Assignment 4

Problem 4.1. Determine the mass moment of inertia of a solid sphere about an axis through its center and perpendicular to its circular face. Express your answer in terms of the radius R and the mass M of the sphere.

Solution:

Consider a sphere with radius R and mass M. We can use the parallel axis theorem to find the moment of inertia about an axis through its center and perpendicular to its circular face. The moment of inertia of a sphere about its center is given by

\[ I = \frac{2}{5} MR^2 \]

The parallel axis theorem states that the moment of inertia about an axis parallel to the center axis and offset by a distance d is given by

\[ I = I_{cm} + Md^2 \]

In this case, the offset distance d is zero, so the moment of inertia remains the same.

Therefore, the moment of inertia of a solid sphere about an axis through its center and perpendicular to its circular face is

\[ I = \frac{2}{5} MR^2 \]