Mechanical Vibration I (4)

Department of Mechanical and Control Engineering

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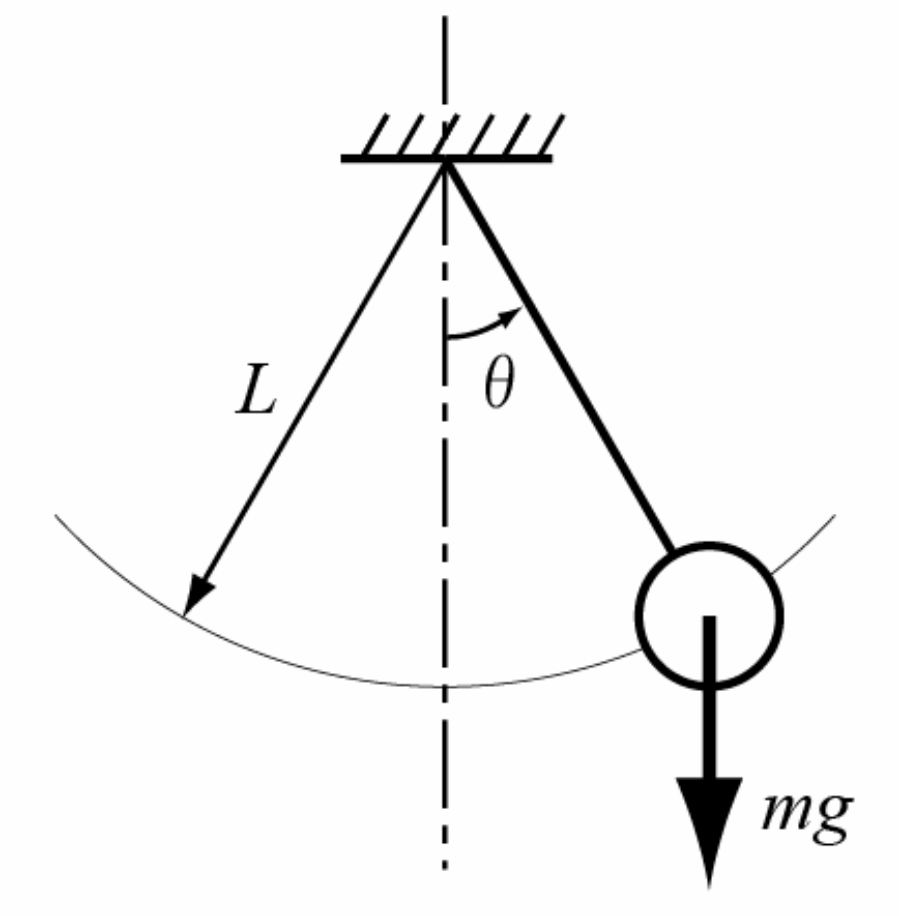
Pendulum and Equivalent Stiffness in Torsional Vibration System

Pendulum (1)



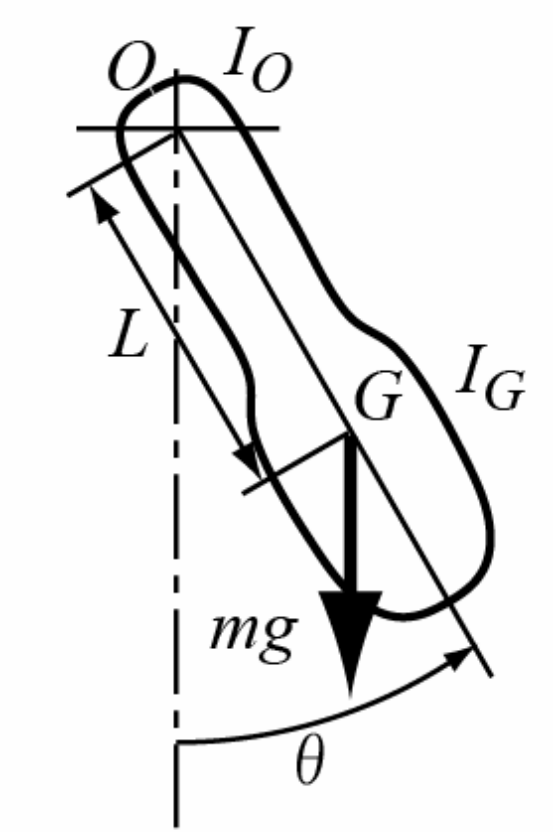
Simple pendulum

$$mL^2\ddot{\theta} + mgL\sin\theta = 0$$

$$\sin\theta \approx \theta$$

$$\ddot{\theta} + \frac{g}{L}\theta = 0$$

Pendulum (2)



Physical pendulum

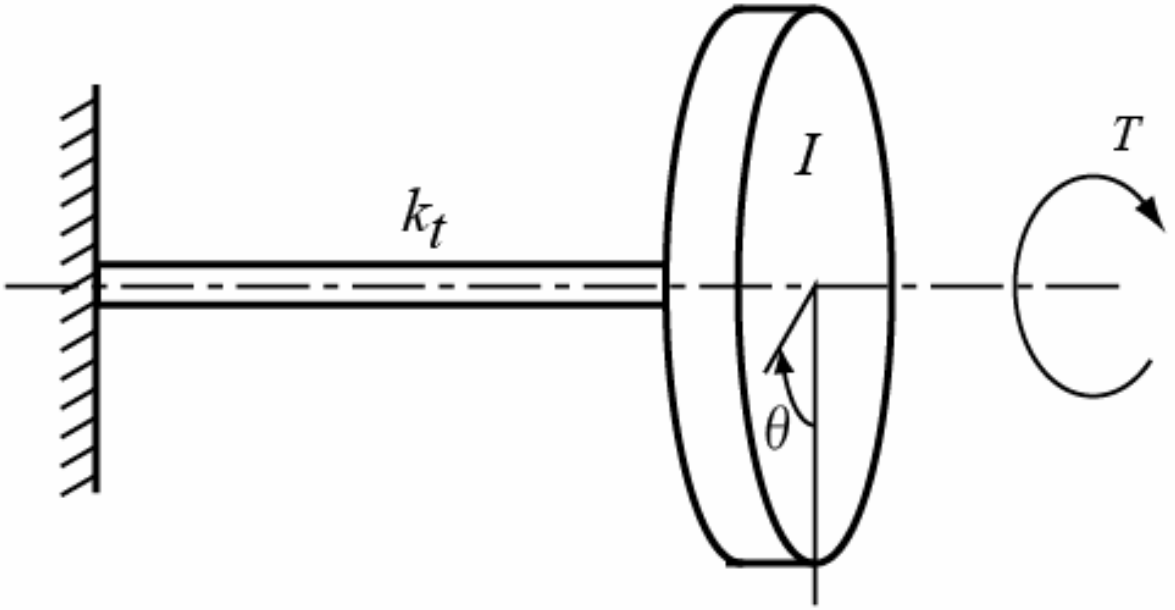
$$I_O\ddot{\theta} + mgL\sin\theta = 0$$

$$\sin\theta \approx \theta$$

$$\ddot{\theta} + \frac{mgL}{I_O}\theta = 0$$

$$\ddot{\theta} + \frac{mgL}{I_G + mL^2}\theta = 0$$

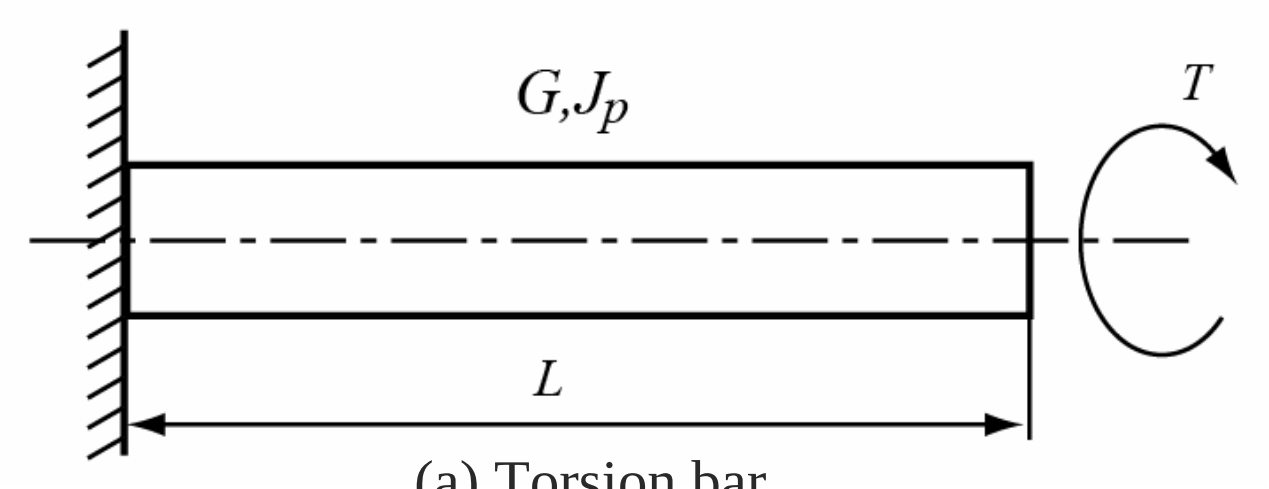
Torsional vibration system (1)



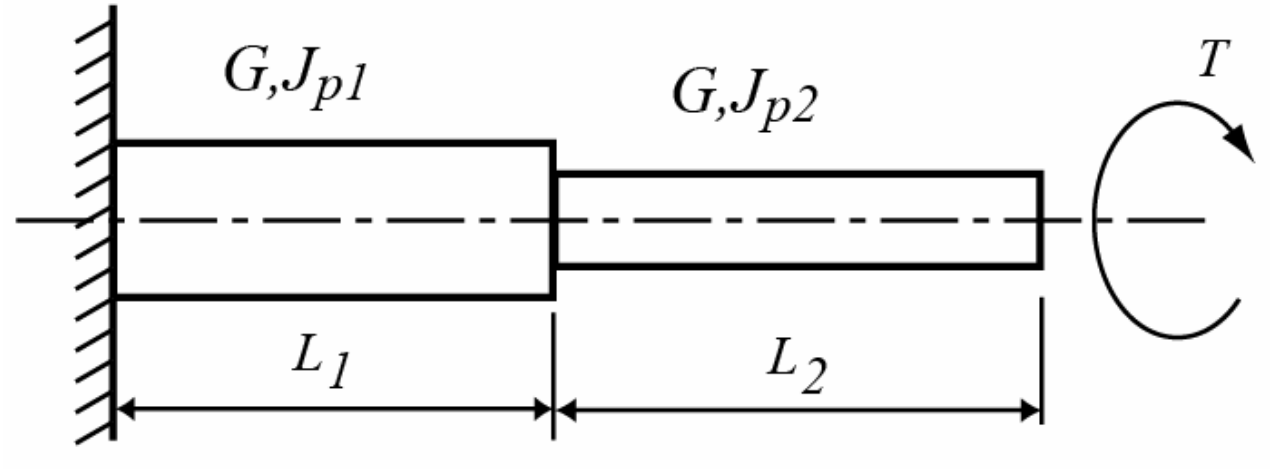
Torsional vibration system

Equation of Motion $$I\ddot{\theta} + k_t\theta = T$$

Torsional vibration system (2)

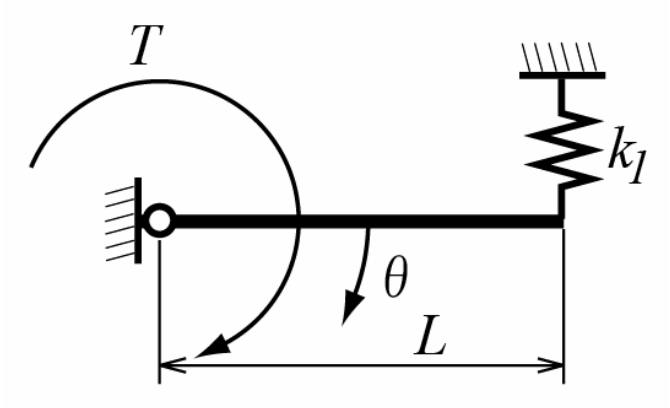


(a) Torsion bar

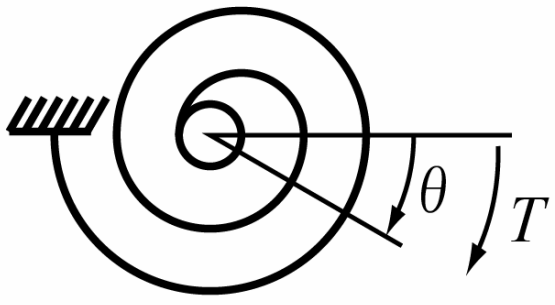


(b) Stepped torsion bar

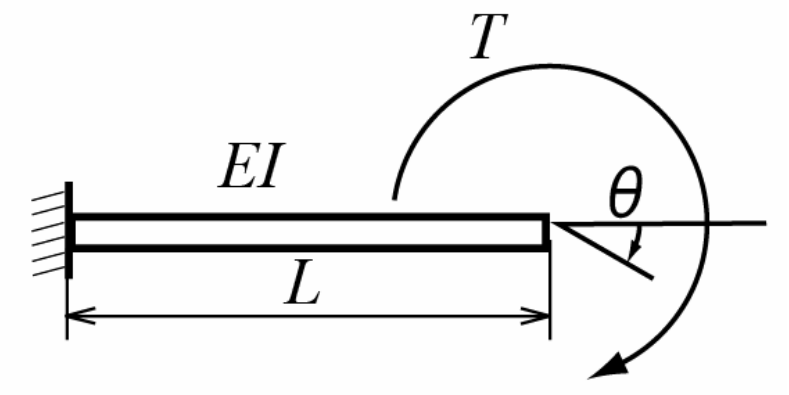
Torsional vibration system (3)



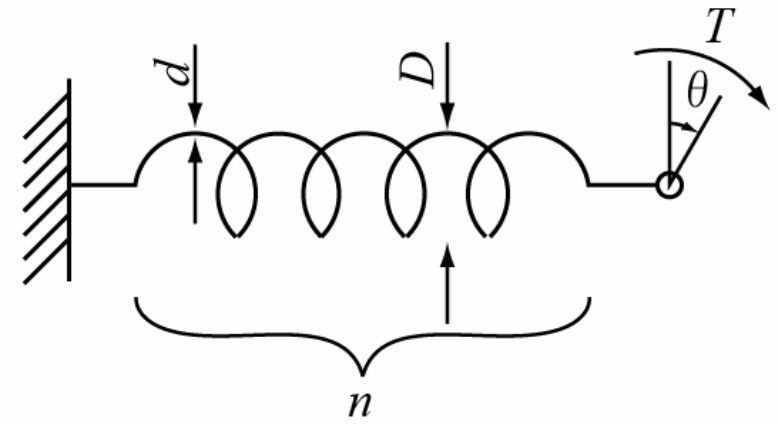
(c) Lever-spring



(d) Spiral spring



(e) Cantilever



(f) Coil spring