Disturbance Response

Title: Disturbance Response
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Summary / Key Takeaways

- System stable for all five disturbance types (zero, step, impulse, bias, random).
- Settling time from 15.9 to 16.1 seconds for all disturbances.
- 24.83 – 25.33 percent overshoot for all disturbance types.

Assumptions / Parameters

- Controller: PID, Ts = 2.5, zeta = 0.7, tau = 0.2
- Sampling Rate: 0.1 s
- Process noise: Q = [1e-4, 1e-4, 1e-3, 1e-3] diagonal
- Disturbances: [zero / step / impulse / bias / random]

Results Table

Parameter / Scenario	Settling Time [s]	Overshoot [%]	RMSE [m]	Notes
Zero	15.9	24.83	0	No disturbance
Step	15.9	24.83	2.00E-03	Step at t=30-60 s
Impulse	15.9	24.83	0	Impulse at t=50 s
Bias	16	25.33	2.00E-03	Constant Bias
Random	16.1	25.06	1.00E-03	Random noise at σ=0.1

Observations / Analysis

- Settling time is relatively similar for all disturbance types.
- Percent overshoot is similar for all disturbances.
- RMSE is small and similar for all disturbance types.

Conclusion

- The system is stable for all types of disturbances, but experiences significant percent overshoot.