

# DEPARTMENT OF MECHANICAL ENGINEERING

## Thesis Defense

**Student:** Paul Fazzino

**Title:** Predictive Methods for Large-scale Progressive Damage in Structural Composites for Aircraft Applications

**Date & Time:** Friday, November 7, 2008 at 1:00pm

**Location:** ME Conference Room (A228)

**Thesis Committee:** Dr. Kenneth Reifsnider - Advisor

Dr. Xingjian Xue - Second Reader

**Graduate Studies Representative:** Dr. Guiren Wang

### Abstract:

Current applications require an understanding of the relationships that exist between the functional characteristics of composite material systems and the long-term behavior of those materials under mechanical loading. In the present work, a method for out of plane fatigue via end-loaded bending experiments was developed and implemented to introduce concentrated degradation in thin woven glass/epoxy composites. Using Electrochemical Impedance Spectroscopy, a method was established and used to characterize the damage initiation and progression. A systematic approach in which the evolution in residual strength due to fatigue in bending was monitored, and a relationship between electrochemical impedance at different frequencies of excitation and the development of damage in that material was established.

Metrics defined by impedance spectroscopy measurements were found to show large, consistent, and clear distinctions as damage developed with remarkable sensitivity which may not be otherwise possible through measuring change in physical properties or visual damage.