Manufacturing Simulations and Processing Optimizations for Thick Composites

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ABSTRACT

In this research, the manufacturing parameter in curing cycle will be simulated. In the simulation, all of the middle laminates will be found the fact that the resulting temperature is lag and the laminate ’s consolidation is nearly perfect. In compress, follow the increasing temperature the viscosity will be changed. Due to the changing, the pressure will load on fiber from resin. After that, the curing cycle will be finished. The conventional thermosetting composite material present temperature lags, degree of cure un-uniform, and consolidation uncompleted in manufacturing process. Therefore, the difference between the middle and boundary laminate ’s temperature is large. When the temperature keeps increase with steady pressure, the resin pressure, composite thickness, and degree of cure will be changed. Since the temperature ’s difference between the middle and boundary laminate ’s is large, the product ’s quality will present instability. In this study, the software, MATLAB and ANSYS, can get temperature ’s results and compare them. The consolidation behavior of laminate is analyzed with Crank-Nicholson of finite difference method. Conclude these results, there is three conclusions can be gotten: the change of thickness, the temperature distribution and cure of middle laminate. Finally, through GA, the optimization ’s design will be obtained.

Keywords : composite material ; finite-difference method ; finite element method ; curing cycle ; genetic algorithm

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