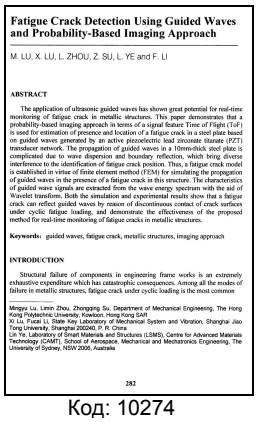
Fatigue Crack Detection Using Guided Waves and Probability-Based Imaging Approach

M. LU, X. LU, L. ZHOU, Z. SU, L. YE and F. LI

ABSTRACT

The application of ultrasonic guided waves has shown great potential for real-time monitoring of fatigue crack in metallic structures. This paper demonstrates that a probability-based imaging approach in terms of a signal feature Time of Flight (ToF) is used for estimation of presence and location of a fatigue crack in a steel plate based on guided waves generated by an active piezoelectric lead zirconate titanate (PZT) transducer network. The propagation of guided waves in a 10mm-thick steel plate is complicated due to wave dispersion and boundary reflection, which bring diverse interference to the identification of fatigue crack position. Thus, a fatigue crack model is established in virtue of finite element method (FEM) for simulating the propagation of guided waves in the presence of a fatigue crack in this structure. The characteristics of guided wave signals are extracted from the wave energy spectrum with the aid of Wavelet transform. Both the simulation and experimental results show that a fatigue crack can reflect guided waves by reason of discontinuous contact of crack surfaces under cyclic fatigue loading, and demonstrate the effectiveness of the proposed method for real-time monitoring of fatigue cracks in metallic structures.

Keywords: guided waves, fatigue crack, metallic structures, imaging approach

INTRODUCTION

Structural failure of components in engineering frame works is an extremely exhaustive expenditure which has catastrophic consequences. Among all the modes of failure in metallic structures, fatigue crack under cyclic loading is the most common

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282

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Ключевые слова:
Guided waves, fatigue crack, metallic structures, imaging approach.

Содержание.