

Research Questions

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Power Estimation and Emulation
in Computer Architectures

Introduction to the problem

- What the Literature Review Revealed
 - Measuring Energy in computer microarchitecture is a problem. Obtaining a suitable granularity at the lower levels is important for design space exploration in microarchitecture.
 - Techniques :
 - Analytical, Simulation, Measurement
 - Quantified table of performance for all techniques not clearly identified
 - Energy Usage in processors is a significant issue and design space exploration in microarchitecture domain needs better tools to evaluate power
- Research Questions
 - **Research Question 1**
 - What are the currently available techniques and tools available to the computer architect in obtaining an accurate model of the power and energy related characteristics when developing a design? What are the possible new techniques in this domain? How should these various techniques be cascaded and combined to obtain accurate estimates in the early stages of design space exploration in computer architecture?
 - **Research Question 2**
 - How to quantify the accuracy of such techniques (current and upcoming) and providing metrics so that the computer architect is able to make well-informed decisions in the early stages of computer architecture exploration? How to interpret the results obtained from the various combinations of these techniques and quantify the trade-offs correctly to facilitate decision making for design exploration?

Execution

Research Methods

The method involved in the development of the techniques will mainly utilize ASIC oriented synthesis tools such as Synopsys and Cadence. Afterwards the plan is to continue into evaluating the accuracy and precision of these measurements with an FPGA based platform to perform high speed emulation. The next step would be to perform measurements on a hardware platform with characteristics similar to the emulated architecture to identify the degree of accuracy across these different stages from early design space exploration to fabrication.

Expected Results

The goal of this project is to research into different power estimation techniques in computer architecture, clearly identify and quantify the interrelationships between different tools and techniques. With respect to these goals the expectation of the thesis would be to:

- Develop new techniques in addition to the currently available techniques for architecture design space exploration with special focus on power simulation of computer architectures and optimization of energy efficiency.

- Develop a toolset that provides computer architects with metrics to identify the techniques needed for power estimation/ simulation depending on the optimal trade-off taking into consideration the factors, time, accuracy and level of abstraction.

- Develop power optimizations in lower abstraction levels of computer architecture.