

Artificial Intelligence (AI) in Hardware

"Agents on Rails: Deterministic AI for Chip Sign-Off"

The most time-consuming work in chip design and verification is judgment-heavy language: interpreting multi-tool sign-off logs, triaging regression failures to root cause, adjudicating waiver requests against policy, reasoning about coverage holes. Large language models are well suited to this — yet non-determinism and tendency to hallucinate are disqualifying where results must be reproducible, auditable, and trusted to gate silicon. An agent that returns a different violation count, waiver verdict, or root cause across identical runs undermines the very sign-off it is meant to accelerate.

We present a family of agentic-AI applications built on a principle we call deterministic by construction: the model is confined to natural-language understanding, while deterministic code owns every ground-truth computation — counting, rule classification, log and report parsing, failure grouping, edit application, and rendering. We enforce this boundary with schema-constrained structured output instead of parsing free-form text; model-facing tools each backed by a pure-code sibling that serves as ground truth; a single source of truth for coding rules consumed directly by code, eliminating prompt-versus-code drift; byte-stable reports with stable ordering; and bounded agency.

Companion agents observe existing flows without mutating them, degrade gracefully when the model is unavailable, and are measured by an evaluation harness with negative controls that tests reproducibility directly.

We demonstrate bounded agentic AI across the design flow: static verification log analysis (Lint, CDC/RDC, DFT) with a safe auto-fix loop; waiver-compliance review grounded in design methodology; DV failure triage and root-cause analysis; and coverage gap analysis toward closure. The model reasons; deterministic code decides — agentic productivity with sign-off-grade trust. Familiar tools, new intelligence.

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