

Additional Practice Questions

1. What is the role of shape in the selection of materials? Can the ability to shape a material change the selection of a material for an application?
2. The maximum shape factor in Ashby for elastic behavior of steel in bending (ϕ_B^e) is given as 65, where as it is only 5 for wood. Why?
3. In the paddle example when shape was considered, wood was less dominant as a material. Explain the result in terms of the structure of wood.
4. Paddle handles are often hollow aluminum tubes. Why?
5. Suggest an alternative shape to the circular cross-section of a wood paddle handle. Why is this advantageous?
6. Suggest a shape for a steel floor joist. When shape is considered how does a steel floor joist compare to a wood floor joist. (example 8.4)
7. As wood becomes scarcer and old growth wood becomes unavailable, the modulus of wood used in many applications decreases. Suggest a modification of the standard wood floor joist using composite materials to stiffen the beam.
8. In a simply supported beam (such as the carbon-epoxy specimens passed around in class) in what direction should the fibers be directed to maximize bending stiffness?
9. Suggest a fiber orientation for a stiff tube in torsion when the tube is made out of PEEK with boron fibers. The modulus of PEEK is much less than that of boron fibers.
10. A bar with a circular cross-section is subject to a tensile load of P and a torsional load of $P/2$. Propose two designs for a composite lay-up for this configuration. Please give numbers for the fiber orientation angles relative to the central axis of the cylinder.