MCEN 4183/5183: Mechanics of Composite Materials
Spring 2018

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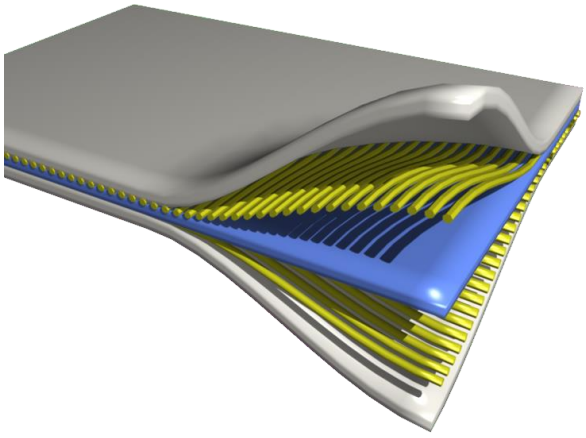
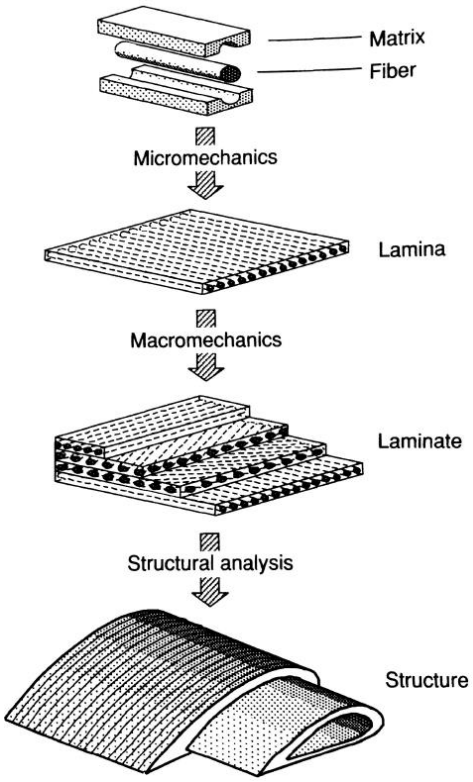
Textbook: Daniel & Ishai, *Engineering mechanics of composite materials*, 2nd edition

Composite materials are widely applied in many industrial areas, including aircraft, automotive, marine, wind energy, infrastructure, armor, and biomedical applications (e.g. prosthetic devices). Historically the concept of composite materials can be dated back to the straw-reinforced clay bricks in ancient Egypt. In modern times, composite materials have evolved greatly due to advancement in manufacturing techniques and design capability. Composites offer advantageous material properties such as high strength, high stiffness, low density and long fatigue life. However, because composites consist of two or more material phases, the mechanics of composite materials is much more complex. For example, composites are typically anisotropic due to the reinforcement agents. A much larger set of material parameters is required to capture their mechanical behavior, which brings challenges to both theoretical analysis and experimental testing. This course will start with a brief review on the fundamentals of solid mechanics and then introduce the concepts required to analyze composite materials. Topics to be discussed include: elastic behavior and strength of composites, failure analysis, unidirectional and multi-directional lamina, and effects of temperature and humidity.



Multilayer multidirectional fiber reinforced laminate



Mechanics of composites at different length scales
(Adapted from the textbook by Daniel & Ishai)