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Comparative Analysis of Active Bonded Piezoelectric Repair Systems for Damaged Structures under Mechanical and Thermo-Mechanical Loads

(2024) *Actuators*, 13 (10), art. no. 390, .

DOI: 10.3390/act13100390

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Abstract

Active repair systems employing piezoelectric (PZT) patches have emerged as promising solutions for mitigating crack propagation and enhancing structural integrity in various engineering applications. However, the existing literature predominantly focuses on the application of PZT patches for repairing structures under mechanical loading. In this study, a finite element analysis (FEA) is employed to investigate the repair of a centre-cracked aluminium plate under both mechanical and thermo-mechanical loading conditions. This study explores the influence of key parameters, including temperature, PZT patch thickness, type of PZT material, adhesive material, and adhesive thickness, on the structural integrity and crack propagation behaviour. The results reveal significant differences in stress distribution and crack propagation tendencies under varying loading conditions and parameter settings. These findings emphasize the necessity of considering thermo-mechanical loading conditions and parameter variations when designing effective active repair systems. In conclusion, this study provides valuable insights into optimizing PZT patch-based repair strategies for improved structural integrity and crack mitigation in aerospace and other engineering applications under diverse loading scenarios. © 2024 by the authors.

Author Keywords

actuators; crack repair; plate; PZT; stress intensity factor

Funding details

Prince Sultan UniversityPSU
FRGS/1/2021/TK0/UIAM/01/5

The authors acknowledge and thank Kulliyah of Engineering, International Islamic University Malaysia, for offering the KOE Postgraduate Tuition Fee Waiver Scheme. Furthermore, the authors acknowledge the support of the Structures and Materials (S&M) Research Lab of Prince Sultan University and Prince Sultan University for paying the article processing charges (APCs) of this publication.

This research was supported by the Ministry of Education of Malaysia (MOE) through the Fundamental Research Grant Scheme (FRGS/1/2021/TK0/UIAM/01/5).

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Publisher: Multidisciplinary Digital Publishing Institute (MDPI)

ISSN: 20760825

Language of Original Document: English

Abbreviated Source Title: Actuators

2-s2.0-85207668503

Document Type: Article

Publication Stage: Final

Source: Scopus

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