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STUDY OF SHAPE MEMORY ALLOY HYBRID COMPOSITE STRUCTURE FOR IMPROVED POST IMPACT STRENGTH

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Summary: Composite materials have advantages over conventional materials due to their tailor able properties; high specific strength, high specific stiffness, ability to take complex shapes etc. But their resistance is poor against impact loading in through-the-thickness direction. Since they dissipate very little strain energy (such as plastic yielding in ductile metals) during impact loading.
There are various methods for improving impact damage resistance of composites such as toughening of fiber and matrix, through the thickness reinforcement by stitching, 3D weaving, braiding and hybrid of the secondary tougher reinforcement with load bearing primary reinforcement. One promising method is Shape Memory Alloys hybrid composites (SMAHCs). Shape Memory Alloys (SMA) materials are capable of absorbing impact energy through superelastic deformation thereby mitigating effect of impact on composite structures.
In present work a numerical modeling approach is developed where effectiveness of using SMA wires in composite plate in reducing the size of delamination is investigated. Cohesive zone based modelling approach was used to predict delamination in composite structure subjected to low velocity impact. One dimensional model of SMA was used to model the embedded SMA wires in composite plate. Numerical analysis shows that embedding SMA wire results into reduction in size of delamination in composite plate subjected to low velocity impact. A parametric analysis was done to find out the effect of location and pre tensioning in embedded SMA wires. Analysis results shows that placing SMA wire close to the bottom layers will leads to maximum reduction in size of delamination. Similarly pre-tensioning in SMA wires also helps in overall reduction in delamination size as compared to conventional composite plate.