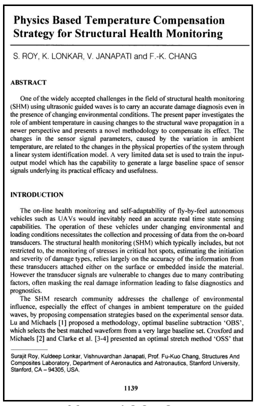

Physics Based Temperature Compensation Strategy for Structural Health Monitoring

S. ROY, K. LONKAR, V. JANAPATI and F.-K. CHANG

ABSTRACT

One of the widely accepted challenges in the field of structural health monitoring (SHM) using ultrasonic guided waves is to carry an accurate damage diagnosis even in the presence of changing environmental conditions. The present paper investigates the role of ambient temperature in causing changes to the structural wave propagation in a newer perspective and presents a novel methodology to compensate its effect. The changes in the sensor signal parameters, caused by the variation in ambient temperature, are related to the changes in the physical properties of the system through a linear system identification model. A very limited data set is used to train the input-output model which has the capability to generate a large baseline space of sensor signals underlying its practical efficacy and usefulness.

INTRODUCTION

The on-line health monitoring and self-adaptability of fly-by-feel autonomous vehicles such as UAVs would inevitably need an accurate real time state sensing capabilities. The operation of these vehicles under changing environmental and loading conditions necessitates the collection and processing of data from the on-board transducers. The structural health monitoring (SHM) which typically includes, but not restricted to, the monitoring of stresses in critical hot spots, estimating the initiation and severity of damage types, relies largely on the accuracy of the information from these transducers attached either on the surface or embedded inside the material. However the transducer signals are vulnerable to changes due to many contributing factors, often masking the real damage information leading to false diagnostics and prognostics.

The SHM research community addresses the challenge of environmental influence, especially the effect of changes in ambient temperature on the guided waves, by proposing compensation strategies based on the experimental sensor data. Lu and Michaels [1] proposed a methodology, optimal baseline subtraction 'OBS', which selects the best matched waveform from a very large baseline set. Croxford and Michaels [2] and Clarke et al. [3-4] presented an optimal stretch method 'OSS' that

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Ключевые слова:

Содержание.