Expanding RISC-V Horizons: Streamlining Heterogeneous Systems Evaluation with Open Source RISC-V AMS VP Framework
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Problem
- RISC-V continuously growing ecosystem
- RISC-V applications in Internet-of-Things (IoT) and Cyber-Physical Systems (CPS)
  - Early development and verification
  - Open-source RISC-V Virtual Prototype (VP)
  - Enable Hardware/Software interactions
  - Lack of accurate environment models for CPS

Experimental Evaluation
- Temperature control algorithm
  - Hysteresis controller
  - Lightweight design
  - Finite state machine based.
- Fault Injection evaluation

Heterogeneous Systems Evaluation Framework
- Open source RISC-V AMS VP
  - System-level (SystemC/AMS)
  - TLM-based hardware/software simulation
  - Registers for hardware/software interactions
    - Software and TLM
    - TLM and AMS
  - TDF models of computation for physical environments
  - AMS-based sensor, heater, and environment models
  - Design, simulation, and verification

More Research
- Cross-level and hybrid modeling (VP in the Loop)
  - Register-Transfer Level (RTL) and RISC-V AMS VP framework
- Automated refinement of non-functional properties of VPs, e.g., time and energy consumption
- Development of library with primitive building blocks for CPS
  - Sensors, actuators, Analog-to-Digital Converters
- Verification using advanced techniques
  - Fuzzing
  - Symbolic execution
- Virtual Environment GUI (VP breadboard)
  - Interactive simulation of off-chip “devices”
- Verification of embedded firmware