Bachelor Thesis

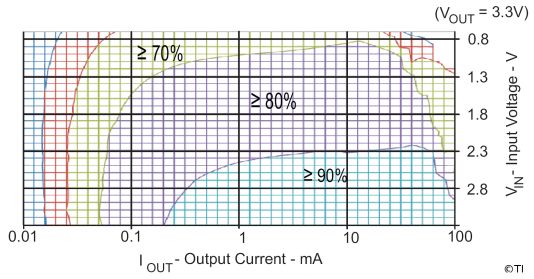
« Efficient DC-DC Converter Power Supply for Wireless Sensor Nodes »

Background

Wireless sensor nodes are powered by batteries in most cases. While depleting the batteries, at some point the provided voltage will drop below the minimum operating voltage of the wireless sensor node. Depending on the battery type, the number of cells and the operating voltage of the node, a significant amount of energy stored in the batteries will remain unused. On the other hand, if the voltage of the batteries is too high, energy is wasted, because the wireless sensor node could operate more energy efficient with less voltage.

In our Institute of Telematics we experiment with electric double-layer capacitor (supercaps). On discharge these rechargeable supercaps behave like normal capacitors and provide a voltage of up to 2.7 V. The wireless sensor nodes we use are based on Atmel microcontrollers and need a minimum operation voltage of 2.4 V - 2.7 V. Therefore if the node is directly connected to the supercap, only a very small amount of energy is usable.

A DC-DC converter can supply the wireless sensor node with the optimal voltage. Some DC-DC converters support buck-boost operation. If the battery voltage is lower than the set output voltage, the converter can boost the output voltage, while if higher it can buck it. By power switching, in theory DC-DC converters can convert voltages at an energy efficiency of up to 100%. Practically the efficiency can be as low as 10%, depending on the input voltage, the ouput voltage and the output current. This thesis investigates, whether DC-DC converters can improve the lifetime of a wireless sensor node by making more use of the provided battery capacity.



Work Description

The first step is a market study on available DC-DC converters. The tasks are to design the electric circuits and evaluate the efficiency. Unlike simple consumer loads, the typical duty cycling of wireless sensor nodes causes a specific load characteristic that has to be regarded. The main objective is to make best use of the energy stored in a supercap. Optionally the output voltage of the DC-DC converter is not fixed, but adjustable by software, e.g. using a software controllable resistor.

Requirements Some knowledge in electric circuit design

Contact: Juergen Jessen

juergen.jessen@tu-harburg.de Phone: +49 40 / 428 78 – 3745 Room: E 4.073