An Energy Harvesting System for Very Low-Power Microbial Fuel Cells

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Abstract

This paper presents an electronic system able to harvest energy from small-size microbial fuel cells (MFCs) – that supply very low levels of voltage (hundreds of mV) and current (hundreds of μA) – and to provide a steady output voltage of 2.5V at its output. The main design steps for this system are described in some detail: first, the MFC was characterized and a model was derived; then various possible solutions for implementing the electronic circuitry were assessed through simulations and the harvesting system was designed and preparations were made to build a prototype electronic module, able to work with actual MFCs. The main design challenge was the start-up procedure, as the MFCs output voltage can be far lower than the minimum level required by the DC-DC boost converter at the core of the system; the solution proposed here is centered on a charge-pump employed only at start-up. In normal operation the charge-pump is bypassed and the more efficient boost converter is used instead. The measurements were carried out using the NI myDAQ device and the processed data was obtained with NI LabView software.

Biography

Gheorghe Țurcan was born in 1989 in a small city from Republic of Moldova; he graduate High school in 2008. In 2012 was awarded the Electronic Engineer degree after graduating a full-time, 4 years course in Applied Electronics at the Faculty of Electronics, Telecommunications and Information Technology, Technical University of Cluj-Napoca. His research activity encompasses low-voltage low-power analog circuit design, and microcontroller based applications.

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