UNIVERSITY OF WINDSOR
DEPARTMENT OF MECHANICAL, AUTOMOTIVE AND MATERIALS ENGINEERING
COURSE MECH-3223, MACHINE DYNAMICS
- PROJECT -

Date: November 3rd, 2023
Due: 4:30pm on November 28th, 2023

Using MATLAB, Maple, Mathcad or any other software package approved by the course instructor conduct a dynamic force analysis for the opposed two-cylinder crank/connecting rod/slider arrangement illustrated in Figure 1. All calculations (whether numerical or symbolic) must be completed and illustrated in your submission. A kinematic and kinetic analysis must be completed within the solution and results must be illustrated in graphical format. Additionally, also complete an analysis of the system using the analytical equations developed in MECH-3223 to determine the out-of-balance forces.

Important parameters which should be determined are:
1) Angular velocities of all linkages.
2) Angular accelerations of all linkages.
3) Forces which are transmitted through the machinery.
4) The input torque necessary for the constant angular velocity prescribed to the crank.
5) The out-of-balance forces arising from the prescribed angular velocity of the crank.

The above calculated parameters should be graphically illustrated as functions of time. The time duration of the analysis of the system should encompass two complete revolutions of the crank.

Values within Table 1 can be used as initial input to your analysis, however, your solution should also be able to consider changes to the following:
1) Mass of the crank.
2) Mass of the connecting rods (assumed to be the same for each cylinder).
3) Mass of the pistons (assumed to be the same for each cylinder).
4) The prescribed constant angular velocity of the crank.
5) The length of the crank.
6) The length of the connecting rods (assumed to be the same for each cylinder).

Assume that each linkage is a slender rod, neglect gravity, and friction. Further assume that all motion occurs in a common plane. Make and state any other assumptions you feel necessary in your solution.

Ensure your solution report is sufficiently documented so that the analysis process can be understood, you should discuss any differences which arose from the different methods of analysis.

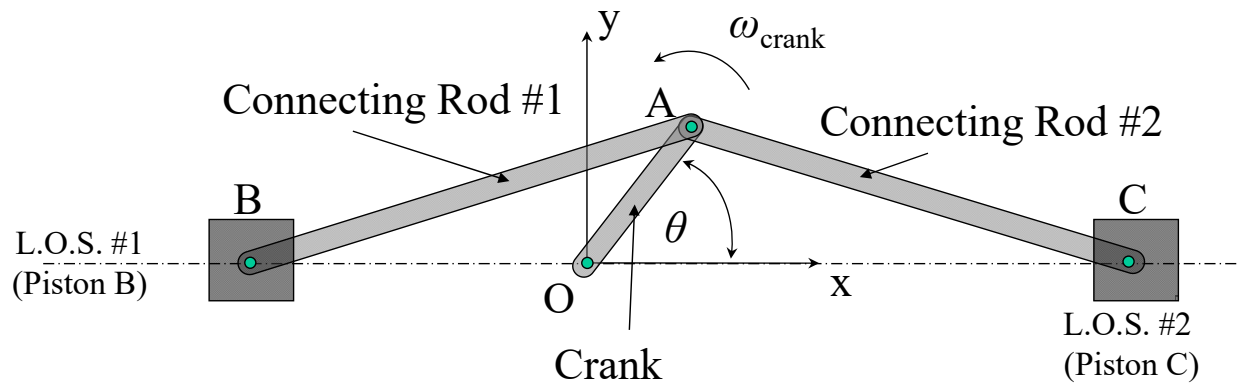

Figure 1

Table 1 – system parameters for your possible use

System Parameter	Value (with units)
Mass of piston (per cylinder)	0.78 kg
Mass of connecting rod (per cylinder)	0.62 kg
Mass of crank	0.98 kg
Constant angular velocity of crank	5500 rpm
Length of crank (crank radius)	10.16 cm
Length of connecting rod (per cylinder)	44.19 cm