



Computer Oriented Problem (COP2)

Due Date: 1403/03/28

Engineering Mechanics: Dynamics

University of Tehran | School of Mechanical Engineering



A motor is attached to joint O_2 of the mechanism below. This motor exerts a torque on link O_2B to rotate it with constant angular speed of 1 rad/s . Slider A can only move toward link O_1B and slider C can only move in horizontal direction. Determine the following parts for one complete revolution of link O_2A ($0 \leq \theta_2 \leq 2\pi$).

$$\overline{O_1O_2} = 12 \text{ m}, \quad \overline{AO_2} = 5 \text{ m}, \quad \overline{BO_1} = 32 \text{ m}, \quad \overline{BC} = 16 \text{ m}, \quad (\overline{CO_1})_y = 32 \text{ m}$$

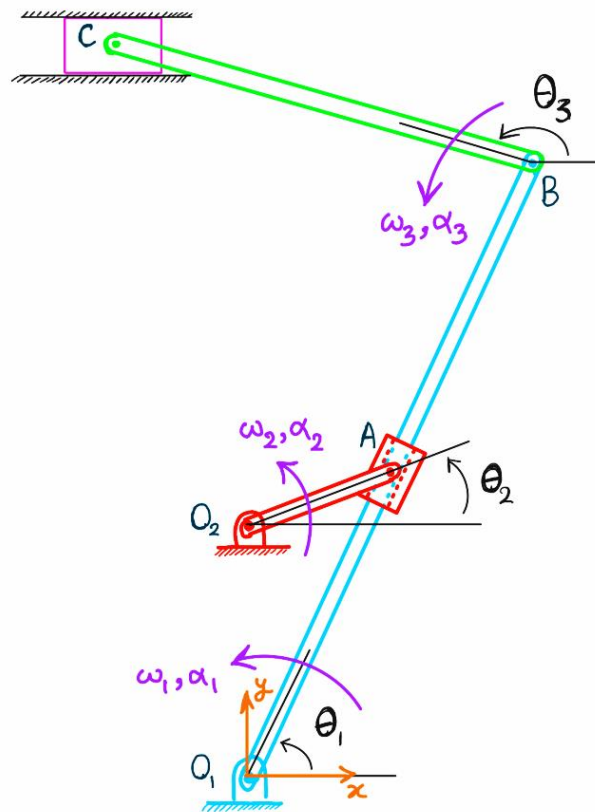


Figure 1: Main mechanism

- a) (20 points)** Find parametric relations for θ_1 and θ_3 as a function of θ_2 and plot them relative to time. It is recommended to use “vpasolve” function in MATLAB for solving non-linear equations. Be sure to determine a valid range for output to get correct answers.
Example: `vpasolve(equations, unknowns, [Upper limits Lower limits])`
- b) (35 points)** Determine and plot ω_1 , ω_2 , ω_3 and v_c relative to time. (**Hint:** Use the relations derived in part **a** and apply the kinematic relations for velocity of links to find equations.)
- c) (45 points)** Determine and plot α_1 , α_3 and a_c relative to time.

d) (Optional - 20 points) Simulate the mechanism in ADAMS software and compare the results with parts **b** and **c**. If there are differences, explain the reasons.

e) (Optional - 15 points) Plot the animation of mechanism in MATLAB by coding. (Hint: At first you will need to make a “for” loop to cover whole range of $[0, 2\pi]$ for θ_2 . Calculate nodes' positions using results of part **a**. Then plot the mechanism by connecting these nodes. After sketching mechanism for a special θ_2 , you will need to clear plot and change θ_2 in the next stage of loop. For this purpose, use “clf” function and add “pause(your needed time)” at the end of loop.)

Note: Use title and axis labels for your plots. Also, if it is needed, plot parameters with same dimension on one figure (for a better comparison) but don't forget to use legend. Give explanations about behavior of the figures and its reasons.

- Use following format for naming this assignment: Dynamics-COP2-[8106XXXXX]
- Attach MATLAB code as copyable text at the end of your pdf file. (Don't use screenshots!)