

Semester / Master Thesis:

## Modeling Transient Energy Sources

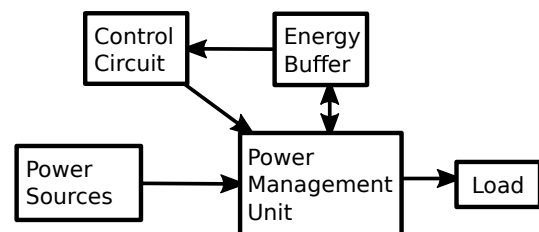
**Motivation:** In traditional energy harvesting applications, sensor nodes are able to store any excess energy in a storage device such as battery or supercapacitor for future use. A correctly dimensioned system will guarantee the node's operation during periods of energy unavailability. More recently, a radically different research line has emerged which focuses on batteryless, energy-driven sensor nodes. These nodes are designed to work with transient energy sources, i.e. highly volatile sources which produce small bursts of energy. As a result, the node's operation is highly sporadic, depending entirely on the source's energy availability.

**Task Description:** During this project you will create a mathematical model for transient energy sources. As a first step, you will familiarize yourself with different sources and power management circuits, which will be the model's critical parameter constraints. The main goal of this thesis is to build a Matlab model which, given a power trace, can calculate the expected characteristics of the generated energy bursts. These models can then be experimentally verified using our current transient node prototype.



This involves the following tasks

- Understanding typical energy harvesters such as photovoltaic, thermoelectric, and piezoelectric.
- Characterizing power traces for different harvesting conditions.
- Proposing a model to predict energy burst's characteristics (such as duration and frequency).
- Validation of models using real-world measurements.



**Requirements:** Familiarity with Matlab is an advantage.

**Interested? Please have a look at <http://www.tec.ethz.ch/research.html> and contact us for more details!**

### Contacts

- Andres Gomez: [gomeza@tik.ee.ethz.ch](mailto:gomeza@tik.ee.ethz.ch), ETZ J68.2
- Lukas Sigrist: [lukas.sigrist@tik.ee.ethz.ch](mailto:lukas.sigrist@tik.ee.ethz.ch), ETZ G78.1
- Lothar Thiele: [thiele@ethz.ch](mailto:thiele@ethz.ch), ETZ G87