

2025-11-01

## section 0

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[2em] Part Overview · Duration:

*Beginner-Friendly Visual Study Guide*

subsection 0.0 What You’ll Learn

- **Core Principle:** Shift from conversational AI-style writing to direct technical prose
- **Detection Tools:** Automated pattern recognition for AI-ish writing
- **Quality Gates:** Measurable standards (<5 AI patterns per file)
- **Enforcement:** Pre-commit hooks + CI/CD integration

subsection 0.0 Why This Matters

**Problem:** AI-generated docs often sound like *"Let’s explore the exciting world of..."* instead of technical specs.

**Solution:** Enforce direct, precise, evidence-based writing via automated tooling.  
**Impact:** Docs become 40% shorter, 3x more scannable, and actually useful for debugging.

section 0 Anti-AI Writing Principles

subsection 0.0 1. Direct, Not Conversational

AI-ish (Conversational)	Technical (Direct)
Let’s explore how to implement...	Implementation requires 3 steps:
We’ll dive into the details...	System architecture:
You might wonder why...	Rationale:

**Rule:** Remove all first-person plural (we/our) and exploratory phrases.

subsection 0.0 2. Specific, Not Generic

Generic Claims	Specific Metrics
Comprehensive testing	87% coverage, 200+ tests
Highly optimized	3ms latency (95th percentile)
Production-ready	Passed 8/8 quality gates

**Rule:** Every claim needs a number, benchmark, or verifiable assertion.

subsection 0.0 3. Technical, Not Marketing

Marketing Language	Technical Facts
Cutting-edge algorithms	PSO with swarm size=30
State-of-the-art control	SMC with $\lambda = 15$ , $\phi = 2$
Revolutionary approach	Novel hybrid STA-adaptive SMC

**Rule:** Replace superlatives with technical specifications.

section 0 Automated Detection System

subsection 0.0 Pattern Recognition Tool

**Location:** scripts/docs/detect\_ai\_patterns.py

```
lstnumber# Check Single File
lstnumberpython scripts/docs/detect_ai_patterns.py --file docs/README.md
lstnumber
lstnumber# Scan Entire Directory
lstnumberpython scripts/docs/detect_ai_patterns.py --dir docs/ --verbose
lstnumber
lstnumber# CI/CD Integration (fail if >5 patterns)
lstnumberpython scripts/docs/detect_ai_patterns.py --file $FILE --max-patterns 5
```

subsection 0.0 Detected Patterns (50+ Total)

- **Conversational:** "Let’s...", "We’ll...", "You might...", "Feel free to..."

- **Generic:** "comprehensive", "robust", "seamless", "powerful"
- **Marketing:** "cutting-edge", "state-of-the-art", "revolutionary"
- **Filler:** "It's worth noting", "Importantly", "Essentially"

### subsection 0.0 Example Output

```
lstnumber[OK] Scanning docs/guides/getting-started.md...
lstnumber[WARNING] Found 3 AI-ish patterns:
lstnumber   Line 12: "Let's explore the configuration system"
lstnumber   Line 45: "We'll dive into controller implementation"
lstnumber   Line 78: "comprehensive testing framework"
lstnumber
lstnumber[INFO] Severity: MEDIUM (3 patterns, threshold is 5)
lstnumber[INFO] Suggested fixes:
lstnumber   - Replace "Let's explore" with "Configuration system"
lstnumber   - Replace "We'll dive into" with "Controller implementation"
lstnumber   - Replace "comprehensive" with "87% coverage, 200+ tests"
```

## section 0 Quality Gates & Enforcement

### subsection 0.0 Documentation Standards

Metric	Threshold	Status
AI patterns per file	< 5	[OK]
Marketing terms per page	< 2	[OK]
Superlatives per section	< 1	[OK]
Claims without evidence	0	[OK]

### subsection 0.0 Pre-commit Hook Integration

File: .pre-commit-config.yaml

```
lstnumberrepos:
lstnumber  - repo: local
lstnumber    hooks:
lstnumber      - id: check-ai-patterns
lstnumber        name: Check Documentation Quality
lstnumber        entry: python scripts/docs/detect_ai_patterns.py
lstnumber        args: [--max-patterns, "5", --file]
lstnumber        language: system
lstnumber        files: \.(md|rst)$
lstnumber        stages: [commit]
```

### subsection 0.0 CI/CD GitHub Actions

```
lstnumbername: Documentation Quality
lstnumberon: [pull_request]
lstnumberjobs:
lstnumber  check-docs:
lstnumber    runs-on: ubuntu-latest
lstnumber    steps:
lstnumber      - uses: actions/checkout@v3
lstnumber      - name: Run AI Pattern Detection
lstnumber        run: |
lstnumber          python scripts/docs/detect_ai_patterns.py \
lstnumber            --dir docs/ --max-patterns 5
```

## section 0 Migration Strategy

### subsection 0.0 Phase 1: Baseline Audit (Week 1)

enumiScan all existing docs: `python scripts/docs/detect_ai_patterns.py -dir docs/`

0. enumiCategorize files by severity: LOW (<5), MEDIUM (5-10), HIGH (>10)

0. enumiPrioritize: Fix HIGH files first, MEDIUM next, LOW last

### subsection 0.0 Phase 2: Automated Fixes (Week 2-3)

0. **Pattern Replacement:** Use regex to replace common patterns

- **Manual Review:** Human verification for context-dependent changes
- **Testing:** Verify Sphinx builds pass after edits

### subsection 0.0 Phase 3: Enforcement (Week 4+)

- Enable pre-commit hook for all contributors
- Add CI/CD checks to block PRs with violations
- Update contributor guidelines: docs/CONTRIBUTING.md

## section 0 Case Study: Real Migration

### subsection 0.0 Before: AI-Generated README (v1.0)

Original Version (15 AI patterns)

#### Welcome to DIP-SMC-PSO!

Let's explore the exciting world of double-inverted pendulum control. We'll dive into state-of-the-art sliding mode control algorithms with cutting-edge PSO optimization. Our comprehensive testing framework ensures robust, production-ready code. Feel free to experiment with our powerful simulation engine!

### subsection 0.0 After: Technical README (v2.0)

Refactored Version (0 AI patterns)

#### DIP-SMC-PSO: Double-Inverted Pendulum Control Toolkit

Simulates double-inverted pendulum systems with 5 SMC variants (classical, STA, adaptive, hybrid, swing-up). Includes PSO optimization (30 particles, 50 iterations), 87% test coverage (200+ tests), and sub-10ms latency (P95). System validation: 8/8 quality gates passing.

**Key Features:** Numba vectorization (20x speedup), WCAG AA UI, 11 MCP servers integrated.

### subsection 0.0 Impact Metrics

- **Length:** Reduced from 250 words to 80 words (68% shorter)
- **AI Patterns:** Dropped from 15 to 0 (100% elimination)
- **Technical Density:** Increased from 3 facts/paragraph to 8 facts/paragraph
- **Maintainability:** Updated 23 cross-references without breaking links

## section 0 Advanced Techniques

### subsection 0.0 Evidence-Based Claims

Every assertion needs one of:

- **Benchmark:** "3ms latency (P95 over 1000 runs)"
- **Test Coverage:** "87% line coverage, 95% branch coverage"

- **Quality Gate:** "Passed 8/8 production readiness checks"
- **Citation:** "Based on Khalil (2002) Lyapunov stability proof"

### subsection 0.0 Information Density

**Goal:** Pack maximum technical value per sentence.

#### Low Density (AI-ish)

The system uses a sophisticated optimization algorithm that intelligently tunes parameters to achieve better performance.

#### High Density (Technical)

PSO tuner optimizes 6 SMC gains ( $\lambda_1$ - $\lambda_2$ ,  $\phi_1$ - $\phi_2$ ,  $k_1$ - $k_2$ ) using 30 particles over 50 iterations, reducing IAE by 40%.

### subsection 0.0 Scannable Structure

- **Headers:** Action-oriented (not "Introduction", use "Quick Start Guide")
- **Lists:** Parallel structure, front-load key info
- **Tables:** For comparisons, specs, benchmarks
- **Code Blocks:** For commands, configs, API calls

## section 0 Tooling Ecosystem

### subsection 0.0 Core Scripts

enumiscripts/docs/detect\_ai\_patterns.py - Pattern detection (50+ patterns)

0. enumiscripts/docs/validate\_links.py - Cross-reference integrity

0. enumiscripts/docs/check\_evidence.py - Verify claims have citations/benchmarks

0. enumiscripts/docs/measure\_density.py - Calculate facts-per-paragraph ratio

### subsection 0.0 Integration Points

0. **Pre-commit Hooks:** Block commits with >5 AI patterns

- **CI/CD Pipeline:** Fail builds if quality gates not met
- **VS Code Extension:** Real-time linting for .md/.rst files
- **Sphinx Build:** Generate quality report during doc build

### subsection 0.0 Reporting Dashboard

**Generated by:** python scripts/docs/generate\_report.py

```
lstnumber=== Documentation Quality Report ===
lstnumberTotal files: 85 (.md) + 42 (.rst) = 127 files
lstnumber
lstnumberAI Pattern Analysis:
lstnumber - LOW severity: 102 files (<5 patterns)
lstnumber - MEDIUM severity: 18 files (5-10 patterns)
lstnumber - HIGH severity: 7 files (>10 patterns)
lstnumber
lstnumberEvidence-Based Claims:
lstnumber - With citations: 234 claims
lstnumber - With benchmarks: 189 claims
lstnumber - Unverified: 12 claims [ACTION REQUIRED]
lstnumber
lstnumberInformation Density:
lstnumber - Average: 6.2 facts/paragraph (target: 5+)
lstnumber - Top performers: getting-started.md (8.9), API.md (9.1)
lstnumber - Needs work: overview.md (2.3), philosophy.md (1.8)
```

## section 0 Common Pitfalls & Solutions

### subsection 0.0 Pitfall 1: Over-Correction

**Problem:** Removing all personality makes docs robotic/boring.

**Solution:** Keep analogies and examples, remove only fluff.

- [OK]: "SMC acts like a relay switch: ON when error positive, OFF when negative."
- [BAD]: "The sliding mode control algorithm operates via discontinuous control action based on state error polarity."

### subsection 0.0 Pitfall 2: False Precision

**Problem:** Adding fake numbers to satisfy metrics.

**Solution:** Use ranges/qualitative when exact data unavailable.

- [BAD]: "System achieves 99.7% reliability" (no tests run)
- [OK]: "System validated via 200+ tests (coverage data pending)"

### subsection 0.0 Pitfall 3: Technical Jargon Overload

**Problem:** Replacing conversational with impenetrable jargon.

**Solution:** Balance accessibility with precision.

- [BAD]: "Utilizing eigenvalue decomposition to ascertain system controllability matrix rank deficiency"
- [OK]: "Uses eigenvalue analysis to verify system controllability (rank=4 for DIP)"

## section 0 Maintenance & Continuous Improvement

### subsection 0.0 Monthly Audit Workflow

```
lstnumber# 1. Run Full Scan
lstnumberpython scripts/docs/detect_ai_patterns.py --dir docs/ --report
lstnumber
lstnumber# 2. Identify Regressions (new files with >5 patterns)
lstnumbergit diff main --name-only | grep -E '\.(md|rst)$' | \
lstnumber  xargs -I {} python scripts/docs/detect_ai_patterns.py --file {}
lstnumber
lstnumber# 3. Update Pattern Database (add new anti-patterns)
lstnumbervim scripts/docs/patterns.yaml
lstnumber
lstnumber# 4. Re-train Contributors (share worst offenders in team meeting)
```

### subsection 0.0 Pattern Database Evolution

File: scripts/docs/patterns.yaml

```
lstnumberconversational:
lstnumber  - pattern: "Let's (explore|dive into|take a look)"
lstnumber    severity: HIGH
lstnumber    suggestion: "Remove phrase, start with technical term"
lstnumber
lstnumber  - pattern: "(We'll|We will) (implement|create|build)"
lstnumber    severity: MEDIUM
lstnumber    suggestion: "Use imperative: 'Implementation requires...'"
lstnumber
lstnumbergeneric_claims:
lstnumber  - pattern: "(comprehensive|robust|powerful|flexible)"
lstnumber    severity: HIGH
lstnumber    suggestion: "Replace with metrics (coverage %, features count)"
lstnumber
lstnumbermarketing:
lstnumber  - pattern: "(cutting-edge|state-of-the-art|revolutionary)"
lstnumber    severity: CRITICAL
lstnumber    suggestion: "Replace with technical specs or citations"
```

- subsection 0.0 Contributor Education
- **PR Template:** Include "Documentation Quality Checklist"
  - **Style Guide:** docs/CONTRIBUTING.md section on anti-AI principles
  - **Examples:** Maintain "Good vs. Bad" snippet library
  - **Workshops:** Quarterly training on technical writing

section 0 Success Metrics

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subsection 0.0 Quantitative Indicators

Metric	Baseline	Target
AI patterns per file	12.3	<5.0
Docs with evidence	45%	>80%
Information density	3.1 facts/para	>5.0
User time-to-answer	8.2 min	<3.0 min

- subsection 0.0 Qualitative Indicators
- Users say "Found what I needed in README" (not "Had to dig through code")
  - External contributors submit PRs without asking basic questions
  - Docs cited in academic papers (proves technical rigor)
  - Zero complaints about "marketing fluff" in reviews

Checklist: Documentation Quality Standards

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- ☐ **Scan:** Run `detect_ai_patterns.py` on all docs (<5 patterns per file)
- ☐ **Evidence:** Verify every claim has benchmark/citation/test coverage
- ☐ **Density:** Measure facts-per-paragraph (target: 5+)
- ☐ **Pre-commit:** Enable hook to block AI-ish writing
- ☐ **CI/CD:** Add quality gates to GitHub Actions
- ☐ **Migrate:** Refactor HIGH severity files (>10 patterns) first
- ☐ **Educate:** Update CONTRIBUTING.md with anti-AI principles
- ☐ **Monitor:** Monthly audits + pattern database updates

Next Steps

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- **E017:** Multi-agent orchestration patterns and checkpoint recovery systems
- **E018:** Testing philosophy - coverage standards and validation strategies
- **E019:** Production safety - memory management and thread safety