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# Fiber-Optic-Based Hierarchical Sensing System for Detecting Impact Damage in Large-Scale Aerospace CFRP Structure

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This study proposes a novel hierarchical sensing system for detecting impact damage in composite structures. In the hierarchical system, numerous three-dimensionally structured sensor devices are distributed throughout the whole structural area and connected with an optical fiber network through transducing mechanisms. The distributed devices detect damage, and the fiber optic network gathers the damage signals and transmits the information to a measuring instrument. This study began by discussing the basic concept of the hierarchical sensing system through comparison with existing fiber-optic-based systems and the impact damage detection system for the composite structure was then proposed. The sensor devices were developed based on Comparative Vacuum Monitoring (CVM) system and Brillouin based distributed strain sensing was utilized to gather the damage signals from the distributed devices. Finally a verification test was conducted using a carbon fiber reinforced plastic (CFRP) fuselage demonstrator. Occurrence of barely visible impact damage was successfully detected and it was clearly indicated that the hierarchical system has better repairability, higher robustness, and wider monitorable area compared to existing systems.

**Ключевые слова:**

**Содержание.**

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