Answer on Question #79347, Classical Mechanics

Question. A plate with M mass and R radius, is rotating if i place an obstacle with m mass and in r distance from center of the plate what will be the rotational motion?

Solution

For a plate of radius *r* and mass *m* the mass moment of inertia

$$I_0 = \frac{1}{2}MR^2$$

For a point mass

$$I = mr^2$$

According to the law of conservation of angular momentum

$$I\omega = const$$

We have

$$\frac{1}{2}MR^2 \cdot \omega_1 = \left(\frac{1}{2}MR^2 + mr^2\right) \cdot \omega_2 \ \rightarrow \ I_0 \cdot \omega_1 = (I_0 + I) \cdot \omega_2 \ \rightarrow$$

$$\omega_2 = \frac{I_0}{I_0 + I} \cdot \omega_1$$

So, ***the angular velocity will decrease.***