Strength Prediction of Double-Lap Bolted Joints of Woven Fabric CFRP Composite Plates using Hashin Formulations

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Abstract. Failure modes in composite plates with bolted joint configuration include net-tension, shear-out and bearing failures. Few analytical and numerical approaches in strength prediction frameworks of composite plates with bolted joints were reported in the literatures. Present works are dealing with strength prediction in bearing failure of woven fabric CFRP plates with double lap bolted joint configurations by modeling 3D finite element analysis framework. The pre-processing stage is modeled using commercial ABAQUS CAE package and takes into account all parts interactions, clamping pressure and friction contact. Testing series are following the experimental works found from the literatures with variation of plate width to hole diameter (W/d) ratios and incorporated with finger-tight clamp-up. Hashin failure criterion was implemented as constitutive modeling in current analysis, based on ply-by-ply approaches found to be more appropriate phenomenon in bearing failure. The strength prediction results demonstrated good agreement with all experimental datasets particularly with bearing failures as compared with previously reported work, used stress concentration approach found to be accurate in net-tension failure only.

Keywords. Bolted Joints, Strength Prediction, Hashin Formulation, Finite Element Analysis, Bearing Failure

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