MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Smart Materials and Adaptive Structures (5)

Author: Dr. Denghong Xiao
Beijing Electro-Mechanical Engineering Institute, China Aerospace Science & Industry Corporation (CASIC), China, xiaodenghong@buaa.edu.cn

Mrs. Xiaohong Zhou
Beijing Electro-Mechanical Engineering Institute, China Aerospace Science & Industry Corporation (CASIC), China, hebeisongwei@163.com
Dr. Yong Gao
Beijing Electro-Mechanical Engineering Institute, China Aerospace Science & Industry Corporation (CASIC), China, 13301283106@163.com
Mr. Naitian Li
Beijing Electro-Mechanical Engineering Institute, China Aerospace Science & Industry Corporation (CASIC), China, flyntl@163.com
Dr. Zongkai Tong
Beijing Electro-Mechanical Engineering Institute, China Aerospace Science & Industry Corporation (CASIC), China, zktong@sina.com
Dr. Liang Jin
Beijing Electro-Mechanical Engineering Institute, China Aerospace Science & Industry Corporation (CASIC), China, goldbright80@sohu.com

PROPAGATION CHARACTERISTICS OF ACOUSTIC EMISSION WAVE IN A CYLINDRICAL COMPOSITE CABIN WITH VARIABLE DIAMETERS

Abstract

The carbon fiber reinforced composite show good prospects in the structural design of the spacecraft cabin because of its large strength, high specific stiffness. When the flight vehicle is distributed among vibration environment, cracks may be aroused, while strong acoustic emission (AE) wave is also generated. AE is defined as the class of phenomena whereby transient elastic wave is generated by the rapid release of energy from a localized source of damage. Various types of AE sources, such as matrix/fiber breakage, fatigue cracks, rubbing, and impact of foreign objects etc., can bring out the propagation of AE waves, which contains most of the structure damage information. This paper aims to study the characteristics of AE wave propagation in a cylindrical composite cabin with variable diameters. In order to obtain the propagation characterizations of AE signals, simulation based on finite element method (FEM) is effective method. Firstly, the finite element model of the carbon fiber reinforced plate CFRPis established. Then, three different types of AE sources including matrix cracking, fiber breakage and interface cracking are simulated. Meanwhile, the wavelet packet method is introduced to analyze the AE signals obtained from the simulation. And the different modes of the AE signals can be identified through the energy distribution. Moreover, the AE signals are decomposed by Choi-Williams transformation, and obtained the reconstructed signals which only contain two basic mode waves. Lastly, the attenuation law of the two basic mode waves at different propagation direction and distance are investigated. The knowledge of the AE wave propagation characteristics in the structure of CFRP is important for damage evolution. The results of this study clearly illustrate the effectiveness of using the FE method to model AE wave propagation problems in cabin with complex shape.