Mechanics of Composite Materials – Spring 2005

Homework #1

Due: Monday, January 25

This assignment is to be done by teams of 4-6 students. The purpose of this assignment is to select an item made of a composite material(s) and investigate some basic information about this item (see questions below). When you select your item, you may wish to consider the following: later in the course, teams will conduct a project to design, build, analyze and test a ***multidirectional*** laminate composite material, and the material design will be based upon an some actual item composed of composite materials. Therefore, the item you select here could be used as the basis for the design project later in the course.

1. Obtain an example of something made with composite material(s).

2. Determine the constituent materials (i.e., fiber and matrix). (Sections 2.9-2.10 discuss typical constituents and typical composite materials.)

3. Determine the fabrication method(s) used (for example, filament wound, multidirectional layup, woven, braided, pultrusion, etc., see handout on fabrication methods).

4. Prior to the use of composite materials, what "traditional" material(s) were used to construct this item?

5. How does the approximate strength to weight ratio of the composites specimen compare to the approximate strength to weight ratio of the traditional specimen? (Note: strength is defined as the stress at failure. Composite materials often have different strengths in tension, compression and shear, as we will see in chapters 4 and 7. See table 2.6 for strength values of unidirectional lamina.)

6. How does the approximate stiffness to weight ratio of the composites specimen compare to the approximate stiffness to weight ratio of the traditional specimen? (Note: stiffness determines the amount of deformation that occurs for a given load (i.e., less deformation for stiff material and more deformation for flexible material). Stiffness is represented by E, Young's modulus for tension or compression and by G for shear. Composite materials often have different stiffnesses in different directions, depending on how the plies are oriented in the laminate, as we will see in chapter 5. See table 2.6 for stiffnesses for a unidirectional lamina).

7. What are the reasons for constructing this item from composite rather than traditional materials? What are the advantages and disadvantages of the composite specimen? In particular, are there any performance advantages? (Perhaps related to the strength, stiffness or weight?)

8. Any other interesting observations about this specimen?

Each team will submit a short, concise report addressing the above questions and issues, and providing any other introductory information you think would be helpful to the reader. Please feel free to include pictures, references and/or web sites. Be creative!

Each team will make a short (5-10 minutes, including questions) presentation to the class summarizing the key information about their composite specimen. If possible, please bring a sample of the item to class. (Note that broken items are very interesting, because you can often see the fiber orientations.)