Title: Energy Harvesting Techniques for the Internet of Things

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ABSTRACT.

As the use of IoT devices is rapidly increasing in a plethora of applications, ranging from industrial condition monitoring, to smart agriculture and wearable electronics, the problem of their power supply is emerging with increasing pressure. Most applications cannot afford that the battery of the wireless sensors is periodically recharged or replaced. Therefore, alternative energy sources are being investigated and the design of autonomous wireless transponders is becoming a hot research topic.
This short course is aimed at providing young researchers with an overview of the current state of the art in energy harvesting technologies for Internet of Things applications. Starting from the analysis of the physics of the energy transduction mechanisms, the course will then focus on the technological aspects of the energy harvesters and on the most widespread design approaches. Finally, hybrid energy harvesting techniques will be also presented to realize reliable power sources for next generation IoT devices.

PROGRAM

Introduction to the problem of energy autonomy for Internet of Things devices and to the energy harvesting approach (2h)
Discussion of the main energy harvesting mechanisms:

- Solar energy harvesting: description of the photovoltaic effect and the solar cell, modeling, irradiance definition, combination of multiple solar cells, indoor and outdoor performance, SoA system performance (3h)
- Radiofrequency energy harvesting: definition of near and far field, rectennas, modeling, SoA system performance (3h)
- Vibration energy harvesting: mechanical transducers, piezoelectric effect, modeling, SoA system performance (3h)
- Thermal energy harvesting: Seebeck effect, modeling, SoA system performance (3h)

Introduction to hybrid energy harvesting and dc-dc converters (3h)
CAD design of energy harvesters (3h)