

Performance Modeling of Digital Processing Systems

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Content

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- Timing prediction of software execution is hard
- Existing system-level modeling methodologies (SystemC, etc.) are complex and inadequate
- Traditionally performance is estimated based on spreadsheets
 - Provides theoretical performance prediction
 - But they are often error-prone and inconsistent with actual performance data





Compute system is too complex to analytically predict SW execution performance

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Proposed Digital System Architecture Modeling

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- Processing systems comprise 2 parts
 - Functional behavior: well established tools and processes for modeling and verification
 - Timing behavior: no process or tool for modeling, have no visibility how SW executes in HW
- Absence of timing behavior results in
 - Unproven system level requirements (such as data throughputs and error rates)
 - Incorrect requirements generation for design and implementation
- New tool and methodology proposed to model timing behavior
 - Connects architecture model with systems requirements
 - Generate optimal and implementable design requirements



Requirements

consumption

- timing information
- Modeling flow
 - Processor modeling uses statistical information from software application
 - Other sub-systems are stochastic or cycle-accurate

Performance Modeling Using VisualSim Tool

• VisualSim - architecture exploration tool for modeling timings behavior of digital processing systems

- Modeling approach focus on data flow and timings
 - Use key events and timings relevant to performance, data flows, error rates and power
 - Use HW platform architecture model to obtain



Data-driven performance

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estimates



VisualSim reduces modeling complexity by separating functional and timing behaviors

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• Radar signal processing flow – SW/FW tasksMission



• Processing platform (Single board computer)



Tune SW tasks and HW configuration for desired processing performance

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- Identified gap in processing systems modeling and proposed timing-only analysis
 - Not focusing on functional aspects makes modeling relatively simple, enabling performance analysis of large processing systems
- Proposed capability enables reasonably accurate performance estimate of algorithms early in architecture and design phases, before hardware is tested and software is written
 - Recognized statistical nature of timings in compute systems
 - Unlike functional aspects, precision/cycle-accurate simulation is not required in most performance analysis of processing systems



Thank You!

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