DESCRIPTION

The transformation of vibrations into electric energy through the use of piezoelectric devices is an exciting and rapidly developing area of research with a widening range of applications constantly materialising. With Piezoelectric Energy Harvesting, world-leading researchers provide a timely and comprehensive coverage of the electromechanical modelling and applications of piezoelectric energy harvesters. They present principal modelling approaches, synthesizing fundamental material related to mechanical, aerospace, civil, electrical and materials engineering disciplines for vibration-based energy harvesting using piezoelectric transduction.

Piezoelectric Energy Harvesting provides the first comprehensive treatment of distributed-parameter electromechanical modelling for piezoelectric energy harvesting with extensive case studies including experimental validations, and is the first book to address modelling of various forms of excitation in piezoelectric energy harvesting, ranging from airflow excitation to moving loads, thus ensuring its relevance to engineers in fields as disparate as aerospace engineering and civil engineering.

Coverage includes:

• Analytical and approximate analytical distributed-parameter electromechanical models with illustrative theoretical case studies as well as extensive experimental validations

• Several problems of piezoelectric energy harvesting ranging from simple harmonic excitation to random vibrations

• Details of introducing and modelling piezoelectric coupling for various problems
• Modelling and exploiting nonlinear dynamics for performance enhancement, supported with experimental verifications

• Applications ranging from moving load excitation of slender bridges to airflow excitation of aeroelastic sections

• A review of standard nonlinear energy harvesting circuits with modelling aspects.

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ABOUT THE AUTHOR

Alper Erturk, Virginia Tech, USA, is a Graduate Research Assistant in the Center for Intelligent Material Systems and Structures at Virginia Tech. He has written 1 book chapter and over 30 articles in various international journals and conference proceedings. His recent article on distributed-parameter electromechanical modelling of piezoelectric energy harvesters published in the ASME Journal of Vibration and Acoustics remained the topmost downloaded article of the journal for several months in 2008. His research includes experimental aspects of piezoelectric energy harvesting not only for verification and validation of his models but also for new applications.

Daniel J Inman, Virginia Tech, USA, is the Director of the Center for Intelligent Material Systems and Structures and the G.R. Goodson Professor in the Department of Mechanical Engineering at Virginia Tech. He also holds the Brunel Chair in Intelligent Materials and Structures at the University of Bristol. Since 1980, he has published 8 books, 20 book chapters, over 225 journal papers and 432 proceedings papers, given 41 keynote or plenary lectures, graduated 47 Ph.D. students and supervised more than 75 MS degrees. He is currently Technical Editor of the Journal of Intelligent Material Systems and Structures (1999-2004), Technical Editor of the Shock and Vibration Digest (1998-2001), and Technical Editor of the journal Shock and Vibration (1999-2004). He was awarded the SPIE Smart Structures and Materials Life Time Achievement Award in 2003, and in 2007 he received the ASME Den Hartog Award for lifetime achievement in teaching and research in vibration.

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