

## ENVIRONMENTAL ENERGY HARVESTING HYBRID SYSTEM BY PHOTOVOLTAIC AND PIEZOELECTRIC CONVERSION, DC/DC TRANSFORMATION WITH MEMS INTEGRATION AND ADAPTIVE STORAGE

### Goal of the project

The design, building and testing of the prototype of a hybrid system for energy harvesting from the ambient through photovoltaic conversion, DC/DC transformation with MEMS integration and adaptive storage, will be carried out. A key novel component is the planar power micro-transformer for high frequency, with hybrid magnetic nanofluid/ferrite core and windings fabricated in MEMS technology, a part of the DC/DC converter. A second key component is the photovoltaic cell, which relies on novel solutions.

### Short description of the project

A prototype with wireless sensors powered by the harvesting system will be designed, built and tested. In this endeavour, there will be prepared a dedicated magnetic fluid to be used as core of a micro-transformer, which will be designed accordingly and tested. Further, an experimental model of the energy harvesting hybrid system will be elaborated, designed and tested. Finally, a prototype for the harvesting device will be designed and tested for a particular application.

The current year research is targeting to accomplish the second activity listed above. The Politehnica University team, together with the Romanian Academy – Timisoara Branch (P2), is responsible for the preparation and characterization (in terms of magnetic, rheological, electrical, thermal and structural properties) of the magnetic fluid used as magnetic fluid core of the power micro-transformer.

### Project implemented by

- National Institute for R&D in Electrical Engineering ICPE-CA Bucharest (Coordinator)
- Politehnica University of Timisoara (Partner 1)
- Romanian Academy – Timisoara Branch (Partner 2)
- Politehnica University of Bucharest (Partner 3)
- SYSCOM PROCESS CONTROL LTD (Partner 4).

### Implementation period

01.07.2014 – 30.06.2016

### Main activities

- elaboration of the experimental model of the energy harvesting hybrid system by photovoltaic conversion and DC/DC transformation with MEMS integration;
- design and testing of the experimental model of the energy harvesting hybrid system by photovoltaic conversion and DC/DC transformation with MEMS integration;
- design and testing of the prototype of the energy harvesting hybrid system by photovoltaic conversion and DC/DC transformation with MEMS integration.

### Results

- The main result of the project will be the integration of an innovative photovoltaic conversion system and an original DC/DC converter, which utilizes a planar, spiral, MEMS, hybrid (magnetic nanofluid/ferrite) cored micro-transformer in an efficient device for energy harvesting.
- Regarding the use of a magnetic nanofluid core micro-transformer for the DC/DC converter, from the manufacturing point of view, it is expected that once the appropriate magnetic nanofluid characteristics are established, it will offer an easier way of obtaining the transformer core compared to a solid one.
- From the operating point of view, it is expected that by replacing the solid core with a liquid core will result in a better heat dissipation and reduction of the thermal stresses in the micro-transformer, leading to a longer life-cycle, maintaining or even improving the electric characteristics.

## Applicability and transferability of the results

- The product can bring added value for further development as an end-product to the industrial partner.
- Possible applications are characterized by their placement in hard to reach places, isolated and without local and/or conventional sources.
- Among these are applications for industrial automation, monitoring of various parameters in industry, agriculture, surveillance and monitoring of perimeters.

## Financed through/by

Financed through/by: Ministry of National Education through the Executive Agency for Higher Education, Research, Development and Innovation Funding, Partnerships in priority S&T domains Programm PN II, Joint Applied Research Projects PCCA 2013.

## Research centre

Research Center for Engineering of Systems with Complex Fluids, Politehnica University of Timisoara,  
URL: <http://mh.mec.upt.ro/ccisfc/>



## Research team

The research team of Politehnica University of Timisoara is consists of three senior researchers, one PhD student and two research assistants

Assoc. Prof. Floriana D. Stoian, PhD

Lect. Sorin Holotescu, PhD

Phys. Oana Marinica

Assoc.Prof. Nicolae Crainic, PhD

Res. Assist. Florica Balanean

Res. Assist. George Giula

## Contact information

Assoc. Prof. Floriana D. STOIAN, PhD

Department of Mechanical Machines, Technology and Transportation  
/Research Center for Engineering of Systems with Complex Fluids

Address: Bv. Mihai Viteazu, No.1, 300222. Timisoara

Phone: (+40) 256 403 671

Mobile:(+40) 744 597 308

E-mail: [floriana.stoian@upt.ro](mailto:floriana.stoian@upt.ro)

Web: <http://www.icpe-ca.ro/lib/files/asemems-harvest.pdf>