Analog and Mixed-Signal Center
3128 TAMU
College Station, TX 77843-3128
Tel. (979) 845-9586
Fax. (979) 845-7161
E-mail:kentesar@ece.tamu.edu

ELECTRICAL & COMPUTER ENGINEERING
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S E M I N A R

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Power Management System with Integrated Maximum Power Extraction Algorithm for Microbial Fuel Cells

by

Salvador Carreon-Bautista
Texas A&M University

Abstract: Microbial fuel cells (MFC) are an alternative renewable power sources that can directly produce electricity from biodegradable substances. However, due to their low power and voltage production, power management systems (PMS) are required to process the MFC power to a more readily usable level. For this application a monolithic PMS with an integrated maximum power extraction algorithm (MPEA) is proposed. The MPEA allows for quick and accurate pin-pointing of the matching conditions for maximum power transfer from the MFC to the PMS. The PMS delivers a regulated fixed voltage from low fluctuating voltages produced by MFC at maximum power point to a super-capacitor from which electronic devices such as wireless sensors for extended operation time can be directly powered. Along with the MPEA system, the PMS is composed of a DC-DC boost converter operating in discontinuous conduction mode (DCM) to maximize efficiency. In addition a Zero Current Switching Tracking (ZCST) loop is proposed to improve overall system efficiency and minimize losses in the PMS through accurate PMOS on/off timing control. The PMS circuit was fabricated in 0.5µm CMOS technology. The maximum dynamic efficiency measured was ~58% for a load of ~250 µW.

Salvador Carreon-Bautista (S'08) received the B.S. degree in electrical engineering and biomedical engineering from the Instituto Tecnologico y de Estudios Superiores de Monterrey (ITESM), Campus Monterrey, in 2007 and 2008 respectively. Since 2008 he has been working towards his Ph.D. degree in electrical engineering.

From the summer of 2009 to the fall of 2010, he was a Research Fellow at the Methodist Research Institute in Houston, Texas, exploring novel drug delivery systems through nanoparticles. During the summer of 2014 he was a Design Engineering Intern at Linear Technology in Colorado Springs, Colorado, where he worked on high performance switching regulators.

His research interests include ultra-low power and energy efficient power management circuits.