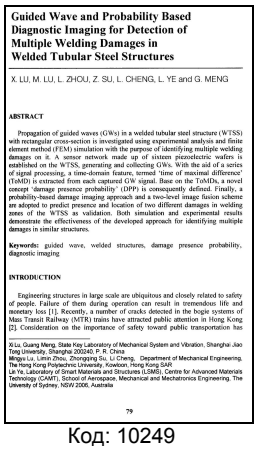

Guided Wave and Probability Based Diagnostic Imaging for Detection of Multiple Welding Damages in Welded Tubular Steel Structures

X. LU, M. LU, L. ZHOU, Z. SU, L. CHENG, L. YE and G. MENG

ABSTRACT

Propagation of guided waves (GWs) in a welded tubular steel structure (WTSS) with rectangular cross-section is investigated using experimental analysis and finite element method (FEM) simulation with the purpose of identifying multiple welding damages on it. A sensor network made up of sixteen piezoelectric wafers is established on the WTSS, generating and collecting GWs. With the aid of a series of signal processing, a time-domain feature, termed 'time of maximal difference' (ToMD) is extracted from each captured GW signal. Base on the ToMDs, a novel concept 'damage presence probability' (DPP) is consequently defined. Finally, a probability-based damage imaging approach and a two-level image fusion scheme are adopted to predict presence and location of two different damages in welding zones of the WTSS as validation. Both simulation and experimental results demonstrate the effectiveness of the developed approach for identifying multiple damages in similar structures.

Keywords: guided wave, welded structures, damage presence probability, diagnostic imaging

INTRODUCTION

Engineering structures in large scale are ubiquitous and closely related to safety of people. Failure of them during operation can result in tremendous life and monetary loss [1]. Recently, a number of cracks detected in the bogie systems of Mass Transit Railway (MTR) trains have attracted public attention in Hong Kong [2]. Consideration on the importance of safety toward public transportation has

Xi Lu, Guang Meng, State Key Laboratory of Mechanical System and Vibration, Shanghai Jiao Tong University, Shanghai 200240, P. R. China
Minjun Lu, Limin Zhou, Zhongqing Su, Li Cheng, Department of Mechanical Engineering, The Hong Kong Polytechnic University, Kowloon, Hong Kong SAR
Lin Ye, Laboratory of Smart Materials and Structures (LSMS), Centre for Advanced Materials Technology (CAMT), School of Aerospace, Mechanical and Mechatronics Engineering, The University of Sydney, NSW 2006, Australia

79

Код: 10249

X. Lu, M. Lu, L. Zhou, Z. Su, L. Cheng, L. Ye, G. Meng

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Издательство DEStech Publications, Lancaster, 2011 год

8 стр; формат: 23,5 x 16 см; библиографический список: 13 единиц
ISBN: 978-1-60595-053-2

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Ключевые слова:
Guided wave, welded structures, damage presence probability, diagnostic imaging.

Содержание.