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PROCEEDINGS

Tapering Optimization of Double-Double Laminates

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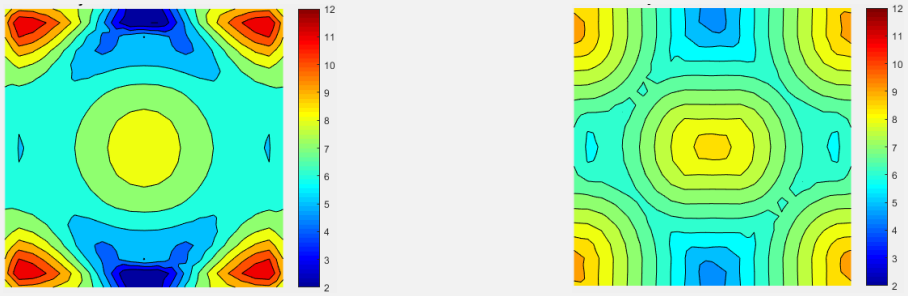
ABSTRACT

Double-Double (DD) laminates are novel layups made up of two groups of angle plies. The assembly of local sub-ply blocks provides homogenized material properties and can achieve the unique laminate layup for the whole structure with different sub-ply block repeats. However, the thickness thinning will bring buckling forward leading to structural failure. Here we work on searching the optimal thickness tapering strategy of DD laminates to achieve the highest buckling load with the given structure weight. The DD laminate is modelled as a shell with the thickness for each element defined as different repeats of the basic sub-laminate. Optimal thickness profiles will include sharp changes in the thickness, which may lead to thickness delamination. To overcome the problem, spacing constraints on thickness tapering are added to the optimization model. Numerical examples show that the added spacing constraints can help to yield a smooth thickness tapering at the cost of a reduced optimal effect.



(a) Without spacing constraints (b) With spacing constraints

Fig. 1. Optimal thickness tapering results with the highest buckling load for DD laminates under uniaxial compression.

KEYWORDS

Structural optimization; Double-Double laminates; buckling; thickness tapering

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