Machine Dynamics - Assignment 3

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Q1

Determine L and R according to the required stroke.

$$\begin{cases} l + r - (l - r) &= 76\text{mm} \\ \frac{l}{r} &= 3.5 \end{cases}$$

Obtains:

$$\begin{cases} r &= 38\text{mm} \\ l &= 133\text{mm} \end{cases}$$

Q2

Consider the gas force only, determine the corresponding shaking force, the shaking moment based on the point O, and the output torque T_2.

$$\begin{cases} \omega_2 &= 120\pi\text{rad/s} \\ \alpha_2 &= 0 \end{cases}$$

$$\begin{cases} F &= F_g + F_i \\ T &= T_g + T_i \end{cases}$$

$$link2 \Rightarrow \begin{cases} F_{12x} + F_{32x} = m_2 a_{G2x} \\ F_{12y} + F_{32y} = m_2 a_{G2y} - m_2 g \\ R_{2x} F_{32y} - R_{2y} F_{32x} = [I_{G2} + m_2 r_{G2}^2]\alpha_2 \end{cases}$$

$$link4 \Rightarrow \begin{cases} F_{34x} + F_g = m_4 a_{G4x} \\ F_{34y} + F_{14} = m_4 a_{G4y} - m_4 g \\ R_{4x} F_{34y} - R_{2y} F_{32x} = [I_{G3} + m_2 r_{G4}^2]\alpha_4 \end{cases}$$

$$F_{34} + F_g + F_{14} = 0$$

Torque on pin 2:

$$T_{21} = F_g \frac{r}{l} \sin \omega_2 t (1 + \frac{r^2}{2l^2} \sin^2 \omega_2 t) r \cos \omega_2 t + F_g r \sin \omega_2 t$$

Shaking force F_S:

$$F_S = F_{12} + F_{14}$$

Q3

Consider the inertial force only, determine the corresponding shaking force, the shaking moment based on the point O, and the output torque T_2.

Link3 inertia force & torque:

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