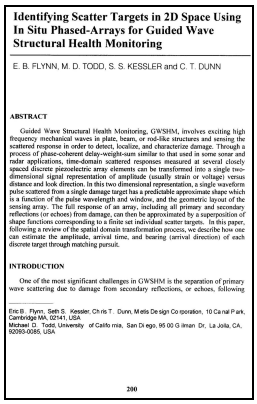

Identifying Scatter Targets in 2D Space Using In Situ Phased-Arrays for Guided Wave Structural Health Monitoring

E. B. FLYNN, M. D. TODD, S. S. KESSLER and C. T. DUNN

ABSTRACT

Guided Wave Structural Health Monitoring, GWSHM, involves exciting high frequency mechanical waves in plate, beam, or rod-like structures and sensing the scattered response in order to detect, localize, and characterize damage. Through a process of phase-coherent delay-weight-sum similar to that used in some sonar and radar applications, time-domain scattered responses measured at several closely spaced discrete piezoelectric array elements can be transformed into a single two-dimensional signal representation of amplitude (usually strain or voltage) versus distance and look direction. In this two dimensional representation, a single waveform pulse scattered from a single damage target has a predictable approximate shape which is a function of the pulse wavelength and window, and the geometric layout of the sensing array. The full response of an array, including all primary and secondary reflections (or echoes) from damage, can then be approximated by a superposition of shape functions corresponding to a finite set individual scatter targets. In this paper, following a review of the spatial domain transformation process, we describe how one can estimate the amplitude, arrival time, and bearing (arrival direction) of each discrete target through matching pursuit.

INTRODUCTION

One of the most significant challenges in GWSHM is the separation of primary wave scattering due to damage from secondary reflections, or echoes, following

Eric B. Flynn, Seth S. Kessler, Chris T. Dunn, Metis Design Corporation, 10 Canal Park, Cambridge MA, 02141, USA
Michael D. Todd, University of California, San Diego, 9500 Gilman Dr., La Jolla, CA, 92093-0085, USA

200

Код: 10264

E.B. Flynn, M.D. Todd, S.S. Kessler, C.T. Dunn

Identifying Scatter Targets in 2D Space Using In Situ Phased-Arrays for Guided Wave Structural Health Monitoring

Издательство DEStech Publications, Lancaster, 2011 год

8 стр; формат: 23,5 x 16 см; библиографический список: 7 единиц
ISBN: 978-1-60595-053-2

Guided Wave Structural Health Monitoring, GWSHM, involves exciting high frequency mechanical waves in plate, beam, or rod-like structures and sensing the scattered response in order to detect, localize, and characterize damage. Through a process of phase-coherent delay-weight-sum similar to that used in some sonar and radar applications, time-domain scattered responses measured at several closely spaced discrete piezoelectric array elements can be transformed into a single two-dimensional signal representation of amplitude (usually strain or voltage) versus distance and look direction. In this two dimensional representation, a single waveform pulse scattered from a single damage target has a predictable approximate shape which is a function of the pulse wavelength and window, and the geometric layout of the sensing array. The full response of an array, including all primary and secondary reflections (or echoes) from damage, can then be approximated by a superposition of shape functions corresponding to a finite set individual scatter targets. In this paper, following a review of the spatial domain transformation process, we describe how one can estimate the amplitude, arrival time, and bearing (arrival direction) of each discrete target through matching pursuit.

Ключевые слова:

Содержание.