Slider Crank Mechanism

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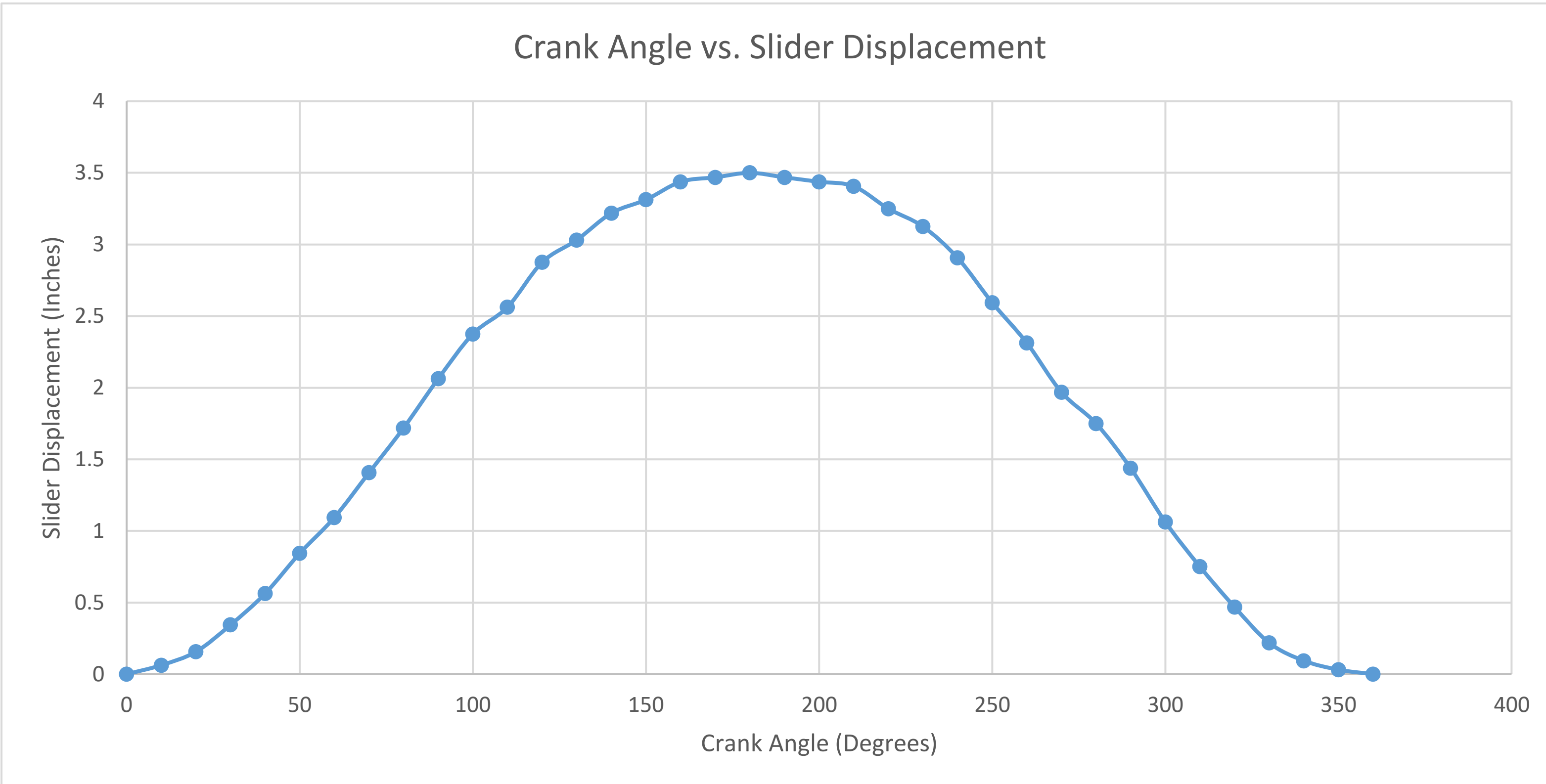
Objective

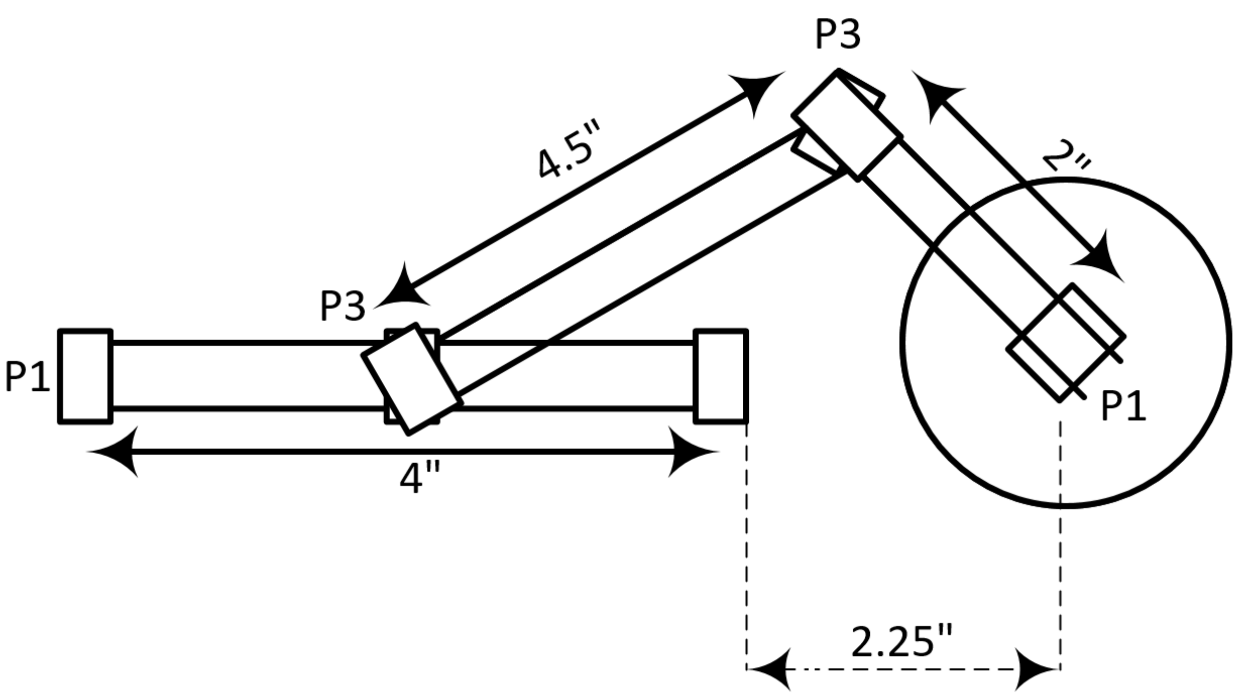
In this laboratory exercise we constructed a slider crank mechanism, which is a system of part, that has the capability of transforming uniform rotational motion of the crank to a linear reciprocating motion of the slider and vice versa. After constructing said mechanism, we proved that the slider stroke was directly proportional to the length of the crank. Through analysis of collected data, we were able to determine that the slider stroke was equivalent to the crank length multiplied by two. Additionally we determined the positions of which the slider would experience its maximum and minimum velocities & accelerations.

Data

Crank Angle (Degrees)	Slider Displacement (Inches)	Crank Angle (Degrees)	Slider Displacement (Inches)
0	0	190	3.46875
10	0.06	200	3.4375
20	0.15625	210	3.40625
30	0.34375	220	3.25
40	0.5625	230	3.125
50	0.84375	240	2.90625
60	1.09375	250	2.59375
70	1.40625	260	2.3125
80	1.71875	270	1.96875
90	2.0625	280	1.75
100	2.375	290	1.4375
110	2.5625	300	1.0625
120	2.875	310	0.75
130	3.03125	320	0.46875
140	3.21875	330	0.21875
150	3.3125	340	0.09375
160	3.4375	350	0.03125
170	3.46875	360	0
180	3.5		



Crank Angle vs. Slider Displacement
Slider Displacement (Inches)
Crank Angle (Degrees)
0
0.5
1
1.5
2
2.5
3
3.5
4
0
50
100
150
200
250
300
350
400



P3
4.5"
2"
P3
P1
P1
4"
2.25"

Questions

1.

Link Lengths (Inches) vs. Stroke (Inches)			
	Crank	Coupler	Stroke
1	1.625”	4.625”	3.25”
2	1.5”	4.6875”	3”

By observation of the data collected in relation to the link lengths and strokes, one may deduce that the stroke observed in this slider crank mechanism is twice the length of the crank.

2. One may deduce the length of the crank & coupler, if given the length of the slider stroke and the total length of the crank & couple via simple algebraic manipulation as shown below using our knowledge of slider crank mechanism characteristics as shown below:

$$Slider\ Stroke = 2 \times Crank$$

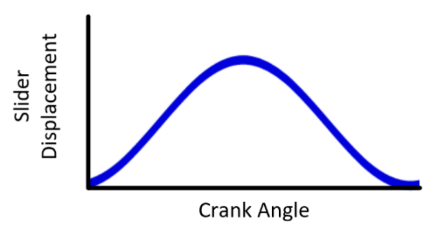
$$Crank = \frac{Slider\ Stroke}{2}$$

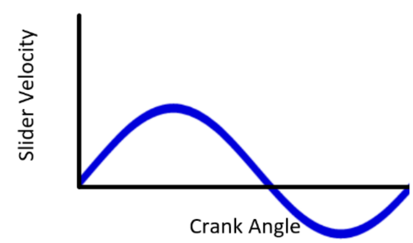
$$[Crank + Coupler] - Crank = Coupler$$

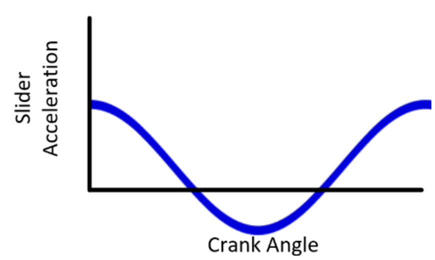
$$[Crank + Coupler] - \frac{Slider\ Stroke}{2} = Coupler$$

3. The resulting graph from the experiment resembles a sinusoidal function and may be represented as the function y= 1-cos(x), with slight variations with given parameters, when needed.

4. The slider will experience maximum linear velocity at the same time where the slope is greatest in the [Slider Displacement v. Crank Angle] graph & where the slope the least and negative in the [Slider Acceleration v. Crank Angle]. The slider will also experience maximum acceleration in the instant of time where the slope of the [Slider Velocity v. Crank Angle] is greatest. This conclusion is plausible due to the relationship between displacement, velocity, & acceleration.







Conclusion

In this laboratory experiment, we learned to utilize various pivots to construct a slider crank mechanism. In addition, we studied the characteristics of a slider crank mechanism, such as the proportional relationship between the crank and slider stroke. By observation of collected data in the displacement of the slider crank with respect to the crank angle, we were able to deduce points of maximum acceleration and velocity as well as their resembling sinusoidal waveform with respect to their corresponding graphical representations.