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ELECTRICAL & COMPUTER ENGINEERING
TEXAS A&M UNIVERSITY

S E M I N A R

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An Area Efficient Thermal Energy Harvester With Reconfigurable Capacitor Charge Pump for IoT Applications

by

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Abstract: Advancement in micro sensors and the scaling down of CMOS process enables consumer applications to be connected in a network. Following the concept of IoT, renewable energy sources such as thermal, solar, vibration, RF have emerged to power the applications rather than batteries which are limited by size and operating cycles. This seminar introduces an integrated energy harvester with on-chip switched capacitor converter. The design provides 1 V regulated voltage boosting the input voltage (0.27 V–1 V) from a thermal energy generator. To ensure the maximum power extraction, the reconfigurable capacitor charge pump distributes on-chip capacitors to required step-up stages. This approach optimizes the silicon area by utilizing 100% on-chip capacitors regardless of a charge pump conversion gain. Also, the design is capable of 3-dimensional maximum power point tracking (MPPT), matching a source impedance to input impedance of an energy harvester. Experimental results show end-to-end power efficiency of 64% @ 1 V output voltage delivering power up to 500 μW, and input impedance matching range of 1 Ω–5 kΩ. The energy harvester was fabricated in 130 nm CMOS technology, occupying 0.835 mm^2.

Sungjun Yoon was born in Seoul, South Korea. In 2013, he received his bachelor degree from Ajou University, Suwon, South Korea and Stony Brook University, New York, US. And, M.S. degree was from Texas A&M University in 2017. He is currently working toward Ph.D. degree at Texas A&M University under the guidance of Prof. Jose Silva-Martinez. His research interests include high performance continuous-time sigma-delta modulators for wireless applications and low power data converters.