ME70

Introduction to the Kinematics of Mechanical Systems

Winter Term, 1999

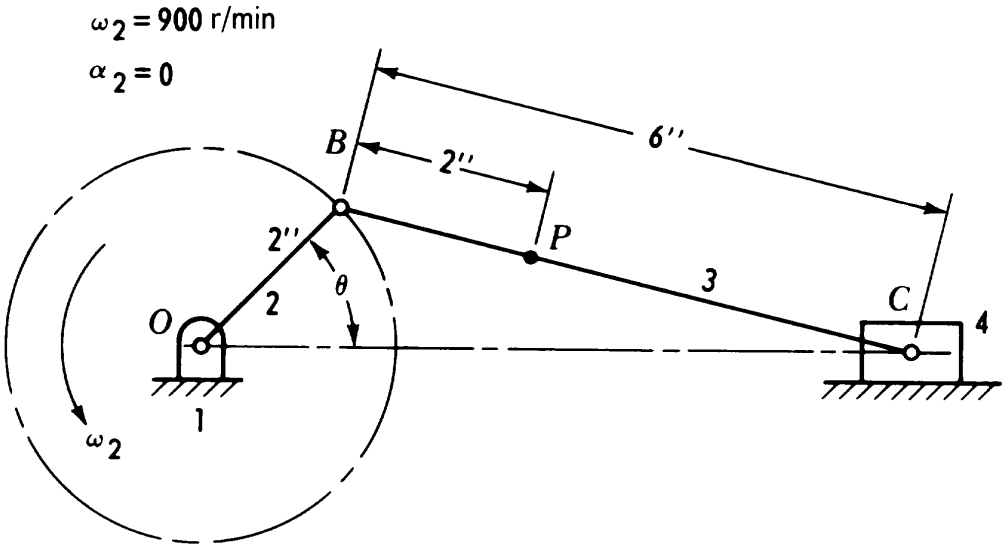
Assignment #4

(2 problems)

Assigned: Thursday February 10, 1999

Due: Thursday February 25, 1999

1. Use Complex analysis and a computer to Print *and* Plot piston (slider) velocity and acceleration every 5° of crank angle (θ_2) for the Figure below.
   Note: $L/r = 3$, $\omega_2 = 900$ revolutions/minute, $\alpha_2 = 0$.
   Compare to the approximate trigonometric method given in class.
   Repeat the comparison for a connecting rod length of 4 inches ($L/r = 2$).
   A good check: Print the Imaginary acceleration of the slider. It should be zero at all times.



http://robby.caltech.edu/∼jwb/courses/ME70/ME70.html

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2. Design two (2) cams with cycloidal rise and fall (no infinite jerk):

   (a) One with a Flat faced follower,

   (b) The other with a Roller follower (Roller Radius: $R_f = 1.0$ cm).

   The following parameters apply to both cams:

   - Rise 1.0 cm in 180°
   - Dwell 30°
   - Fall 1.0 cm in 120°
   - Dwell 30°
   - $\omega = 1000$ rpm
   - $R_b = 5.0$ cm

   Make the following calculations and plots for both cams:

   (a) Find maximum "slip" velocity (perpendicular to follower motion).

   (b) Find maximum follower acceleration: $\frac{d^2S}{dt^2}$

   (c) Find the Pitch Curve ($R_b + S(\theta)$), Tabulate and Polar Plot

   (d) Find the Cam Surface, Tabulate and Polar Plot

   (e) Find the Pressure Angle:
   $\eta(\theta)$ for the Flat faced follower; $\phi(\theta)$ for the Roller follower,
   Tabulate and Cartesian Plot η vs. θ; ϕ vs. θ

   All Tabulations are to be in 10° increments.
   Plots can be made with smaller angular increments (perhaps 1°) to produce smooth curves.
   Have the computer print your name on each page of output.
   Turn in a printout of your source code with your name in comments at the top.