omega}_2)\right]\vec{k}$
2.30:	$\{v_P\}_{OXY} = \begin{Bmatrix} v_0 + \dot{\theta}_1\ell_1\cos\theta_1 + (\dot{\theta}_1 + \dot{\theta}_2)\ell_2\cos(\theta_1 + \theta_2) \\ \dot{\theta}_1\ell_1\,sen\,\theta_1 + (\dot{\theta}_1 + \dot{\theta}_2)\ell_2\,sen(\theta_1 + \theta_2) \end{Bmatrix}$; $\{a_P\}_{OXY} = \begin{Bmatrix} a_0 + \ddot{\theta}_1\ell_1\cos\theta_1 - \dot{\theta}_1^2\ell_1\,sen\,\theta_1 \\ \ddot{\theta}_1\ell_1\,sen\,\theta_1 + \dot{\theta}_1^2\ell_1\cos\theta_1 \end{Bmatrix} +$ $+\begin{Bmatrix} (\ddot{\theta}_1 + \ddot{\theta}_2)\ell_2\cos(\theta_1 + \theta_2) - (\dot{\theta}_1 + \dot{\theta}_2)^2\ell_2\,sen(\theta_1 + \theta_2) \\ (\ddot{\theta}_1 + \ddot{\theta}_2)\ell_2\,sen(\theta_1 + \theta_2) + (\dot{\theta}_1 + \dot{\theta}_2)^2\ell_2\cos(\theta_1 + \theta_2) \end{Bmatrix}$