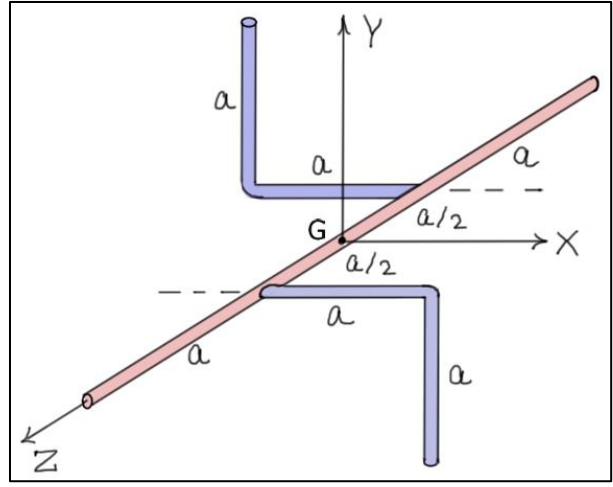
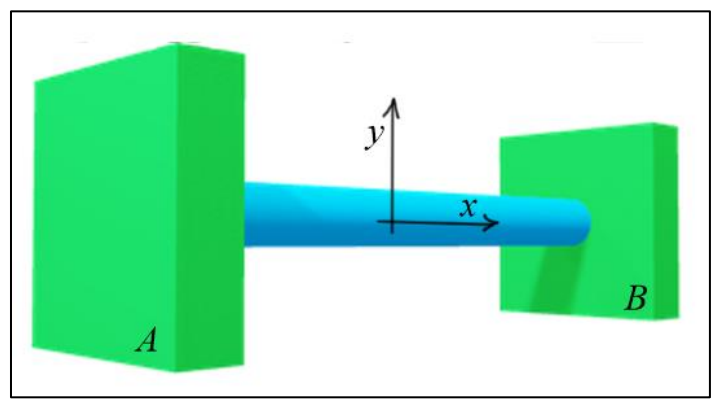
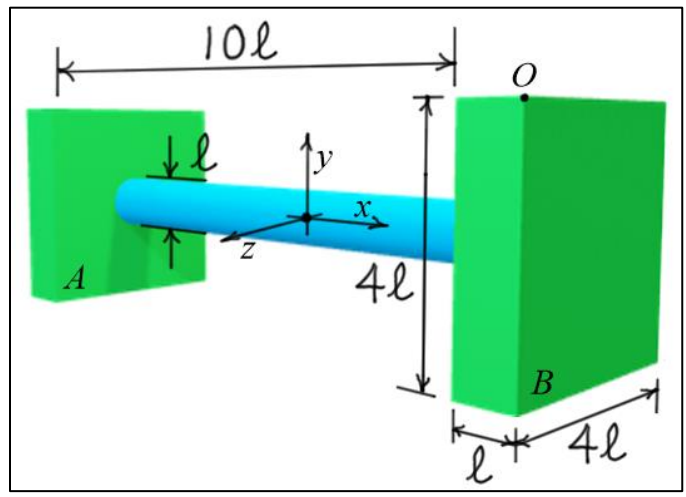


ME 6590 Multibody Dynamics
Exercises #5

- The body shown consists of two L-shaped arms welded to a straight rod. The straight segment has length $3a$, and each segment of the L-shaped arms has length a . Each segment of length a has mass m . All segments are slender.
 - Find the *principal moments of inertia* and the *principal directions* for the mass-center G .
 - Show that the eigenvector (or modal) matrix found in part (a) diagonalizes the inertia matrix.



- The figures below show two views of a body with a central cylindrical section and two identical, box-like ends. The central cylindrical section has a diameter of ℓ and length of 10ℓ . The box-like ends have two square sides (length and width equal to 4ℓ) and a depth of ℓ . The cylinder has mass m and the box-like ends each have mass $2m$, so the total mass of the composite shape is $5m$. Find the *principal moments of inertia* and the *principal directions* for the point O .



Note: In each of the problems, the eigenvalue and eigenvector calculations can be done using MATLAB.

Helpful Observations:

- If α is an arbitrary scalar, and if λ is an eigenvalue of matrix $[A]$, then $\alpha\lambda$ is an eigenvalue of matrix $\alpha[A]$.
- If α is an arbitrary scalar, and if \underline{x} is an eigenvector of matrix $[A]$, then \underline{x} is also an eigenvector of matrix $\alpha[A]$ corresponding to the eigenvalue $\alpha\lambda$.