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ANALYSIS OF PROCESS-INDUCED DEFORMATION OF COMPLICATED COMPOSITE CURVED SURFACE

Abstract

Process-induced deformation is an important factor which would affect the forming accuracy of large-size curved composite surface. To predict the process-induced deformation by utilizing numerical simulation method could help to improve the processing quality and shorten the development cycle. In this paper, a modularized program was developed based on commercial finite element software ABAQUS to predict the process-induced deformation of composite curved surface. First, according to the theory of physical and chemical change of composite material during the curing process, the curing process was decomposed into three relatively independent modules: thermo-chemical module, flow-compaction module and stress-deformation module. The thermo-chemical module simulates the chemical reaction, the flow-compaction module reflects the influence of pressure on the curing process and the stress-deformation module reveals the relationship between stress and deformation. Then a set of varied material properties, boundary conditions, loads and temperature fields were developed on the basis of the functions of each module. Analyses of process-induced deformation for typical composite curved surfaces were performed. The predicted results are compared with the available experimental and numerical results. It is shown that the predicted process-induced deformation using this method are comparable with those obtained. Finally, the process-induced deformation of a large-size complicated composites curved surface was calculated with the developed procedure. The impact of factors,such as temperature fields and pressure,on process-induced deformation were also analyzed.