

Accepted Manuscript

Modelling Nonlinearity of Guided Ultrasonic Waves in Fatigued Materials Using a Nonlinear Local Interaction Simulation Approach and a Spring Model

Rafal Radecki, Zhongqing Su, Li Cheng, Pawel Packo, Wieslaw J. Staszewski

PII: S0041-624X(17)30819-3
DOI: <https://doi.org/10.1016/j.ultras.2017.11.008>
Reference: ULTRAS 5654

To appear in: *Ultrasonics*

Received Date: 21 June 2017
Revised Date: 29 September 2017
Accepted Date: 13 November 2017

Please cite this article as: R. Radecki, Z. Su, L. Cheng, P. Packo, W.J. Staszewski, Modelling Nonlinearity of Guided Ultrasonic Waves in Fatigued Materials Using a Nonlinear Local Interaction Simulation Approach and a Spring Model, *Ultrasonics* (2017), doi: <https://doi.org/10.1016/j.ultras.2017.11.008>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Modelling Nonlinearity of Guided Ultrasonic Waves in Fatigued Materials Using a Nonlinear Local Interaction Simulation Approach and a Spring Model

Rafal Radecki^{a,b,*}, Zhongqing Su^a, Li Cheng^a, Pawel Packo^b, and
Wieslaw J. Staszewski^b

^a*Department of Mechanical Engineering
The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong SAR*

^b*Department of Robotics and Mechatronics
AGH University of Science and Technology, Al. Mickiewicza 30, 30-059 Krakow, Poland*

Abstract

Modelling and numerical simulation — based on the framework of the Local Interaction Simulation Approach — was developed to have more insight into nonlinear attributes of guided ultrasonic waves propagating in fatigued metallic materials. Various sources of nonlinearity were considered in this modelling work, with particular emphases on higher-order harmonic generation and accumulation of nonlinearity along wave propagation. The material hyper-elasticity was considered in the model using an energy density approach based on the Landau–Lifshitz formulation; and the “breathing” motion pattern of a fatigue crack in the material was interrogated using a spring model. Upon the successful validation with the model prepared in the commercial software based on the Finite Element Methods, two scenarios were comparatively investigated, i.e. the lower and higher frequency regime. In the first case propagation of a basic symmetric mode pair was simulated using the model to observe a cumulative characteristic of the second harmonic mode with nonlinear hyper-elastic material definition upon appropriate selection of

*Corresponding author
Email address: rafal.radecki@agh.edu.pl (Rafal Radecki)

Download English Version:

<https://daneshyari.com/en/article/8129997>

Download Persian Version:

<https://daneshyari.com/article/8129997>

[Daneshyari.com](https://daneshyari.com)