Part 5: Design case studies and future scopes

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Outline of this talk

Advanced applications of energy harvesters

- Using the fundamental principles outlined before, it is possible to apply the energy harvesting approaches to advanced problems.
- This lecture will introduce four new topics to demonstrate few advancements in the field.

Topic 1

- Friswell, M. I. and Adhikari, S., ”Sensor shape design for piezoelectric cantilever beams to harvest vibration energy”, Journal of Applied Physics, 108[1] (2010), pp. 014901:1-6.
- `http://tinyurl.com/ycl57gse`

Topic 2

- Jacquelin, E., Adhikari, S. and Friswell, M. I., ”Piezoelectric device for impact energy harvesting”, Smart Materials and Structures, 20[10] (2011), pp. 105008:1-12.
- `http://tinyurl.com/yd9gyb3z`

Topic 3

- Ali, S. F., Friswell, M. I. and Adhikari, S., ”Analysis of energy harvesters for highway bridges”, Journal of Intelligent Material Systems and Structures, 22[16] (2011), pp. 1929-1938.
- `http://tinyurl.com/ycbvvd4y`

Topic 4

- Ali, S. F. and Adhikari, S., ”Energy harvesting dynamic vibration absorbers”, Transactions of ASME, Journal of Applied Mechanics, 80[4] (2013), pp. 041004:1-9.
- `http://tinyurl.com/ybrnhljh`

Future research directions

- Huge potential for the application of classical/modern random vibration analysis techniques
- Vibration energy harvesting under non-Gaussian random excitations - linear and nonlinear systems
- Generalisation of the results to higher dimensional cases (3 or 4 dimensional state-space models)
- Stability issues - energy harvesting from instability?
- Vibration control - simultaneous control and energy harvesting - extension of EHDVA - perhaps active control?
- Stochastic systems + nonlinearity in higher dimensions
- Hybrid piezo-electric and electro magnetic energy harvesting
- Multi-scale energy harvesting - incorporating nano-scale piezoelectric materials such as ZnO, GaN and BN nano tubes and nano wires
- Parameter optimisation
- Experimental validation