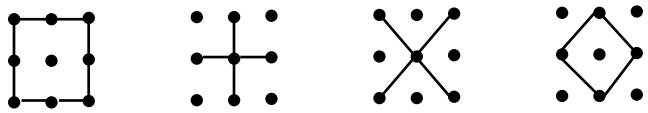
ME 260: Structural Optimization: Size, Shape, and Topology		
Assigned: Oct. 12, 2021	Programming Assignment 2	Due: Nov. 2, 2021

In this team programming assignment, you explore developing general code for designing optimal heterogeneous meso-scale lattice structures for 2D continua using Timoshenko beam elements.

Note the following points before you start.

- You would use four kinds of unit lattices joining nine nodes in a unit square cell.



- Notice that each lattice has four beam segments. The four segments should have the same area of cross-section and second moment of area. But each lattice type in a unit cell (i.e., a square) could have different areas of cross section, thus giving heterogeneous. At a cell, all lattice types can exist, more than one can exist, or none can exist. For the first lattice, it is safer to assume that it has eight segments so that its connectivity to the other lattice units is ensured.
- We use an upper bound on the area of cross-section of any beam segment. The cross-section dimensions should not be smaller than five times the length the beam segment.
- Use Timoshenko beam element in finite element analysis. Code will be supplied.
- You should do sensitivity analysis.
- You can any optimization algorithm: fmincon, MMA, optimality criteria method, etc.
- You should minimize the mean compliance subject to volume constraint.

This is what you should submit:

Question 1 (50 points)

Working Matlab code along with illustrative examples. You should show that optimizing with a single lattice are not better than multi-lattice optimization.

Question 2 (15 points)

Compare your solutions with those obtained using YinSyn or TopOpt programs.

Question 3 (15 points)

Interpret the optimization solutions. Why were particular lattice units are selected for different places in the design domain.

Anything else you do extra will carry bonus points.