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Hierarchical Sensing System Combining a Fiber-Optic Network and Distributed Built-in Capillary Sensors for Impact Damage Monitoring of CFRP Structures

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In this study, the authors propose a novel hierarchical sensing concept for detecting damage in composite structures. In order to overcome the weak points of conventional fiber-optic-based monitoring, such as reparability and robustness, the proposed system stratifies the roles of "damage detection" and "damage signal transmission" with distributed damage sensing mechanisms and a fiber optic backbone. In order to validate the proposed concept, an impact damage detection system for large-scale composite panel structures was established, utilizing comparative vacuum monitoring (CVM). It was indicated that the hierarchical system has better reparability, higher robustness, and wider monitorable area compared to existing systems. Since this system was only able to detect damage that penetrates the back surface, the authors have begun investigating a distributed device with the capability of detecting internal damage. Glass capillaries (or "hollow glass fibers") embedded in the structure are considered here as a damage detection device. A concept utilizing glass capillaries is proposed, and preliminary tests were undertaken to verify the feasibility of this concept.

Ключевые слова:

Содержание.

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