

MotorKit Parameters

The linearized model of inverted pendulum system is:

$$J_{ip}\ddot{\theta} + \frac{K^2}{R}\dot{\theta} - mgl_c\theta = \frac{KV_s}{R}d$$

Using parameters:

| Parameter | Value | Description |
|-----------------------------------------|-----------------------|---------------------------------------------------------|
| $m(\text{kg})$ | 4.4×10^{-2} | Mass of pendulum |
| $g(\text{m/s}^2)$ | 9.81 | Gravitational acceleration |
| $l_c(\text{m})$ | 2.54×10^{-2} | Distance from pivot joint to the center of pendulum rod |
| $J_{rodc}(\text{kg}\cdot\text{m}^2)$ | 2.16×10^{-5} | Moment of inertia of pendulum about center of rod |
| $J_{rode}(\text{kg}\cdot\text{m}^2)$ | 8.37×10^{-5} | Moment of inertia of pendulum about end of rod |
| $J_{rotor}(\text{kg}\cdot\text{m}^2)$ | 1.67×10^{-6} | Moment of inertia of motor rotor |
| $J_{inertia}(\text{kg}\cdot\text{m}^2)$ | 2.33×10^{-5} | Moment of inertia of inertia mode of system |
| $J_{dp}(\text{kg}\cdot\text{m}^2)$ | 8.54×10^{-5} | Moment of inertia of downward pendulum mode of system |
| $J_{ip}(\text{kg}\cdot\text{m}^2)$ | 8.54×10^{-5} | Moment of inertia of inverted pendulum mode of system |
| $V_s(\text{V})$ | 10.7 | Supply voltage of the motor drive (H-bridge) |
| d | - | Duty cycle |
| $\theta(\text{rad})$ | - | Angle of pendulum |

Table 1: Pendulum system parameters in SI units.

From Lab2 System Identification, you should get your k and τ as parameters of motor, where

$$k = \frac{V_s}{K}$$

$$\tau = \frac{J_{inertia}R}{K^2}$$

For more details, read MotorLabManual you got from Lab2.