

## Oscillation of a rectangular block on a fixed cylinder

<http://mpec.sc.mahidol.ac.th/ipho2011/node/150>

A hard rubber cylinder of radius  $R$  is held fixed with its axis horizontal, and a uniform rectangular block of mass  $M$ , length  $b$  and height  $H$  is balanced on top of the cylinder, with its centre vertically above the cylinder's axis and four of its sides parallel to the axis. Assume that the block does not slip on the cylinder but can rock from side to side.

- (a) Find the frequency of small oscillation of the block on the cylinder.
- (b) If the angle of oscillation is too large the block will slide off the cylinder. How large can the angle of oscillation be before the block slides off the cylinder?
- (c) Also, if the height  $H$  of the block is too large, no oscillation can occur. Find the condition that the oscillation can occur. The coefficient of static friction between the block and the cylinder is  $\mu_s$ .