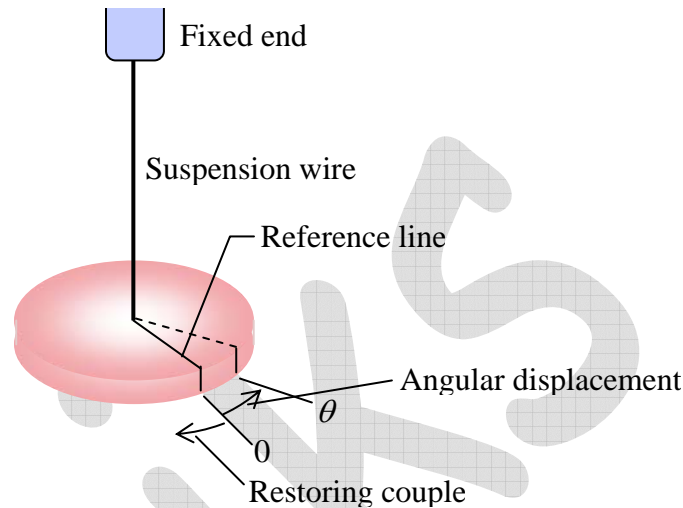


(e) The Torsional Pendulum

A torsional pendulum consists of a heavy body such as a disc or cylinder hung by a long and thin vertical wire from a rigid support. If the disc is turned in the horizontal plane and then released, due to wire elasticity, it executes a torsional oscillation about the wire as an axis.



If the disc is turned by an angle θ , the wire is also twisted by the same angle. A restoring torque ($-\tau\theta$) is produced which brings the pendulum back to its original position. If I is the moment of inertia of the disc about the wire, then the torque acting on the disc must be equal to the product of the moment of inertia I and the angular acceleration.

Thus,
$$\frac{d^2\theta}{dt^2} = -\tau\theta \Rightarrow \frac{d^2\theta}{dt^2} = -\frac{\tau}{I}\theta$$

The time period of the oscillation is
$$T = 2\pi\sqrt{\frac{I}{\tau}}$$