

# ANALYSIS ON THE PARAMETERS OF ADHESIVELY BONDING PATCH REPAIRING CRACKED SANDWICH FACE PANEL

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## INTRODUCTION

Sandwich composites have been successfully applied to commercial aircraft for more than 20 years. A large amount of damages have been founded in its applications. One of them is the edge crack around the bolt hole on the sandwich face panel. The adhesively bonding patch can be used to repair the cracked face sheet or reinforce the face sheet with some bolt holes. The effects of the patch parameters are studied in this paper, such as patch size, patch thickness, material etc. The stress intensity factor (SIF) is calculated by the commercial FEA code ABAQUS.

## GEOMETRY MODEL

Considering a bolt hole on the composite sandwich panel, an edge crack is found in its face sheet (fig. 1). An additional bonding patch is adopted to repair the cracked sandwich panel. The detail configuration of the face sheet with a symmetric edge crack around the hole is shown in the fig 2. The thickness of the face sheet is 2mm. The thickness of honeycomb is 10mm. The radius of the hole on the panel,  $R$ , is 12.5mm.

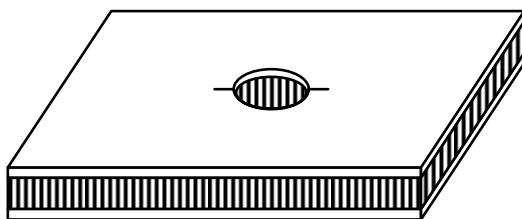


Fig. 1: Cracked face sheet sandwich panel

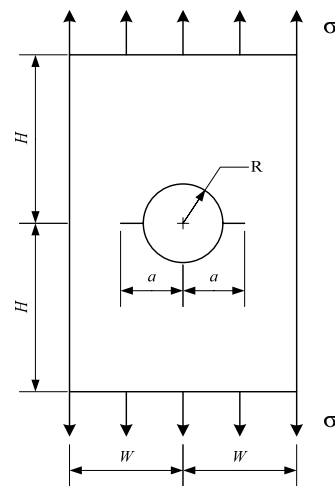


Fig. 2: Face sheet with crack

## ANALYSIS AND RESULTS

In order to verify the correctness of the SIF calculated by the FEA models, the panel with edge crack hole (fig 2) is modelled in the 2D and 3D respectively. The numerical results and the analytical results are listed in the table 1. The agreement between the analytical results and the numerical results shows the correctness of the FEA model established in this paper.

$$K_I^* = K_I / (\sigma \sqrt{\pi W})$$

Table 1: The numerical result and analytical result ( $H/W = 2$ ,  $R/W = 0.25$ )

| a/W | $K_I^*$                   |        |        |
|-----|---------------------------|--------|--------|
|     | Analytical <sup>[1]</sup> | 2D FEA | 3D FEA |
| 0.4 | 0.7668                    | 0.7676 | 0.7612 |
| 0.8 | 1.6822                    | 1.6838 | 1.6627 |

Note: the out surface value is listed in the 3D FEM column.

The effect of the patch size on the SIF of the sandwich panel with different crack length is shown in the fig 3. The SIF is dramatically reduced when the patch size equals the crack length. The patch size has a little impact on the SIF when it is bigger than the crack length.

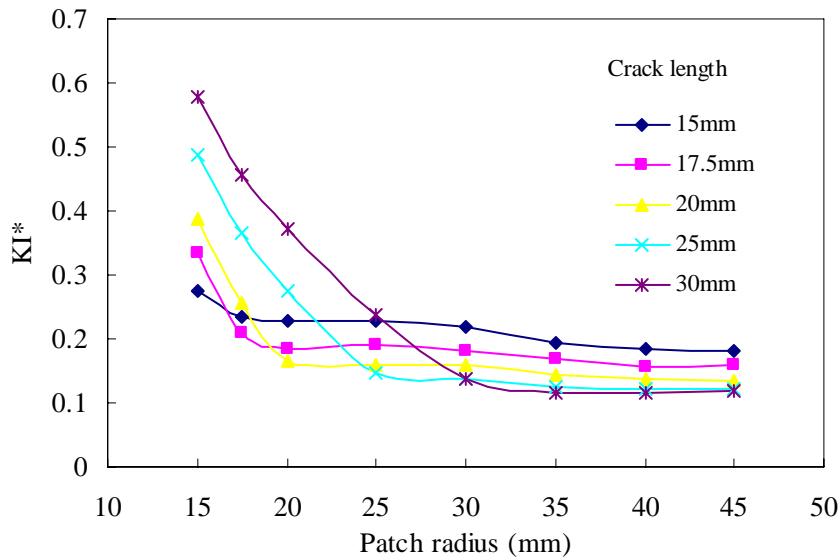


Fig. 3: The effectiveness of the patch size on the panel with different crack length

## CONCLUSION

This paper presents the impact on the SIF of the parameters of adhesively bonding patch repairing the cracked sandwich face sheet. The analysis results are useful to design the patch for repair or reinforcement the sandwich face sheet with notch.

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