Optimizing piezoelectric patch placement for active repair of center-cracked plates

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Abstract

Active repair using piezoelectric materials offers a promising direction for extending the service life of cracked structural components. Conventional methods typically employ multiple patches placed around the crack, but such layouts may not deliver maximum efficiency. In this work, a different strategy is examined by bonding a single piezoelectric material patch directly across the crack line of a plate. A coupled finite element analysis in ANSYS is used to study how this placement influences stress intensity factor (SIF) and overall repair performance. The results highlight the critical role of patch location when bonded on the crack and energized by an electric field, the piezoelectric patch produces a markedly greater reduction in SIF compared to patches placed around the crack. This demonstrates the effectiveness of direct-on-crack placement in suppressing crack growth and emphasizes the need for careful consideration of patch positioning in active repair design. The study contributes new guidance for applying piezoelectric materials in structural repair and damage control. © 2025 the author(s), published by De Gruyter, Berlin/Boston.

Abstract
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