PROGRAMMING ASSIGNMENT
MS2111 KINEMATICS AND DYNAMICS OF MACHINERY
Semester 1, 2020/2021

Figure 1 shows a four-bar mechanism. The lengths of the crankshaft (link 2), coupler (link 3), and rocker (link 4) are L^2, L^3, and L^4, respectively. The crankshaft of the mechanism is assumed to rotate with a constant angular velocity ω^2. The initial orientation of the crankshaft is assumed to be θ_o^2. Please conduct the kinematics analysis of the four-bar mechanism below. You must write down all the matrix needed in the kinematics analysis in A4 papers and write the program in the MATLAB or Octave.

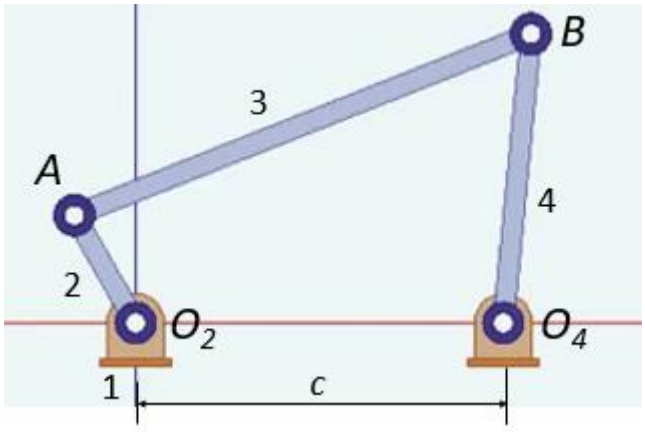

Figure 1 Four bar mechanism

The **input** of the program are the geometry or dimension of the mechanism and the angular velocity of link 2, as below:

$$L^2 = 50 + \text{XYZ}\ [mm] \qquad L^4 = 1.5L^2$$
$$L^3 = 2L^2 \qquad c = 1.7L^2$$

$$\omega^2 = \begin{cases} 15\ \dfrac{rad}{s} & \text{if XYZ is odd number} \\ 30\ \dfrac{rad}{s} & \text{if XYZ is even number} \end{cases}$$

$$\theta_o^2 = \frac{\pi}{4}\ rad$$

where:
L^2 : length of link 2
L^3 : length of link 3
L^4 : length of link 4
c : distance between O_2 and O_4
ω^2 : angular velocity of link 2
θ_o^2 : initial angle of link 2
XYZ : last three digits of your NIM, i.e. 13119XYZ

The expected **output** are the plot of:

1. Trajectory of joint A $(r_{A,x}^2 - r_{A,y}^2)$
2. Trajectory of joint B $(r_{B,x}^3 - r_{B,y}^3)$
3. Angular velocity of link 3 vs. time, $(\omega^3 - t)$
4. Angular velocity of link 4 vs. time, $(\omega^4 - t)$
5. Angular acceleration of link 3 vs. time, $(\alpha^3 - t)$
6. Angular acceleration of link 4 vs. time, $(\alpha^4 - t)$

You may use the simulation time from 0 s to 2 s, t = 0 – 2 [s]

Submission and due date:

You should submit following documents or files:

1. All the matrices required in the kinematics analysis (e.g. constraint matrix, Jacobian matrix, etc.) in pdf file
2. The syntax of your program (with extension .m)
3. All the expected plots in .jpg or .png file.

Please submit all the documents or files in .rar or .zip extension to e-learning page or MSTeam channel of your each class before **Wednesday, 13 November 2020**.

Note: please study MATLAB or Octave by yourself.