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Editorial

Vibration Energy Harvesting for Monitoring Dynamical Systems

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The objective of this special issue is to address recent research trends and developments in the application of vibration energy harvesting for the monitoring of dynamical systems. While significant research has been carried out around maximization of harvested energy, the use of such harvesting signatures for the monitoring of dynamical systems is at a nascent stage. This special issue attempts to focus on this aspect. A substantial number of papers were submitted, and after a thorough peer review process, five papers were selected to be included in this special issue. These papers cover important applications in design, analyses, potential, and actual applications on this topic. We believe that the original papers collected in this special issue highlight the contemporary topics in research where vibration energy harvesting signatures can be useful for monitoring of built infrastructure and other dynamical systems.

The paper by C. Maruccio et al. targets a nonlinear dynamic response of piezoelectric energy harvester and demonstrates how a hybrid approach can be beneficial in this regard. A coupled multiphysics Finite Element analysis leads to an enhanced reduced order model in this paper that benefits from the analyses carried out at the FE stage. The approach relieves some of the computational burden, while preserving key behavioural aspects of the harvester.

D. Mazeika et al. approach the topic through design and presents numerical and experimental studies on a polygon shaped cantilever array. The design enhances the ability of the harvester to align with multiple frequencies and the experimental results confirm the same.

The design and modelling approach is expanded in this issue by Y. Zhao et al., who present modelling and experimentation of a V-shaped energy harvester. The authors have demonstrated how such design can increase the bandwidth of the harvester in order to take a step towards self-powered monitoring.

X. Zhang et al. have addressed the aspect of random variations of input excitation for energy harvesting in relation to built infrastructure in the form of statistical analyses involving wind induced vibrations of transmission power line system. Variations due to effects of wind field models are investigated.

Finally, R. Wang et al. present the effect of supercapacitor initial terminal voltage on the regenerative and semiactive suspension energy-regeneration and dynamic performance.

Overall, it is observed that the topic is at its infancy and consequently the research topics around it remain diverse and challenging. Another important observation is that while demonstrative results on the implementation of vibration energy harvesting for monitoring form an important knowledge gap, several challenges remain in relation to the design and analysis of the harvester.

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