Composite Materials: Analysis and Design

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Chapter 1:

Introduction to Composite Materials

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❑ Outline

- **Mechanics Terminology**

✓ **How is a composite structure analyzed mechanically?**

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❑ Mechanics Terminology

Several terms are defined to develop the fundamentals of the mechanical behavior of composites. These include the following:

✓ **Isotropic body:** An isotropic material has properties that are:

✓ **Homogeneous body:** A homogeneous body has properties that are the:

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❑ Are composite materials isotropic and/or homogeneous?

✓ Most composite materials are neither isotropic nor homogeneous. For example, consider epoxy reinforced with long glass fibers.

- If one chooses a location on the glass fiber, the properties are different from a location on the epoxy matrix. This makes the composite material:
- The stiffness in the direction parallel to the fibers is higher than in the direction perpendicular to the fibers and thus the properties are not independent of the direction. This makes the composite material:

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❑ Mechanics Terminology

✓ **Nonhomogeneous body:**

✓ **Anisotropic material:**

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✓ **Lamina:** A lamina (also called a ply or layer) is a:

✓ **Laminate:** A laminate is a:

✓ **Hybrid laminate:** Hybrid composites contain more than..

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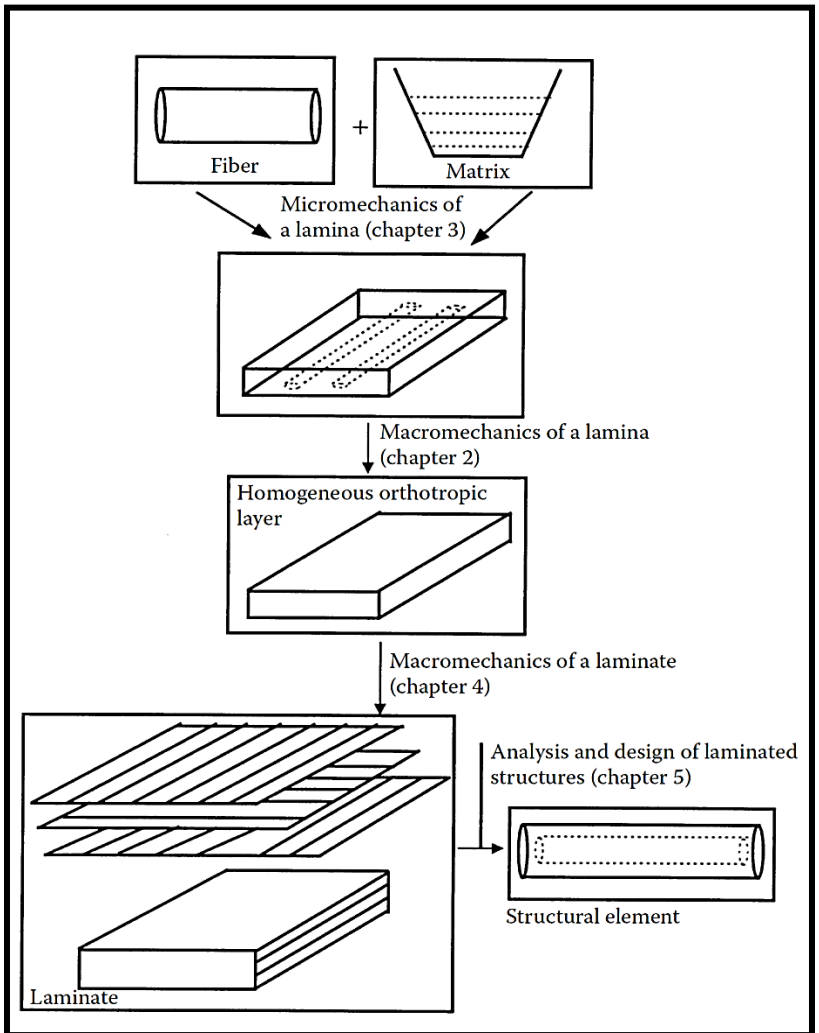
- **Mechanics Terminology**



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❑ Mechanics Terminology

I. Find the average properties of a composite ply from the individual properties of the constituents. Properties include stiffness, strength, thermal, and moisture expansion coefficients. Note that average properties are derived by considering the ply to be homogeneous. This is called:

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❑ Mechanics Terminology

II. Develop the stress-strain relationships for a unidirectional/bidirectional lamina. Loads may be applied along the principal directions of symmetry of the lamina or off-axis. Also, one develops relationships for stiffness, thermal and moisture expansion coefficients, and strengths of angle plies. Failure theories of a lamina are based on stresses in the lamina and strength properties of a lamina. This is called: