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COMPUTATIONALLY EFFICIENT SIMULATION OF LOW VELOCITY IMPACT AND COMPRESSION AFTER IMPACT RESPONSE IN LAMINATED COMPOSITES

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An efficient modeling approach for simulating the damage and failure mechanism of laminated composites under low velocity impact (LVI) and compression after impact (CAI) loading scenarios by means of the Finite Element Method is presented. The efficient modeling approach has been utilized by using shell elements to model the individual plies and cohesive zone elements (CZE) in-between [1]. Single and double LVI events are performed to mimic the drop tower test set-up. Two impact spots are impacted sequentially, each at the same distance from the center of the laminated composite samples. The damage and failure mechanism for three different impact distances between the double positions as well as single impact are compared in terms of energy analysis and delamination area. CAI simulations are performed to assess the residual compressive strength of laminated composites after low velocity impact. The compression of unimpacted sample (CUS) simulations are also utilized to evaluate the compressive strength of the prestine laminated composite. Furthermore, the residual compressive strength ratio (CAI/CUS) is compared for various LVI configurations and a significant strength reduction is predicted. The modeling approach utilized in this study can accurately predict the damage and failure mechanisms of laminated composites under LVI and CAI with efficient computing time.

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REFERENCES

[1] M. Schwab, M. Todt, M. Wolfahrt, and H.E. Pettermann, Failure mechanism based modeling of impact on fabric reinforced composite laminates based on shell elements. *Composite Science and Technology*, Vol. **128**, pp. 131–137, 2016.