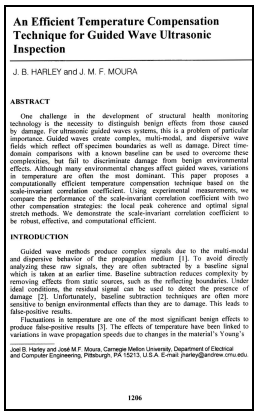

An Efficient Temperature Compensation Technique for Guided Wave Ultrasonic Inspection

J. B. HARLEY and J. M. F. MOURA

ABSTRACT

One challenge in the development of structural health monitoring technology is the necessity to distinguish benign effects from those caused by damage. For ultrasonic guided waves systems, this is a problem of particular importance. Guided waves create complex, multi-modal, and dispersive wave fields which reflect off specimen boundaries as well as damage. Direct time-domain comparisons with a known baseline can be used to overcome these complexities, but fail to discriminate damage from benign environmental effects. Although many environmental changes affect guided waves, variations in temperature are often the most dominant. This paper proposes a computationally efficient temperature compensation technique based on the scale-invariant correlation coefficient. Using experimental measurements, we compare the performance of the scale-invariant correlation coefficient with two other compensation strategies: the local peak coherence and optimal signal stretch methods. We demonstrate the scale-invariant correlation coefficient to be robust, effective, and computational efficient.

INTRODUCTION

Guided wave methods produce complex signals due to the multi-modal and dispersive behavior of the propagation medium [1]. To avoid directly analyzing these raw signals, they are often subtracted by a baseline signal which is taken at an earlier time. Baseline subtraction reduces complexity by removing effects from static sources, such as the reflecting boundaries. Under ideal conditions, the residual signal can be used to detect the presence of damage [2]. Unfortunately, baseline subtraction techniques are often more sensitive to benign environmental effects than they are to damage. This leads to false-positive results.

Fluctuations in temperature are one of the most significant benign effects to produce false-positive results [3]. The effects of temperature have been linked to variations in wave propagation speeds due to changes in the material's Young's

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Ключевые слова:

Содержание.