MODEL PREDICTIVE CONTROL (SIMULINK) · CARIMO DCMK KIT

MPC SPEED CONTROL

Optimal, constraint-aware motor control. The method that runs refineries, power grids and self-driving cars, now on your own bench.

13 HARDWARE EXPERIMENTS

Plans every move: a smooth approach to target with minimal overshoot



Characteristic MPC step response on the DCMK plant: the controller plans ahead, so the speed rises smoothly and settles on target with little overshoot.

IN ONE BREATH

Every 15 ms, MPC forecasts where the speed is heading, solves for the gentlest moves that hit the target inside every hard limit, acts, then re-plans. A Kalman disturbance observer keeps tracking offset-free even when a sudden load hits the motor. Where a fixed-gain PID gets twitchy, MPC stays smooth and never blows past a limit.

15 ms — live control tick

0 — steady-state error, holds at the limit

Editable — Simulink source, every block

How MPC works, four steps every tick

1 MEASURE
Read the live speed and load on every 15 ms tick.

2 PREDICT
Forecast where the speed is heading over a future horizon.

3 OPTIMISE
Solve for the gentlest moves that hit target inside every limit.

4 APPLY
Commit the first move, then re-plan on the next tick.

Thirteen hardware experiments

1. Aggressive vs smooth tuning
2. Constraint handling
3. Disturbance observer
4. Model mismatch (A / B / C)
5. Sine vs step response
6. Control horizon (M) sweep
7. Software disturbance rejection
8. Staircase tracking
9. MV-rate limit sweep
10. Move-suppression (R) sweep
11. 1 Hz sinusoidal tracking
12. Prediction horizon (N) sweep
13. Output weight (Q) sweep

Why students win

Industry-standard
The advanced method behind cars, aircraft, robots and process plants.

Respects limits
Actuator and rate limits honoured by design, not bolted on.

Real hardware
Every figure measured on a live spinning motor.

Research-ready
Constraints, estimation and model ID feed straight into capstones.

Open source
Fully editable Simulink, inspect and extend every block.

What you need

Software
MATLAB® R2021a or later · Simulink® · Model Predictive Control Toolbox™
Also: a no-MATLAB Python edition.

System
Windows 10 or 11 · one free USB port. Perpetual lab licence with a year of updates.

Hardware
CARIMO DC Motor Kit (V1.0 / V2.0) with magnetic load disk · **sold separately**

One motor, three paradigms: PID, Fuzzy and MPC.

Part of the CARIMO DCMK control family, built on a 15-year teaching heritage at IIT Bombay

Request a demo or quote | www.carimotech.com | contact@carimo.tech | +91 90823 97027

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