Homework 1: Linkage Analysis

Lorenzo Hess

2025-02-03

Contents

1 Assumptions

1. Steady-state rate of 7450 parts in seven hours

2 Free-Body Diagrams

3 Statics and Dynamics Equations

3.1 Forces and Moments

3.2 Mass Calculations

3.3 Mass Moment of Inertia Calculations

3.4 Kinematics Equations

3.4.1 Position

3.4.2 Velocity

To solve the angular velocities, we require the steady-state crank angular velocity, ω_1. With a part per hour rate of 7450 parts per seven hours, we can compute:

$$\dot{p} = \frac{7450\text{part}}{7\text{hr}} = 0.29\frac{\text{part}}{\text{sec}}$$

$$p^{-1} = 3.38\frac{\text{s}}{\text{part}}$$

By inspection of the PMKS+ model, we see that the output link completes one cycle at the same rate as the input link. Thus:

$$\omega_1 = \omega_5$$

The output link delivers one part per revolution, so the output link angular velocity is:

$$\omega_5 = \frac{2\pi}{p^{-1}} \cdot 1 \text{ part}$$

$$\Rightarrow \omega_1 = 21.25\text{rad/s}$$