2025-11-01

: `config.yaml` (Pydantic-validated)

subsection **0.0   Key Sections**

- **physics**: Mass, length, damping, gravity

- **controller_settings**: Gains for 7 SMC variants

- **pso_parameters**: Swarm size (50), iterations (100)

- **simulation_settings**: Time step (0.01s), duration (10s)

section **0   Installation**

```
lstnumbergit clone https://github.com/theSadeQ/dip-smc-pso
lstnumbercd dip-smc-pso
lstnumberpython -m venv .venv
lstnumbersource .venv/bin/activate  # Windows: .venv\Scripts\activate
lstnumberpip install -r requirements.txt
```

section **0   Quick Start**

```
lstnumber# Run simulation
lstnumberpython simulate.py --ctrl classical_smc --plot
lstnumber
lstnumber# Run PSO optimization
lstnumberpython simulate.py --ctrl classical_smc --run-pso --save gains.json
lstnumber
lstnumber# Launch web UI
lstnumberstreamlit run streamlit_app.py
```

Next: E026 Controllers Reference