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Editorial

Vibration Energy Harvesting: Linear, Nonlinear, and Rotational Approaches

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In recent years, multifunctional and low-power consuming features of modern electronic devices enable their widespread deployment in integrated and embedded sensor systems in the consumer electronics, Internet of things (IoT), etc. However, their continuous functionality is limited by the life of the power source. To overcome this limitation, there is a growing interest in energy harvesting from the ambient environment to supply uninterruptible power to these devices. Vibration is widely available and therefore regarded as one of the most promising sources for energy harvesting. Depending on the source of vibration and intended application, vibration energy harvesting could be linear, nonlinear, and rotational. The main challenge is to design an effective harvesting system. The effective design of such an energy harvesting system requires a thorough understanding of the characteristics of the surrounding vibration, the transducers, and the dynamics of the overall system.

This special issue presents current state-of-the-art works in the area of vibration energy harvesting systems, addressing a variety of topics from fundamental theories to realistic applications. A total of 5 articles have been accepted for publication in this special issue, which are divided into two aspects: (i) vibration system analysis for effective electromechanical coupling and (ii) system design and optimization for intended application.

In the paper "Modeling and Simulation of Transverse Free Vibration Analysis of a Rectangular Plate with Cutouts Using Energy Principles" by S. Shi et al., the possibility of using the energy principles in conjunction with the Rayleigh–Ritz solution technique for computing the natural frequencies and modal behavior of plates with rectangular cut-outs has been demonstrated. The paper "Energy Dissipation Contribution Modeling of Vibratory Behavior for Silicon Micromachined Gyroscope" by J. Zhou et al. presents modeling, numerical analysis, and experimental verification of the energy dissipation contribution of a micromachined Coriolis vibratory gyroscope (MCVG). In the paper "Broadening Band of Wind Speed for Aeroelastic Energy Scavenging of a Cylinder through Buffeting in the Wakes of a Squared Prism" by J. Wang et al., a numerical method combined with the electromechanical coupling model was employed to solve the aero-electromechanical coupling problem of piezoelectric energy harvesting from buffeting. The paper "Impedance Analysis and Optimization of Self-Powered Interface Circuit for Wireless Sensor Nodes Application" by Y. Dong et al. presents a self-powered wireless sensor network (WSN) node scenario by coupling the electric charge extraction interface circuit, power management module, and wireless communication module. In the paper "Temperature Energy Influence Compensation for MEMS Vibration Gyroscope Based on RBF NN-GA-KF Method" by H. Cao et al., the MEMS vibration temperature energy influence model is investigated and three methods are analyzed to compensate the temperature energy influence drift: radial basis function neural network (RBF NN), RBF NN-based genetic algorithm (GA), and RBF NN-based GA with Kalman filter (KF).

Conflicts of Interest

The editors declare that there are no conflicts of interest regarding the publication of this editorial.

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