

## Problem 4.68 (In Excel)

A free jet of water with constant cross-section area  $0.005 \text{ m}^2$  is deflected by a hinged plate of length  $2 \text{ m}$  supported by a spring with spring constant  $k = 1 \text{ N/m}$  and uncompressed length  $x_0 = 1 \text{ m}$ . Find and plot the deflection angle  $\theta$  as a function of jet speed  $V$ . What jet speed has a deflection of  $10^\circ$ ?

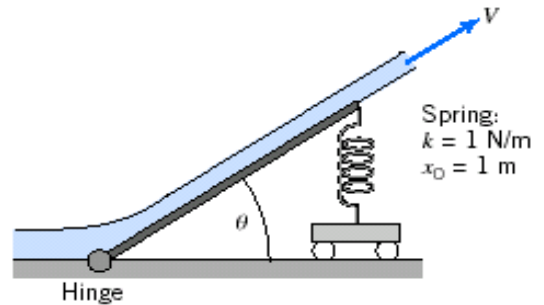
Given: Geometry of system

Find: Speed for angle to be  $10^\circ$ ; plot angle versus speed

### Solution

The equation for  $\chi$  is  $\chi = \arcsin\left(\frac{k x_0}{\rho A V^2 L}\right)$

- $\rho = 999 \text{ kg/m}^3$
- $x_0 = 1 \text{ m}$
- $L = 2 \text{ m}$
- $k = 1 \text{ N/m}$
- $A = 0.005 \text{ m}^2$



To find when  $\theta = 10^\circ$ , use *Goal Seek*

$V \text{ (m/s)}$	$\theta \text{ (}^\circ\text{)}$
0.867	10

$V \text{ (m/s)}$	$\theta \text{ (}^\circ\text{)}$
0.0	30.0
0.1	29.2
0.2	27.0
0.3	24.1
0.4	20.9
0.5	17.9
0.6	15.3
0.7	13.0
0.8	11.1
0.9	9.52
1.0	8.22
1.1	7.14
1.2	6.25
1.3	5.50
1.4	4.87
1.5	4.33

