謝秉璇 教授

Ping-Hsuan Hsieh was born in Taipei, Taiwan. She received the B.S. degree from National Taiwan University in 2001, and the M.S. and Ph.D. degrees from the University of California, Los Angeles, in 2004 and 2009, respectively, all in electrical engineering.

She was an Intern with Texas Instruments in the summers from 2004 to 2006. From 2009 to 2011, she was with the IBM T.J. Watson Research Center, where she worked on the design of mixed-signal integrated circuits for high-speed serial data communication. In 2011, she joined the Electrical Engineering Department of National Tsing Hua University, Hsinchu, Taiwan, where she is currently an Assistant Professor. Her research interests include mixed-signal integrated circuit designs for high-speed electrical data communications, clocking and synchronization systems, and energy-harvesting systems for wireless sensor networks and machine-to-machine applications.

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現為清華大學電機系教授,
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2000-02 年於聯發科技類比設計部門工作(當年為聯詠科技樓下).
其研究領域為類比及混合訊號架構與電路, 應用於通訊系統與電源管理.
近年來亦將其研究領域應用於生醫與健康照護系統.

Interface Designs for RF and Piezoelectric Energy Harvesting
Prof. Ping-Hsuan Hsieh

Energy harvesting is a process to capture and store energy from ambient environment. It has enabled a variety of applications, including health and lifestyle improvement, RFID, and industrial process monitoring/control, especially for applications with remote inaccessible devices. As the power available in the environment is typically very low (on the order of a few tens of W), the architecture and design of the power processing circuit have to be optimized for minimal loss through the energy harvesting process.

In this talk, we will present two interface designs, one for RF energy harvesting, and the other for vibrational energy harvesting with a piezoelectric transducer. The ac nature of the two sources requires the use of a rectifier, imposing great challenge on the power extraction process.

Followed by a simple characterization of a four-transistor cross-coupled rectifier, we will present how the proposed RF energy harvester uses a low-power adaptive control to maintain close-to-optimal power conversion efficiency. The proposed design is implemented in 0.18-m CMOS technology. It achieves an end-to-end power conversion efficiency of 35.7% with –15 dBm of input available power.

On the other hand, nonlinear processing of the interface voltage through switching has shown to improve the extracted power significantly in piezoelectric energy harvesting. In the second half of this talk, we will present a technique to further improve the performance when operating at off-resonance by adjusting the switching timing. Preliminary experimental results will be shown to validate the proposed technique.

適用於系統晶片之電源管理技術
Prof. Po-Chiun Huang

隨著晶片整合度日趨提高，製程條件更形嚴苛，與可攜式系統的需求強烈，電源管理技術為近來系統晶片發展的熱門主題.

要達到最佳的功耗管理與電源控制，需含括從系統至製程各個層級的考量. 實難面面提及. 於本次討論中，我們將就三種技術，作一概念性的介紹: 第一為以數位控制方式設計電能轉換系統，以達系統晶片不同需求. 第二為協同管理的想法，將晶片內的轉換資源作有效地應用. 第三為一整合性的升壓電路，提供系統晶片操作的另一資源.

本討論，將不限定須具備電源管理技術背景. 目標期望能觸發不同層級的設計者，配合電源管理，達到系統晶片節能，更甚能解決目前一些設計困難.