2025-11-01

E027: Appendix Reference Part 3

DIP-SMC-PSO Educational Series

January 25, 2026

Overview

This episode covers appendix reference part 3 from the DIP-SMC-PSO project.

Part: Appendix
Duration: 15-20 minutes
Source: Comprehensive Presentation Materials

section0 Codebase Statistics

Project Scale Metrics:

Category	**Files**	**Lines**	**Size**
Source (‘src/‘)	120	15,000	450 KB
Tests (‘tests/‘)	85	8,000	280 KB
Docs (‘docs/‘)	814	20,000	3.2 MB
Scripts (‘scripts/‘)	173	6,000	220 KB

section0 Research Output Statistics

Research Phase Deliverables:

Phase 5 Research (October 29 - November 7, 2025):

- **Tasks completed:** 11/11 (100 - **Quick wins:** 5 tasks (8 hours) - **Medium-term:** 4 tasks (18 hours) - **Long-term:** 2 tasks (46 hours) - **Total effort:** 72 hours over 8 weeks

Research Artifacts:

- **LT-7 Paper:** SUBMISSION-READY (v2.1), 14 figures, comprehensive bibliography - **Experimental data:** 16 MB (controller-based + cross-controller studies) - **Benchmark logs:** 10 MB (MT-5, MT-7, MT-8, LT-6) - **Lyapunov proofs:** 1,000 lines (LT-4) - **Theory documentation:** 2,000 lines (QW-1)

section0 Quality Metrics

Code Quality & Testing:

Metric	**Target**	**Current**
Test pass rate	100 Critical issues	0
[OK] 0		
High-priority issues	3	[OK] 0
Code coverage (overall)	85 Coverage (critical)	95 Thread safety tests
100 Browser tests	100 Documentation files	–
985		
Navigation systems	–	11
Learning paths	–	5

Production Readiness Score:

- **Current:** 23.9/100 (NOT production-ready) - **Status:** Research-ready [OK], controllers functional

section0 Performance Benchmarks Summary

Controller Performance Rankings:

Controller	**Settle (s)**	**Energy**	**Chatter**	**Rank**
Hybrid Adaptive STA	1.8	45	Low	1
STA SMC	2.1	52	Low	2
Adaptive SMC	2.3	48	Medium	3
Classical SMC	2.5	55	High	4
Swing-Up	3.2	68	Medium	5
MPC (experimental)	2.8	42	Low	6

PSO Optimization Results:

- **Convergence:** 50-80 generations (30 particles) - **Speedup:** 3.1× (Numba JIT), 20.8× (vectorized batch) - **Robustness:** Validated across 100 random seeds (MT-7)

Resources

- **Repository:** `https://github.com/theSadeQ/dip-smc-pso.git`
- **Documentation:** See `docs/` directory
- **Getting Started:** `docs/guides/getting-started.md`

Educational podcast episode generated from comprehensive presentation materials