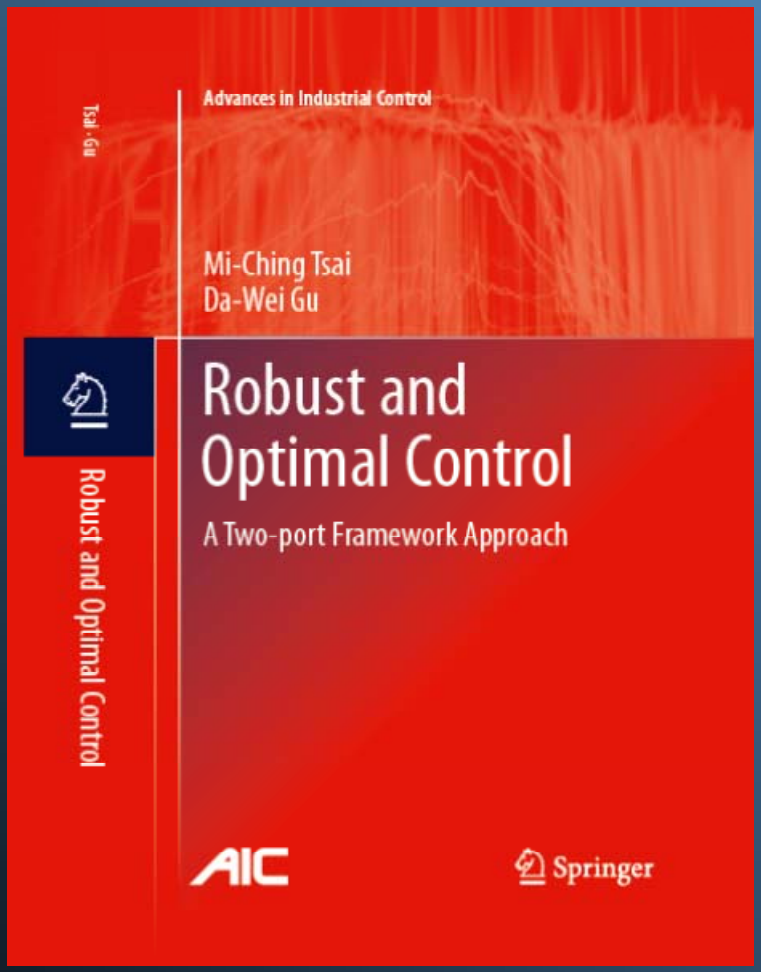


Robust and Optimal Control

A Two-port Framework Approach

H_∞ Robust Controller Design for PDFF control

Outline

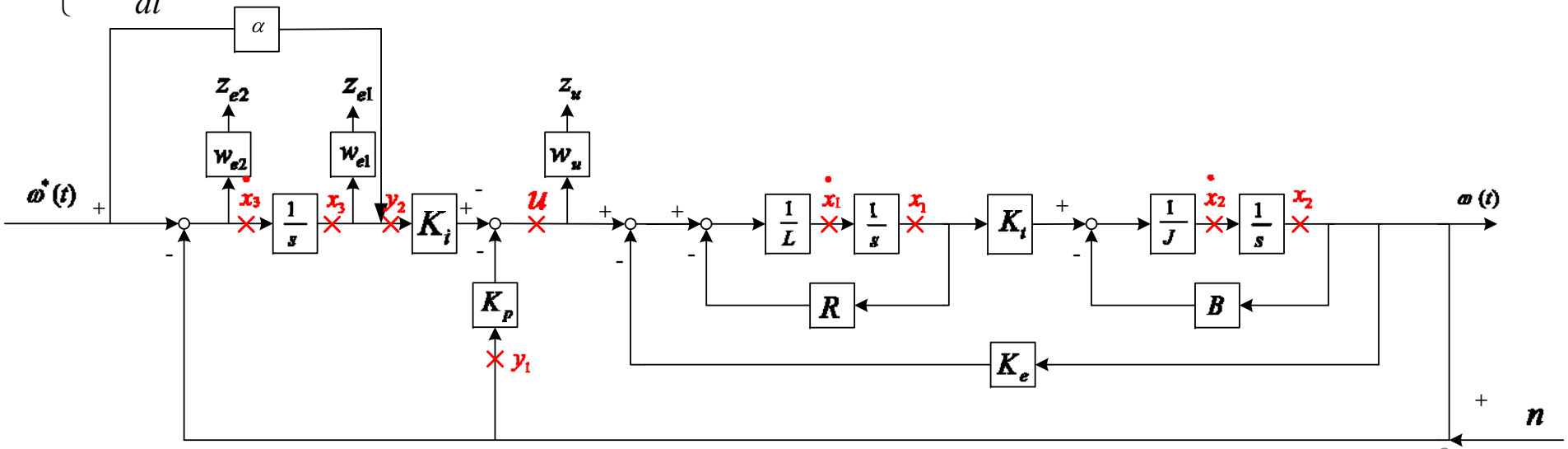
1. Introduction
2. Methodology
3. Simulation Result
4. Conclusion

Introduction

1. Purpose: Design a controller for velocity control of servo motor
2. Target: Minimize the system parameters changing effect
3. Controller: PDFF Controller

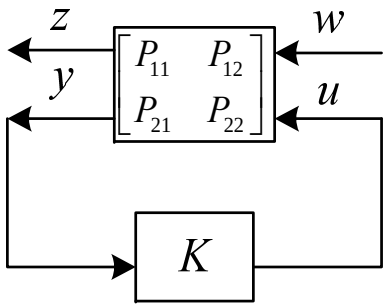
Dynamic equation of the motor:

$$\begin{cases} V = iR_c + L\dfrac{di}{dt} + k_e\omega \\ J_m\dfrac{d\omega}{dt} = k_t i - B_m\omega \end{cases}$$



Step1: Find LFT matrix P(s)

Linear fractional transformation:



Simulation parameters:

Resistance, R	7.155
Inductance, L	0.0038
Inertia of motor, J	$5.77 \cdot 10^{-5}$
Damping ratio, B	0.00055
Back EMF constant, k_e	0.21
Torque constant, k_t	0.21
Alpha,α	0.04

We1	**1**
We2	**1**
Wu	**1**

$$P = \begin{bmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{bmatrix} \overset{s}{=} \begin{array}{c} \\ \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \\ \hline Z_{e1} \\ Z_{e2} \\ Z_u \\ \hline y_1 \\ \hline y_2 \end{array} \left[\begin{array}{ccc|cc|c} x_1 & x_2 & x_3 & \omega^* & n & u \\ \hline \frac{-R}{L} & \frac{-K_e}{L} & 0 & 0 & 0 & \frac{1}{L} \\ \frac{K_t}{J} & \frac{-B}{J} & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 1 & -1 & 0 \\ \hline 0 & 0 & W_{e1} & 0 & 0 & 0 \\ 0 & -W_{e2} & 0 & W_{e2} & -W_{e2} & 0 \\ 0 & 0 & 0 & 0 & 0 & W_u \\ \hline 0 & 1 & 0 & 0 & 1 & 0 \\ \hline 0 & 0 & 1 & \alpha & 0 & 0 \end{array}\right] = \left[\begin{array}{ccc|cc|c} -1882.9 & -55.263 & 0 & 0 & 0 & 263.16 \\ 3639.5 & -9.5321 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 1 & -1 & 0 \\ \hline 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ \hline 0 & 1 & 0 & 0 & 1 & 0 \\ \hline 0 & 0 & 1 & 0.04 & 0 & 0 \end{array}\right]$$