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Broadband vibration energy harvesters for IoT applications

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Venue: 31A, 3F Faculty of Engineering Bldg. 2

Abstract:

Vibration-based energy harvesters are usually composed of a mechanical oscillator to amplify ambient vibrations, an electromechanical transducer to convert mechanical energy into electrical energy, and an electrical interface circuit to extract the generated energy and to transfer it on a storage element. The first generations of such generators were implementing linear oscillators (such as cantilever beams with tip mass) because of their simplicity and their ability to drastically amplify the ambient displacement around their resonant frequency. The main drawback of this architecture is that ambient vibration energy is usually spread over a large frequency range, whereas linear mechanical oscillators are characterized by a narrow band response. Widening the frequency bandwidth of inertial generators has then become a hot topic in the energy harvesting research community. In this talk, two different approaches to widen the frequency response of piezoelectric generators will be discussed: (1) using nonlinear mechanical oscillators whose frequency responses are intrinsically larger than linear ones and (2) exploiting piezoelectric linear oscillators exhibiting large electromechanical coefficients enabling to tune their resonant frequency from the electrical interface. Benefits and limitation of both approaches will be highlighted, as wells as current research trends in this field.

Short Biography:

Adrien Badel graduated from Institut National des Sciences Appliquées de Lyon (INSA), Lyon, France, in electrical engineering in 2002 (MS degree). He prepared his Ph.D. at the Electrical Engineering and Ferroelectricity Laboratory of INSA Lyon. He received his Ph.D. degree in 2005 for his work on vibration control and energy harvesting. From November 2005 to November 2007, he was a JSPS (Japanese Society for the Promotion of Science) postdoctoral fellow at the Institute of Fluid Science of Tohoku University, Sendai, Japan. He is now a professor at the Laboratory of Systems and Materials for Mechatronics from the Université Savoie Mont Blanc, Annecy, France. His research interests include energy harvesting, vibration damping and piezoelectric actuators modeling and control.

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