

# X-pendulum study

Charles R Patton

charles.r.patton@iecc.org

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Most equations from "Ultralow frequency oscillator using a pendulum with crossed suspension wires" by Mark A. Barton and Kazuaki Kuroda in Rev. Sci. Instrum. 65 (12), December 1994, pg. 3775-3779

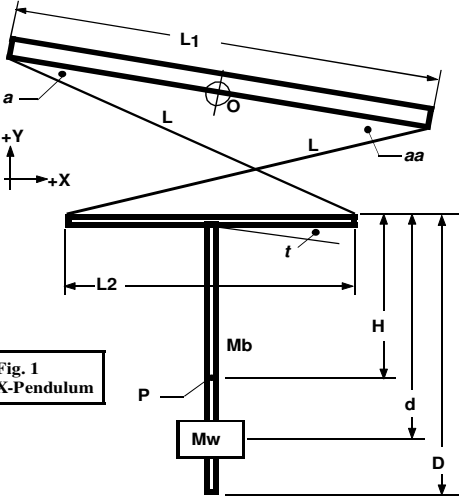


Fig. 1 X-Pendulum

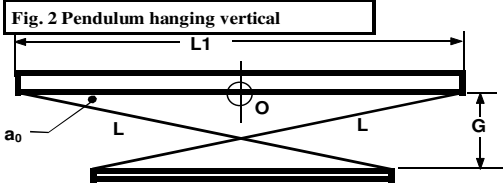


Fig. 2 Pendulum hanging vertical

Fig. 3 Find a0 and L given L1, L2 and gap G

$$a_0 = \arctan\left(\frac{2G}{L_1 + L_2}\right)$$

$$L = \frac{L_1 + L_2}{2 \cos a_0}$$

Fig. 4 Find where locus of P is horizontal G

$$W = \frac{2L \cos^2 a_0 - L_2 \cos a_0}{L_2 \sin a_0}$$

$$H_{horizontal} = \frac{L_2^2 (W \cos a_0 - \sin a_0)}{4L \cos^2 a_0} = \frac{L_2}{4L \sin a_0} \left( 2L \cos a_0 - \frac{L_2}{\cos^2 a_0} \right)$$

INPUTS:

2
2
2

L1  
L2  
G

various combinations:

2  
2  
2

3  
2  
2

1  
2  
2

2  
2  
1

2  
2  
3

0  
2  
2

RESULTS:

0.785398
2.828427
1
2.22E-16

a0  
L  
W  
H

0.785398  
2.828427  
1  
2.22E-16

0.674741 0.927295  
3.201562 2.5  
1.875 0.375  
0.43 -0.638889

0.463648 0.982794  
2.236068 3.605551  
2 0.666667  
0.75 -0.416667

1.107149  
2.236068  
6.21E-17  
-2