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TEXAS A&M UNIVERSITY

S E M I N A R

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A Power Management Unit with 40dB Switching-Noise-Suppression for a Thermal Harvesting Array

by

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Abstract: A high efficiency, maximum power point tracking (MPPT) Power Management Unit (PMU), with 3.6 µW quiescent power, aimed at a thermoelectric generator (TEG) array is presented. The proposed energy harvesting PMU is made up of a boost converter with a cascaded capacitor-less low drop-out (CL-LDO) voltage regulator. The segmented approach allows the PMU to match the TEG array's changing dynamic series resistance via the boost converter and simultaneously provide voltage regulation with adaptive, high switching noise rejection via the CL-LDO. The boost converter's switching frequency (f_{sw}) is tracked via a sense-and-control loop which modifies the CL-LDO's power supply rejection (PSR) characteristics to place a notch in the PSR transfer function around the average f_{sw}. Experimental results show an overall system efficiency better than 57% @ 1.6 V output voltage, PSR of 40dB at f_{sw}, and a notch-tuning range of 15-65 kHz. The total active area is 0.93 mm^2 in 0.5 µm CMOS.

Jorge Zarate-Roldan received the B.S. degree (Honors) in electrical engineering from the Instituto Tecnologico y de Estudios Superiores de Monterrey (ITESM), Campus Guadalajara, Mexico in 2004. In the fall of 2007, summer of 2008, and fall of 2012, he interned with Intel Corp. He is currently working toward the Ph.D. degree in electrical engineering at Texas A&M. His research interests include low-power and high PSR LDOs, and low-power, low-noise oscillators for wireless transceivers.