Answer on Question #58660-Physics-Classical Mechanics

A horizontal disk is rotating counter-clockwise about its axis of symmetry at 14 rps. Its rotational inertia with respect to its axis of symmetry is 8 kg m2. A second disk, of rotational inertia 2 kg m2 with respect to its axis of symmetry, rotating clockwise about the same axis at 7 rps, is dropped on top of the first disk. The two disks stick together and rotate as one about their common axis of symmetry. What is the angular velocity of the system?

Solution

The angular momentum is conserves:

$$\overrightarrow{L_1} + \overrightarrow{L_2} = \vec{L}$$

$$I_1\omega_1 - I_2\omega_2 = (I_1 + I_2)\omega$$

The angular velocity of the system is

$$\omega = \frac{I_1\omega_1 - I_2\omega_2}{(I_1 + I_2)} = \frac{8 \cdot 14 - 2 \cdot 7}{(8 + 2)} = 9.8\, rps\ counter - clockwise.$$

Answer: $9.8\ rps\ counter - clockwise$.