# Effect of adhesive debonding and patch materials on stress intensity factor in repaired cracked plates

Mechanics Research Communications • Article • 2026 •
DOI: 10.1016/j.mechrescom.2026.104720

Aabid, Abdul [a] ; Hrairi, Meftah [b] ; Baig, Muneer [a] ; Ali, Jaffer Syed Mohamed [b]

[a] Department of Engineering Management, College of Engineering, Prince Sultan University, PO BOX 66833, Riyadh, 11586, Saudi Arabia



## Abstract

The major challenge in aerospace structures is the sensitivity of materials to failure from minor cracks caused by external loads. Therefore, researchers have extensively studied passive repair methods that use composite material patches for repairing damaged plates. This study investigates the effects of debonding and patching materials on repaired plates. The study considered center-cracked plates repaired with bonded patches using the mathematical modelling and finite element (FE) method. Mathematical modelling has been derived from a crack-bridging model via Rose's and Kim's analytical approach, and then a simulation model was developed using the FE method, and the results of both methods were compared. The study also compares the effectiveness of isotropic and orthotropic patches, demonstrating that reinforced patches achieve greater stress intensity factor (SIF) reduction

due to their uniform material properties, while composite patches are influenced by direction-dependent characteristics. This investigation reveals that debonding increases the SIF by reducing the load transfer efficiency of the patch, highlighting its critical impact on repair performance. This study quantifies the reduction in patching efficiency due to debonding. The numerical results were compared with existing experimental results, and the current mathematical model showed good agreement, with <5% of relative errors. © 2026 Elsevier Ltd

## Author keywords

Crack-bridging model; Debonding; Finite element method; Patch; Stress intensity factor

## Indexed keywords

**Engineering controlled terms**

Cracks; Efficiency; Plates (structural components); Repair

**Engineering uncontrolled terms**

Adhesive debonding; Adhesive patches; Aerospace structure; Bridging models; Crack-bridging; Crack-bridging model; Cracked plate; Element method; Patch; Stress-intensity factors

**Engineering main heading**

Debonding; Finite element method; Stress intensity factors



## Funding details

Details about financial support for research, including funding sources and grant numbers as provided in academic publications.

| Funding sponsor | Funding number | Acronym |
| --- | --- | --- |
| Prince Sultan University<br>See opportunities | | |

**Funding text**

The authors acknowledge the support of the Structures and Materials (S&M) Research Lab of Prince Sultan University.

## Corresponding authors


| | |
|---|---|
| Corresponding author | A. Aabid |
| Affiliation | Department of Engineering Management, College of Engineering, Prince Sultan University, PO BOX 66833, Riyadh, 11586, Saudi Arabia |
| Email address | aaabid@psu.edu.sa |

Просмотр версии на русском языке

## Customer Service

Help

Tutorials

Contact us

ELSEVIER