

THERMAL AND STRUCTURAL MODELLING OF THERMOSET COMPOSITE REPAIRS TOWARDS OPTIMIZATION OF THE CURE CYCLE FOR MINIMUM DISTORTION

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During manufacturing of composite materials residual stresses can result in distortion of the final part. This distortion is even more critical when building on existing parts, e.g. for a repair, as the added material has to conform to the original structure. To predict this distortion due to curing of thermoset carbon-matrix composite repairs a numerical modelling method is employed [1].

The temperature cycle applied for the cure of thermoset composites can significantly influence the amount of residual stress and resulting deformation after manufacturing [2]. Therefore a method is devised to parametrise and subsequently tune this temperature cycle for minimum distortion after manufacturing. Numerical tests with the optimised temperature cycle resulted in a total of 36% reduction in process induced strain for a repair of a flat laminate plate.

The same methodology is applied to a wing box consisting of two composite skins connected by two C-spars where a scarf repair is applied in the skin. The repair patch is locally heated by a heating blanket to cure the repair patch. A subsequent thermal-mechanical model is employed to investigate the amount of residual stress and strain after cure and the influence of underlying structural elements on the repair. This framework with optimisation of the cure cycle can support the patch fabrication with accurate design and analysis for repairs with minimum distortion. Which in turn will result in development of cost-effective composite repairs.

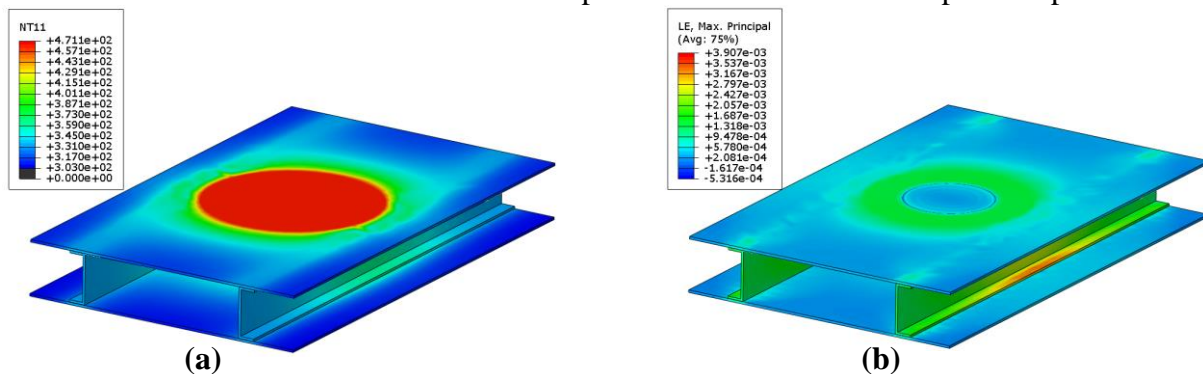


Figure 1: Numerical simulation results of a repair of a wing box with (a) the temperature distribution and (b) maximum principal strain during curing of the repair patch.

REFERENCES

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