

flying cable

A flexible cable of length L which weighs $M \text{ kg m}^{-1}$ hangs over a pulley of negligible mass, radius, and friction. Initially, the cable is just balanced. It is given a slight push to unbalance it, and it proceeds to accelerate. Find its speed as the end flies off the pulley.

Solution by Gabriel Lombardi

This problem can be solved by using conservation of energy. The center of mass of the cable falls a distance $L/4$, as show in the figure.

The loss in gravitational potential energy equals the gain in kinetic energy:

$$Mg \frac{L}{4} = \frac{1}{2} Mv^2$$

Solving for v :

$$v = \sqrt{\frac{gL}{2}}$$

