

7.24. Two discs of moments of inertia I_1 and I_2 about their respective axes and rotating with angular speed ω_1 and ω_2 are brought into contact face to face with their axes of rotation coincident.

- a) does the law of conservation of angular momentum apply to the situation? why?
- b) find the angular speed of the two-disc system
- c) calculate the loss in kinetic energy of the system in the process
- d) account for this loss

Answer:

a) The law of conservation of angular momentum can be applied as there is no external torque on the system and the gravitational and its normal reaction towards the external forces have net torque zero.

b) Using law of conservation of angular momentum,

$$L_f = L_i$$

$$I_1 \omega_1 + I_2 \omega_2$$

$$\omega = I_1 \omega_1 + I_2 \omega_2 / I_1 + I_2$$

c) Final kinetic energy = rotational + translation energy

$$K_f = KE_R + KE_T$$

$$\Delta K = -I_1 I_2 / 2(I_1 + I_2) (\omega_1 - \omega_2)^2 < 0$$

d) $K_f < K_i$ as there is lose in energy during friction between the moving surfaces.