ABSTRACT

BROAD FREQUENCY BAND VIBRATION-BASED POWER GENERATION: ANALYSIS, DESIGN, AND CONTROL

Cultivating electric power from natural mechanical vibrations via micro-generators has been attracting the attention of researchers for its potential in numerous applications. The focus in this thesis is on the analysis and the design of such generators to improve their characteristics and broaden their applications. Two critical performance characteristics are addressed and schemes for improvement are proposed: the operating frequency bandwidth and the available power. The first characteristic is the most critical since present generators are tuned to a specific frequency where power can be available while most applications require operation in a wide frequency range. The multi-generator system concept is introduced in this thesis to broaden the bandwidth of the system and facilitate capturing sufficient power over a predefined range of frequencies. Methodologies for designing multi-generator systems are developed and simulation results are presented. Optimization of power output is also addressed and specific design and implementation schemes are proposed.

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