DOUBLE-DOUBLE LAMINATES AND THEIR DESIGN AND MANUFACTURING INNOVATIONS

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Abstract: As a new family of laminates, double-double laminates consists of [±□/±□] are stronger, tougher, and easier layup than legacy quad, can be homogenized and deployed in large zones that transcend bays, with aggressive taper to save weight. To facilitate optimization a 3-parameter model based on trace, X and X' is shown to be effective and conservative. Both 2D and 3D formulations will be shown, and with trace master plies of carbon composites have been found to be simple and accurate. A new classes of Lam search engines have been built so the best laminate based on strength can be selected rapidly, in addition, the controlling loads, same-strength taper for the best laminate are provided. Homogenization across the thickness and in-plane are important attributes of double-double and can guide and accelerate layup with single ply drops located at desirable locations. A new laminate is an "orthotropic aluminum" fully homogenized that is easy to optimize taper to save weight. The simplified trace-X-X', master-ply can be used so specific material can be scaled after the best laminate is found, not before.