POSTDOCTORAL FELLOWSHIP – Electrostrictive MEMS resonators for mechanical energy harvesting

Job offer

The demand for energy harvesting technologies is dramatically increasing with various needs in wireless micro-systems, robotics, electronics, autonomous sensor networks, internet of things, etc. Harvesting energy from mechanical ambient vibrations is one of the most promising approaches. Variable capacitors made of electrostrictive materials, i.e. which exhibit changes of dielectric properties when they are deformed, present several advantages over other mechanical energy harvesters. The major challenge in the field consists in achieving large changes of capacitance under mechanical deformations. Near percolated networks of conducting particles in insulating matrices are expected to display large dielectric permittivity and susceptibility to mechanical deformations. Recently, original electrostrictive materials based on emulsions and developed at CRPP show promising performances for effective mechanical harvesting. However, their integration in autonomous microsystems remains challenging. In particular, organic Micro Electro Mechanical Systems (MEMS) integrating such active materials have to be developed and optimized. From a previous work at IMS, a simple, cost-effective fabrication process has been developed, that needs to be optimized for optimal mechanical energy harvesting. In this context, the main objective of the present post-doctoral position is to integrate the most recently electrostrictive materials developed at CRPP into MEMS devices in all-organic approach and to apply the resonators to the harvesting of energy from ambient vibrations. Concretely, the candidate will have to fabricate organic MEMS resonators designed specifically for energy harvesting (low resonant frequency, large deformation). Fabrication processes will be developed at ElorprintTec, a new 1000m2 clean room facility of the Univ. of Bordeaux dedicated to printable organic materials, from their synthesis to their integration in devices, including their processing. Then, the resulting MEMS resonators will be characterized mechanically and electrically. A particular attention will be paid to the electromechanical performances of the integrated electrostrictive materials. In a last part of the project, energy harvesting experiments will be conducted, with the objective of generating a power in the microwatt range, suitable to power small electronic devices.
According to the quality of results obtained in this project, an additional side project could be conducted on the development of a conductive MEMS switch resonator for fluidic mechanical energy harvesting.

Candidate's profile

Candidates should have a PhD degree in MEMS devices and/or mechanical harvesting and/or polymer physical-chemistry and processing preferentially with knowledge in organic electronics, composite or polymer materials and microfabrication technologies. The candidate is expected to develop an experimental research project on the fabrication of organic MEMS resonators, the characterization of mechanical and electrical properties of polymer nanocomposites and MEMS and application of electrostrictive MEMS to mechanical energy harvesting. Skills on electronics would be a benefit. This work will be conducted in collaboration with the IMS and CRPP institutes.

Salary
2 300 €/month (neto)

Research Labs involved

- Laboratoire de l'Intégration du Matériau au Système (IMS), UMR 5218, Bât. A31 – 351 cours de la libération – 33 400 Pessac, France
- Centre de Recherche Paul Pascal (CRPP), UPR 8641, 115 Avenue A. Schweitzer, 33 600 Pessac, France

Application

Applicants are invited to submit a complete CV, a motivation letter, a copy of PhD diploma, references details and 2 recommendation letters at http://amadeus.labex.u-bordeaux.fr/en/Jobs/ job opportunity ref: 2017 AMADEus 059. Applications will be considered until positions are filled.

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