

Osa X:

$$F_t = k \cdot F_{tk} = \xi \cdot m \cdot g \cdot \frac{2}{d_K} = 0,002 \cdot 12 \cdot 9,81 \cdot \frac{2}{0,024} = 19,62 \text{ N} \quad (3.3)$$

$$M_S = \frac{1}{N_m} \cdot (F_t + F_0) \cdot r_R = \frac{1}{N_m} \cdot (F_t + F_0) \cdot \frac{d_R}{2} = \frac{1}{2} \cdot (19,62 + 20) \cdot \frac{0,018}{2} = 0,18 \text{ Nm} \quad (3.4)$$

$$J_R = \frac{1}{8} \cdot m_R \cdot (d_1^2 + d_2^2) = \frac{1}{8} \cdot 0,012 \cdot (0,022^2 + 0,00635^2) = 0,786 \cdot 10^{-6} \text{ kg.m}^2 \quad (3.5)$$

$$J_Z = m \cdot r_R^2 = m \cdot \frac{d_R^2}{4} = 12 \cdot \frac{0,018^2}{4} = 0,972 \cdot 10^{-3} \text{ kg.m}^2 \quad (3.6)$$

$$J = J_m + J_R + \frac{J_Z}{N_m} = 30 \cdot 10^{-6} + 0,786 \cdot 10^{-6} + \frac{0,972 \cdot 10^{-3}}{2} = 0,517 \cdot 10^{-3} \text{ kg.m}^2 \quad (3.7)$$

$$M_D = J \cdot \varepsilon = J \cdot \frac{d\omega}{dt} = \frac{J}{r_R} \cdot \frac{dv}{dt} = \frac{2 \cdot J}{d_R} \cdot a(t) = \frac{2 \cdot 0,517 \cdot 10^{-3}}{0,018} \cdot 2 = 0,115 \text{ Nm} \quad (3.8)$$

$$M_m = (M_S + M_D) \cdot S_f = (0,18 + 0,115) \cdot 2 = \underline{0,59 \text{ Nm}} \quad (3.1)$$

Osa Y:

$$F_t = k \cdot F_{tk} = \xi \cdot m \cdot g \cdot \frac{2}{d_K} = 0,002 \cdot 5 \cdot 9,81 \cdot \frac{2}{0,024} = 8,18 \text{ N} \quad (3.3)$$

$$M_S = \frac{1}{N_m} \cdot (F_t + F_0) \cdot r_R = \frac{1}{N_m} \cdot (F_t + F_0) \cdot \frac{d_R}{2} = \frac{1}{1} \cdot (8,18 + 20) \cdot \frac{0,018}{2} = 0,25 \text{ Nm} \quad (3.4)$$

$$J_R = \frac{1}{8} \cdot m_R \cdot (d_1^2 + d_2^2) = \frac{1}{8} \cdot 0,012 \cdot (0,022^2 + 0,00635^2) = 0,786 \cdot 10^{-6} \text{ kg.m}^2 \quad (3.5)$$

$$J_Z = m \cdot r_R^2 = m \cdot \frac{d_R^2}{4} = 5 \cdot \frac{0,018^2}{4} = 0,405 \cdot 10^{-3} \text{ kg.m}^2 \quad (3.6)$$

$$J = J_m + J_R + \frac{J_Z}{N_m} = 30 \cdot 10^{-6} + 0,786 \cdot 10^{-6} + \frac{0,405 \cdot 10^{-3}}{1} = 0,438 \cdot 10^{-3} \text{ kg.m}^2 \quad (3.7)$$

$$M_D = J \cdot \varepsilon = J \cdot \frac{d\omega}{dt} = \frac{J}{r_R} \cdot \frac{dv}{dt} = \frac{2 \cdot J}{d_R} \cdot a(t) = \frac{2 \cdot 0,233 \cdot 10^{-3}}{0,018} \cdot 2 = 0,10 \text{ Nm} \quad (3.8)$$

$$M_m = (M_S + M_D) \cdot S_f = (0,18 + 0,115) \cdot 2 = \underline{0,70 \text{ Nm}} \quad (3.1)$$

Osa Z:

$$\alpha = \arctan\left(\frac{P}{\pi \cdot d_{T2}}\right) = \arctan\left(\frac{8}{\pi \cdot 7}\right) = 20^\circ \quad (3.10)$$

$$\begin{aligned} F &= F_{Gx} + F_t = F_{Gx} + \mu \cdot F_N = m \cdot g \cdot (\sin \alpha + \mu \cdot \cos \alpha) = \\ &= 2 \cdot 9,81 \cdot (\sin 20 + 0,45 \cdot \cos 20) = 15 \text{ N} \end{aligned} \quad (3.13)$$

$$M_S = F \cdot \frac{P}{2\pi} \cdot \frac{1}{\eta} = 15 \cdot \frac{8}{2\pi} \cdot \frac{1}{0,65} = 0,03 \text{ Nm} \quad (3.14)$$

$$J_S = \frac{1}{8} \cdot m_S \cdot (d_1^2 + d_2^2) = \frac{1}{8} \cdot 0,015 \cdot (0,019^2 + 0,007^2) = 0,769 \cdot 10^{-6} \text{ kg.m}^2 \quad (3.15)$$

$$J_T = \frac{1}{8} \cdot m_T \cdot d_{T1}^2 = \frac{1}{8} \cdot 0,062 \cdot 0,008^2 = 0,496 \cdot 10^{-6} \text{ kg.m}^2 \quad (3.16)$$

$$J_Z = m \cdot \left(\frac{P}{2\pi}\right)^2 = 2 \cdot \left(\frac{0,008}{2\pi}\right)^2 = 3,24 \cdot 10^{-6} \text{ kg.m}^2 \quad (3.17)$$

$$\begin{aligned} M_D &= (J_m + J_S + J_T + J_Z) \cdot \frac{2\pi}{P} \cdot a(t) = \\ (30 \cdot 10^{-6} + 0,769 \cdot 10^{-6} + 0,496 \cdot 10^{-6} + 3,24 \cdot 10^{-6}) \cdot \frac{2\pi}{0,008} \cdot 5 &= 0,14 \text{ Nm} \end{aligned} \quad (3.18)$$

$$M_m = (M_S + M_D) \cdot S_f = (0,03 + 0,14) \cdot 2 = \underline{0,33 \text{ Nm}} \quad (3.1)$$