1) Modify your Working Model (WM) slider crank simulation as detailed below and on the following page. Attach a screen shot of your WM mechanism. Be certain to shift the centroid for link 3.
   a) Use a motor to drive the crank at constant 1000 rpm for R = 0.985 inch and L = 4.33 inch.
   b) Use a statically balanced crank (G$_2$ at A).
   c) Modify your connecting rod and piston to use inertial data from H10.

m_3 ___0.462 lbm___ BG_3 ___1.043 inch___ J_{G3} ___1.5 lbm.in^2___ m_4 ___0.781 lbm___

2) Plot crank torque as a function of crank angle from your WM simulation and from the two-mass equivalent link approximation on the same MATLAB graph.

m_{3B} _____ m_{3C} _____

3) Plot shaking force with $F_{21}{}^X$ on the x axis and $(F_{21}{}^Y + F_{41}{}^Y)$ on the y axis from your WM simulation and the two-mass equivalent link approximation on the same MATLAB graph.

4) Add a counter balance mass at radius R to the crank equal to m_{3B} and repeat part 3) above. Use the same scale as part 3).

5) Adjust your counter balance mass to minimize the maximum shaking force and repeat part 3) above. Use the same scale as part 3).

m_{BAL} _____ F_{S_MAX} _____

EXTRA CREDIT
Add a second piston and connecting rod to model the two cylinder in-line air compressor demonstrated in class. Plot shaking force from your WM simulation and the two-mass equivalent link approximation on the same MATLAB graph. Use the same scale as part 3). Attach a screenshot of your mechanism.

WM dynamic analysis for slider crank

1) <u>World Gravity</u> - none

2) Select the Motor and then the <u>Split</u> button

3) Select the link that you used for your crank
    a) Change the link length to 1.97 inches
    b) Move point A to the center so that AB = R = 0.985
    c) Select the <u>Join</u> button
    d) Add a square point to the left end of the Crank

4) Select the Con Rod
    a) <u>Window Properties</u> - change mass and mass moment
    b) <u>Window Appearance</u> – show COM
    c) <u>Window Geometry</u> – change COM x-offset

5) Select the Piston - <u>Window Properties</u> - change mass

6) Select the Crank – <u>Measure Position Rotation Graph</u>

7) Select the Piston – <u>Measure Acceleration X Graph</u>

8) Select the Motor
    a) <u>Measure Torque Transmitted</u>
    b) <u>Measure Force</u>

9) Select the square point for piston slider constraint – CANNOT measure force

10) Select wrist pin between Con Rod and Piston – <u>Measure Force</u>

11) <u>Run</u> and then <u>Export</u>

12) Create a small circular object for counter balance mass
    a) Place a square point at its center
    b) <u>Window Properties</u> - change mass
    c) Select the square point on the over-balance mass
    d) Hold down the Shift Key and also select the square point on the left end of the Crank
    e) Select the <u>Join</u> button