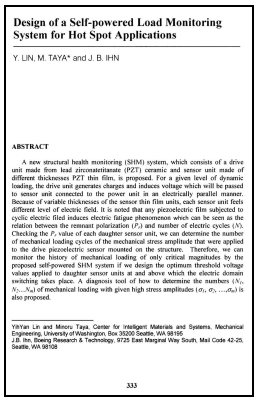

Design of a Self-powered Load Monitoring System for Hot Spot Applications

Y. LIN, M. TAYA* and J. B. IHN

ABSTRACT

A new structural health monitoring (SHM) system, which consists of a drive unit made from lead zirconatetitanate (PZT) ceramic and sensor unit made of different thicknesses PZT thin film, is proposed. For a given level of dynamic loading, the drive unit generates charges and induces voltage which will be passed to sensor unit connected to the power unit in an electrically parallel manner. Because of variable thicknesses of the sensor thin film units, each sensor unit feels different level of electric field. It is noted that any piezoelectric film subjected to cyclic electric filed induces electric fatigue phenomenon which can be seen as the relation between the remnant polarization (P_r) and number of electric cycles (N). Checking the P_r value of each daughter sensor unit, we can determine the number of mechanical loading cycles of the mechanical stress amplitude that were applied to the drive piezoelectric sensor mounted on the structure. Therefore, we can monitor the history of mechanical loading of only critical magnitudes by the proposed self-powered SHM system if we design the optimum threshold voltage values applied to daughter sensor units at and above which the electric domain switching takes place. A diagnosis tool of how to determine the numbers (N_1, N_2...N_m) of mechanical loading with given high stress amplitudes (σ_1, σ_2, ..., σ_m) is also proposed.

YiHan Lin and Minoru Taya, Center for Intelligent Materials and Systems, Mechanical Engineering, University of Washington, Box 35200 Seattle, WA 98195
J.B. Ihn, Boeing Research & Technology, 9725 East Marginal Way South, Mail Code 42-25, Seattle, WA 98108

Код: 10280

Y. Lin, M. Taya, J.B. Ihn

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Ключевые слова:

Содержание.