FEA of Composites: The Fundamentals and Beyond…

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Role of FEA in Design

• Gain understanding
• Explore feasibility
• Optimize a particular solution
• Evaluate safety and efficacy

“The purpose of computing is insight, not numbers”
R. W. Hamming
List of Proposed Topics

1 Review of FEA Principles and Practices
   Governing Equations
   1-D-to 3-D elements
   Plate and Shell Formulations

2 Modeling Techniques
   Mesh Refinement
   Submodeling
   Boundary Condition Interpretation

3 Sources of Nonlinear Behaviour
   Plasticity
   Large Deformations
   Finite Strains
   Buckling

\[ D_{ep} = D - \frac{1}{H_p + n : D : m} (D : m \otimes n : D) \]

\[ K_L = \iiint_V \left( B^T_O DB_L + B^T_L DB_L + B^T_L DB_O \right) dV \]
4 Convergence Criteria
   Tolerances and Residual Forces
   Restarts
5 Composites
   Anisotropic Materials
   Layered Elements
   Ply Drop-Offs
   Cores
6 User Subroutines
   Constitutive models
   Field Variables
7 Reliability
   Damage and Delaminations
   Fatigue Performance Evaluation
Goals

• Provide the composite specialists with the basic understanding of FEA methodology and solution interpretation

• Provide the FEA jockey with the basic understanding of additional complexities associated with modeling composites
Proposed Format

Day 1
4-hour class (topics 1, 2, 3)
1 hour class (topics 4, 5)
2 hour computer lab (review topics 1-5)
1 hour class (good fea practices)

Day 2
4-hour class (topics 5-7)
2-hour computer lab (composites applications)
1 hour class (good fea practices)
1 hour round table???
Feedback Needed

Additional topics and format
- Define audience and select instructors/lab assistants

Appropriate platform (ABAQUS, Ansys, other??)

Workshop format (computer laboratory setting??)
- demonstrate key concepts through selected examples

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