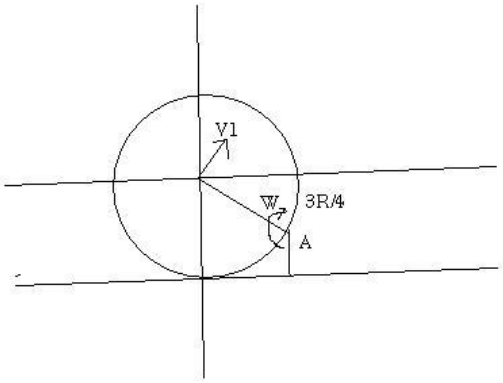
Answer on Question#39724, Physics, Mechanics

A disc of mass M and R radius is rolling purely wide center of velocity v on a flat surface, then it hits a step in the floor of height R/4. The corner of step is sufficiently rough to prevent any slipping of disc against itself. What is the velocity of center of disc just after the impact?

Solution



Initially it is purely rotating, so

$$\omega = \frac{v}{R}.$$

Initial angular momentum about point A:

$$L_i = I\left(\frac{V_0}{R}\right) + MV_0\left(\frac{3R}{4}\right) = \frac{\mathrm{MR}V_0}{2} + \frac{3}{4}\mathrm{MR}V_0 = \frac{5}{4}\mathrm{MR}V_0.$$

Just after the impact sphere start rotating about point A:

$$L_f = MV_1R.$$

So according to the conservation of angular momentum law:

$$\frac{5}{4}\mathrm{MR}V_0 = MV_1R,$$

and

$$V_1 = \frac{5}{4}V_0.$$