

UCLA Electrical Engineering ARR 2011

Session 3. New Trends in Power-Aware Design South Bay Room

9:00-9:25

"Total System Power Minimization of Microprocessors using Refrigerated Systems for Electronic Cooling"

Wonho Park and Ken Yang

Abstract:

Power dissipation and thermal problems have become a growing issue for scaled technology. This phenomenon drives the need for advance cooling systems. It is well-known that cooling the operating temperature results in reduced electric power and/or speed gains. However, total power dissipation includes both electric power and the refrigeration power. A refrigeration system is developed and experimentally tested to demonstrate that cooling the high performance microprocessor can lead to overall system power improvement. A processor that dissipates 175.4W of maximum power with 30% electronic leakage power operating at 97Å°C is cooled using our refrigeration system. Our measurement results show that with a minimum refrigeration coefficient of performance of 2.7, the processor operates with junction temperature <40Å°C and offers a 25% total system power reduction over the non-refrigerated design. This experiment is the first demonstration of active cooling that lead reduced total wall power. The experiment also indicate that the compressor requires high COP across a broad range of cooling capacity in order for the system to obtain total power savings across different range of processor utilization. In such case, our analysis shows that at least >12% of total power is saved across the entire range of processor utilization.

9:25-9:50

"Practical Energy-Aware Link Adaptation for MIMO-OFDM Radios"

Eren Eraslan, Chao-Yi Wang, and Babak Daneshrad

Abstract:

Circuit designers have put substantial effort to reduce the energy consumption of specific blocks in wireless communication devices. However, much more significant increase in energy efficiency can be achieved at the system level by proper choice of transmission parameters.

Choosing the best mode to transmit given the channel conditions in a wireless link is referred to as link adaptation. In this talk, we present a novel energy-aware link adaptation protocol for MIMO OFDM systems, which chooses the transmission parameters, such as transmit power, number of transmit/receive antennas, modulation and coding scheme, to minimize the total energy consumption of the link while satisfying the application's QoS requirements. Through simulation and experimental results, we show that it provides orders of magnitude gain in energy efficiency of the communication link.

9:50-10:15

"Efficiency Enhancement of a Class E Power Amplifier under Back-off"

Nitesh Singhal and Sudhakar Pamarti

Abstract:

As modern wireless communication technologies increasingly use non-constant envelope modulation schemes, power amplifiers (PAs) that can maintain close to peak efficiency over the dynamic range of such modulation schemes become critical. This talk focuses on novel methods of maintaining high efficiency under output power back-off using a class E amplifier. A Zero voltage switching technique which can ideally maintain 100% efficiency at all power is discussed. Another technique which involves modulating the load in an optimal way is also presented. The application of the techniques is illustrated by the design and measurement on discrete and IC based prototypes.

10:15-10:40

"A Behavioral Algorithm for State of Charge Estimation"

Ayca Balkan, Min Gao, Paulo Tabuada, and Lei He

Abstract:

Estimating the state of charge (SOC) of electrochemical batteries is an important, yet challenging task. In our work, we propose a new algorithm to estimate the SOC using the behavioral framework proposed by Jan Willems. Our method, which only requires terminal voltage and terminal current data, does not postulate any model of a battery unlike most of the previous work. We compare the performance of our algorithm with existing methods and demonstrate comparable results.