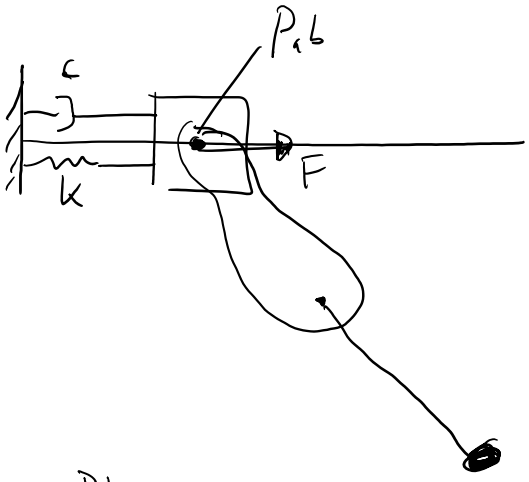
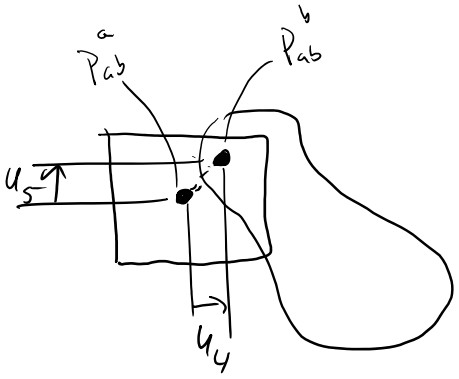
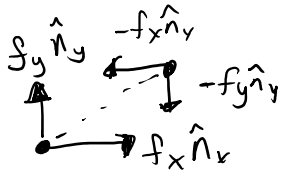
MAE223-L17-01

Wednesday, November 22, 2017 11:34 AM



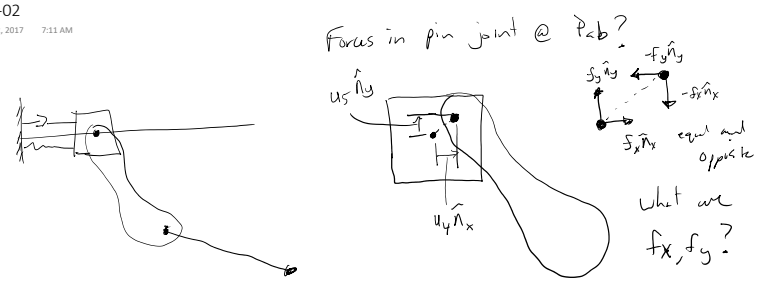




u_4, u_5 : auxiliary speeds

$$\mathcal{N} - P_{ab} \quad V = u_1 \hat{n}_x + u_4 \hat{n}_x + u_5 \hat{n}_y$$

$$\mathcal{R}^{ab} = -k q_1 \hat{n}_x - c u_1 \hat{n}_x + F + f_x \hat{n}_x + f_y \hat{n}_y$$



$${}^N\bar{V}^{P_{ab}} = u_1\hat{n}_x + u_4\hat{n}_x + u_5\hat{n}_y$$ (auxiliary speeds)

$$\bar{R}^{P_{ab}} = -cu_1\hat{n}_x - kq_1\hat{n}_x + f_x\hat{n}_x + f_y\hat{n}_y$$

$${}^N\bar{V}_1^{P_{ab}} = \hat{n}_x \qquad \bar{V}_3^{P_{ab}} = 0 \qquad \bar{V}_5^{P_{ab}} = \hat{n}_y$$

$${}^N\bar{V}_2^{P_{ab}} = 0 \qquad \bar{V}_4^{P_{ab}} = \hat{n}_x$$

$$F_r^{P_{ab}} = \bar{V}_r \cdot \bar{R}^{P_{ab}}$$

$$F_1^{P_{ab}} = -cu_1 - kq_1 + f_x \qquad F_3^{P_{ab}} = 0 \qquad F_5^{P_{ab}} = f_y$$

$$F_2^{P_{ab}} = 0 \qquad F_4^{P_{ab}} = -cu_1 - kq_1 + f_x$$

$$\bar{a}^{P_{ab}} = (\dot{u}_1 + \dot{u}_4)\hat{n}_x + \dot{u}_5\hat{n}_y$$

$$F_1^{*P_{ab}} = -m_{ab}\bar{a}^{P_{ab}} \cdot \hat{n}_x = -m_{ab}(\dot{u}_1 + \dot{u}_4) \qquad F_3^* = 0 \qquad F_5^* = -m_{ab}(\dot{u}_5)$$

$$F_2^{P_{ab}} = 0 \qquad F_4^* = -m_{ab}(\dot{u}_1 + \dot{u}_4)$$

(1) $cu_1 - kq_1 + f_x - m_{ab}(\dot{u}_1 + \dot{u}_4) = 0 \Rightarrow f_x = cu_1 + kq_1 - m_{ab}\dot{u}_1$

(2) $0 + 0 = 0$

(3) $0 = 0$

(4) $-cu_1 - kq_1 + f_x - m_{ab}(\dot{u}_1 + \dot{u}_4) = 0 \Rightarrow f_x = cu_1 + kq_1 - m_{ab}\dot{u}_1$

(5) $f_y - m_{ab}\dot{u}_5 = 0 \Rightarrow f_y = 0$