Oficina de Patents i Llicències
UNIVERSITAT POLITÈCNICA DE CATALUNYA

New technology to harvest the maximum ambient energy for low-power autonomous devices

A method for the Maximum Power Point Tracking (MPPT) of low-power energy transducers has been developed. The patented technology can be useful to power a low-power device from the energy harvested from the environment by an energy transducer. For example, to power sensors nodes or mobile devices from optical, thermal or mechanical energy. Partners to further develop the system and/or to establish license agreements are sought.

The Challenge

Low power devices mainly use either primary or secondary (rechargeable) batteries. Primary batteries are cheaper and are suitable whenever they survive the life cycle of the device. On the other hand, secondary batteries are used in mobile devices that must often be recharged from the mains, such as for example mobile phones. However, this solution is not practical for remote sensors or whenever the power network is not available or accessible. Energy harvesting, and in particular solar cells or photovoltaic (PV) panels, constitutes a feasible alternative. In order to achieve the maximum energy from a PV panel, MPPT controllers are commonly used for high-power systems. Nevertheless, their application to low-power PV panels (<1 W) has not been successfully achieved. Mainly, because in contrast to high power applications, the power consumption of the MPPT control circuit can significantly spoil the power efficiency.

The Technology

This new patented technology maximizes the harvested energy from low-power (<1 W) energy transducers (e.g. solar cells, thermogenerators, mechanical transducers) in order to power autonomous devices. The proposed MPPT controller transfers the harvested energy to an input capacitor. Whenever the capacitor voltage surpasses a high threshold (V_{TH}), an ensuing dc-dc converter activates and further transfers the electrical charge of the input capacitor to a storage unit (e.g. a rechargeable battery or supercapacitor) until the voltage of the input capacitor goes down to a low threshold (V_{TL}). At this point the dc-dc converter deactivates and the above described process repeats again. During the inactive periods of the dc-dc converter, the MPPT controller estimates the output power of the energy transducer in base to the charge time of the input capacitor. Then, by using an appropriate algorithm, the transducer output is positioned at its Maximum Power Point (MPP).

Innovative advantages

- Excellent MPPT controller for low-power energy transducers with high tracking accuracy (>99.5%)
- Low cost production: Avoids the use of current and voltage sensors and the use of A/D converters, with minimum extracomponents needed.
- Low-current consumption (units of μA)
- High overall-efficiency (90% for 20 mW)
- Integrable control algorithms into the device μC
- Adapted to changing environmental conditions

Current stage of development

Tested microcontroller-based prototype with low power solar cells (~ 100 mW)

Applications and Target Market

This technology could be of interest for companies that develop low-power energy transducers, complete energy harvesters, or low-power devices that must gather part of full of their energy from the ambient (optical, thermal, mechanical, RF energy).

Reference number

MKT2010/0003_I

A new Maximum Power Point Tracking controller specifically adapted to low power devices

Low cost, easy of integration and very low energy consumption

High tracking accuracy even in changing environmental conditions

Business Opportunity

Technology available for licensing with technical cooperation

Patent Status

PCT application filed

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