Course ER-3/ES-4

FEA, DIC, and Advanced Stress Methods for Composite Structures and Repairs

Course Summary

Given the depth of information, all the advanced topics that were originally intended for ER-2 and ES-3 cannot be fully presented and explained in five days. The advanced topics primarily focus on Finite Element Analysis (FEA) and Digital Image Correlation (DIC). However, since these methods are applicable to both original structure design as well as repairs, their application was merged into a combined ER-3/ES-4 that sits at the top of the engineering training pyramid. This course has been developed to keep engineers up to date on the latest analysis and testing methods for composite structures and repairs using FEA and DIC. However, the need for analytical methods cannot be overlooked. This course also presents real-world applications of some of the most advanced stress methods that can be found in specialized composite analysis books throughout the industry that are applicable to both structural and repair analysis. FEA is widely recognized in structural analysis, so it is necessary for engineers to understand enough of the theory behind the Finite Element Method and the practical applications of FEA software to comprehend the requirements for its specific inputs and outputs - but also understand the limitations inherent to FEA. There are many unique aspects to composite FEA models that may be foreign to engineers that are familiar with FEA using metals. This course begins with identifying the proper sources for composite material properties, entering these properties into FEA, modeling a laminate in FEA, creating a laminate property, meshing the structure, applying constraints, applying loads, analyzing the model, and interpreting the results. Most engineers are familiar with stress distributions revealed with FEA, but for composites, an evaluation of the strain field, ply-by-ply failure criteria, and strain energy density is critical. Equally interesting in this course is use of Digital Image Correlation (DIC) in structural testing to validate the FEA results. DIC uses digital camera imagery taken at timed increments to digitize a speckle pattern applied to the surface of the laminate. The DIC software tracks the movement of the digitized speckles and equates it to the deformation of the structure. The analytical methods calculate the load distribution throughout the structure, that is commonly only considered to be available from FEA.

Introduction

New Course - Merges ES-4 and ER-3 curricula into one course.

Check back in Q3 of CY22 for full description and schedule for CY23.

Topics

To be published by Q3 of CY22

Course Benefits

Engineers will learn the latest in Finite Element Analysis (FEA) and Digital Image Correlation (DIC) methodologies as applied to analysis of composite structures..

Prerequisites

Either: ER-2 or ES-3

ER-2 Advanced Aerospace Repair Analysis and Substantiation from the ER curriculum.

ES-3 Design of Composite Structures from the ES curriculum.

Teaching Method

Classroom theory mixed with hands on workshop

CEU

3.6