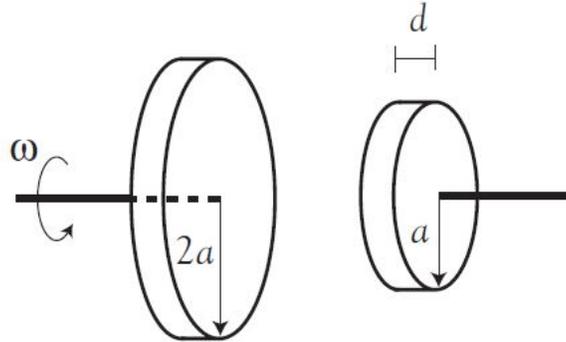


**QP41**

Two wheels are mounted on collinear frictionless shafts, initially without touching. The first wheel turns with angular velocity  $\omega$  while the second wheel is stationary. Both wheels are uniform disks of thickness  $d$  and density  $\rho$ . The radii of the wheels are  $2a$  and  $a$  respectively.



- a) (1 point) Express the moment of inertia of each wheel in terms of  $a$ ,  $\rho$  and  $d$ . What is the ratio of the two moments of inertia?

Now imagine that the shafts are slowly moved until the two wheels come into contact. The axes of rotation remain collinear throughout. After a while, an equilibrium is achieved and the wheels turn without their surfaces slipping.

- b) (2 points) Compute the final angular velocity of the second wheel in terms of  $\omega$ .
- c) (1 point) Is the kinetic energy of rotation conserved? Explain.