

2025-11-01

# E026: Appendix Part 2

## Controllers & Dynamics Reference

Part Appendix · Duration: 5-7 minutes

*Beginner-Friendly Visual Study Guide*

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Overview

Quick reference for DIP-SMC-PSO controllers and dynamics models.

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Controller Variants

Controller	Gains	Complexity
Classical SMC	6 ( $\lambda_1$ - $\lambda_2$ , $\phi_1$ - $\phi_2$ , $k_1$ - $k_2$ )	Low
Super-Twisting	8 (classical + STA params)	Medium
Adaptive SMC	6 + adaptation rates	Medium
Hybrid Adaptive STA	8 + adaptation	High

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Dynamics Models

- **Simplified:** Linearized equations (fast prototyping)
- **Full Nonlinear:** Complete physics (research accuracy)
- **Low-Rank:** Approximations (real-time applications)

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API Reference

```
from src.controllers.factory import create_controller
controller = create_controller('classical_smc', config, gains)
control = controller.compute_control(state)
```

Next: E027 Testing & Benchmarking Reference