BLACK-BOX AND WHITE-BOX EARLY POWER INTENT SIMULATION AND VERIFICATION: TWO NOVEL APPROACHES

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A General Power-Aware Transaction-Level Methodology

The Methodology Flow

1. Power Intent Specification Stage
   - High level power architecture
   - Software Flow Analysis
2. PMU Modeling Stage
   - Power-aware & Simulation-based Verification Stage
3. Full Power-aware Simulation Stage
   - Power Estimation & Analysis
   - Power-aware Design Errors

The Ten Requirements

1. The methodology must allow easy enabling and disabling power features depending on the simulation
2. Power-aware features including power intent specification and control are based on a power domain based reasoning
3. The UPF (IEEE-1850) standard semantics are used as the reference to add power intent at a higher level
4. A Power Management Unit (PMU) should dynamically configure power domains states to set a system power mode according to a static power state table (PST) specification
5. Power Control Transactions (PCT) should be integrated with the embedded software running on the TL platform
6. All blocks involved in a power domain state change should be blocked until the PMU ends setting the requested system power mode
7. Each power-gated domain needs a separate power controller which automatically controls the power domain power and power up sequencing
8. The pmu management strategy as well as the PMU model should be designed to use the three different power management interfaces
9. The verification process should be power-aware and contract-based, and should dynamically check all the defined classes of contracts
10. The contracts should be marked or removed without adding the source code and a possible selective disabling of the different categories of checks (e.g., preconditions, postconditions and invariants) should be allowed

UPF Concepts

- PwARCH
- PAL

The white-box approach is:
- More accurate
- Less fast
- More flexible

The black-box approach is:
- More limited
- More fast
- More generic (Ideally applied to hybrid VPs)

A White-Box Implementation Approach

White-Box Implementation Approach

Proof of Concept Results

Black-Box Vs. White-Box VPs

References