1. Two springs (same spring constant) are used in a series configuration and a parallel configuration as shown below. Which configuration has “higher” overall spring constants?

2. An array of single crystal silicon cantilevers with length $L$ of 500 $\mu$m, width of 50 $\mu$m, and thickness of 2 $\mu$m is placed on a flat surface as shown below. Assume that Young’s modulus of Si is 170 GPa. Although it is extremely small, the cantilever beam bends due to its own weight (another words, due to gravitation). Find the amount of the deflection in $y$-direction at the free end.

3. Consider a silicon fixed-fixed beam shown. Assume that silicon’s Young’s modulus is 160 GPa. A point load ($F_z$) of 100 $\mu$N was applied at the center of the beam. Determine the maximum amount of deflection at the center of the beam.

4. Consider a square silicon proof mass with four silicon tethers. The proof mass is 200 $\mu$m x 200 $\mu$m x 100 $\mu$m, length and width of the tethers are 200 $\mu$m and 5 $\mu$m, and thickness of the tether is 1 $\mu$m. Assume that Young’s modulus of silicon is 160 GPa. This is used as an accelerometer and it is designed in such a way that applied acceleration/deceleration pulls the plate up/down. Calculate the effective spring constant in the direction of acceleration. And calculate the amount of displacement at the center point of the proof mass with 10g acceleration.
5. Consider a torsional spring in a micro-mirror. The micro-mirror is tethered by two torsional springs. Both micro-mirror and tethers are made of aluminum. Two tethers are fixed at the end. The length of tether (L) is 100 µm, thickness (t) is 1 µm, and width is 5 µm. Assume that aluminum’s Young’s modulus is 70 GPa and Poisson’s ratio is 0.33. The micro-mirror tilted in the direction into the page. Find its torsional spring constant of the micro-mirror. **Do not use equation (4.30) in the book. Instead, use the equation in the slide.**