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Performance Evaluation of the FBG Sensing Device and Comparison with Piezoelectric Sensors for Acoustic Emission Detection

Chuang Zhang^{1,2}, Leonard J. Bond², ¹Province-Ministry Joint Key Laboratory of Electromagnetic Field and Electrical Apparatus Reliability Hebei University of Technology, Tianjin, China, 300130;

²Center for Nondestructive Evaluation, Iowa State University, 1915 Scholl Rd., 111 ASC II, Ames, Iowa 50011-3041

In-service structural health monitoring (SHM) of engineering structures has assumed a significant role in assessing their safety and integrity. As the most mature technique in fiber-optic field, Fiber Bragg Grating (FBG) sensors have emerged as a reliable, in situ and nondestructive tool for monitoring and diagnostics in large-scale structure. Main objectives of this work are to evaluate and compare the acoustic emission (AE) sensing characteristics simultaneously with FBG sensor array and piezoelectric (PZ) sensors. The pencil-lead-break (PLB) test, ball dropping test and the excitation from the PZ transducer are treated as the AE source which conducted on the platy and blocky structure respectively for acoustic wave. The source repeatability will be verified to choose the source with more stable performance. A commercial 4-channel FBG AE detection device was used to compare with the PZ sensor on the amplitude and frequency response which can indicate the sensitivity of the sensors. The low sensitivity and low sampling rate are the main issue for the engineering application of the FBG sensors. Besides, the sensitivity and directional dependence of the FBG sensor have been discussed. It shows that the encapsulation method of the FBG sensor will impact both of them significantly.

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