Research Title: From Processing to Performance; Linking Process Modeling to Performance Modeling Using Discrete Damage Methodologies

Individual Sponsor:

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Academic Area/Field and Education Level:

Ph.D or Ph.D candidate, Mechanical/Materials/Chemical Engineering Discipline

Objectives:

1) Work to link available data and produce a cure kinetics model using the Abaqus plugin Compro
2) Define and measure any unknown resin properties required to produce the cure kinetics model
3) Model cure processes and compare the predicted geometric shape to measured components
4) Link cure stresses to the performance modeling software and predict quasi-static strength

Description:

High performance carbon fiber composites offer several significant advantages over traditional metallic components such as high stiffness to weight ratios, as well as the ability to tailor part stiffness by varying ply stacking sequences. Current design and certification requirements use an extremely time and cost intensive building block testing approach to certify components for use. This process is used for idealized components and any defects that develop during fabrication can result in parts being scrapped. This work seeks to understand how local variations in degree of cure and residual stress develop during the fabrication process in order to link these to variations in mechanical performance. The goal of this work is to utilize recent developments in process modeling coupled with newly developed discrete damage methodologies to produce computational models that predict the impact of process induced defects (geometric distortion, variations in cure, etc.) during fabrication of bonded composite joints. This work aims to develop an appropriate cure model and predict quasi-static strength of a bonded composite joint.

Research Classification/Restrictions:

US Citizens Only

Eligible Research Institutions:

University of Dayton