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ELECTRICAL & COMPUTER ENGINEERING
TEXAS A&M UNIVERSITY

S E M I N A R

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A Single-Cycle MPPT Charge-Pump Energy Harvester Using a Thyristor-Based VCO without Storage Capacitor

by

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Abstract: The conventional switched-capacitor energy harvester lacked the startup and self-sustaining capability, which are vital to the power-management unit for IoE. Another practical design challenge is the huge storage capacitor utilized for buffering and MPPT purposes at the output of the charge pump. Therefore, a storage capacitor-less charge pump is designed for PV cells with 1.8V output voltage. The regulation signals are analyzed in the frequency domain, resulting in a single-cycle MPPT that senses the output power based on digital clocking. Moreover, a thyristor-like device is used as an inverter with a strong hysteresis, high slew rate, and small shoot-through current. A thyristor-based voltage-controlled oscillator (VCO) is proposed with local positive feedback for low-voltage startup and reduced power consumption. The entire controller is supplied by the output of the CP, which allows it to achieve self-sustaining capability.

Xiaosen Liu (S'08) was born in Jiangsu Province, China, in 1985. He received the B.Sc. and M. Phil. degrees in electrical engineering from Southeast University, Nanjing, China, and Hong Kong University of Sci & Tech (HKUST), Hong Kong, in 2008, and 2011, respectively. He is currently working toward the Ph.D. degree in electrical and computer engineering at Texas A&M University, College Station. From 2008 to 2011, he worked in the Nanoelectronics Fabrication Facility (NFF) as a process development scientist for compound semiconductors, where he was involved with the development of GaN E/D-HEMT mixed signal circuits. His research interests include green energy harvesting system, smart power management systems, RF integrated circuits (RFIC) design, and application circuits for compound semiconductor.