Assignments

GROUP 1: The considered four-bar (R-RRR) planar mechanism is shown in Figure 1 below. The driver link is the rigid link 1 (the element AB) and the origin of the reference frame is at A. The following data are given: AB=0.150 m, BC=0.35 m, CD=0.30 m, CE=0.15 m, x_D=0.30 m, and y_D=0.30 m. The angle of the driver link 1 with the horizontal axis is $\varphi = \varphi 1 = 45°$. Find the positions of the joints and the angles of the links with the horizontal axis.

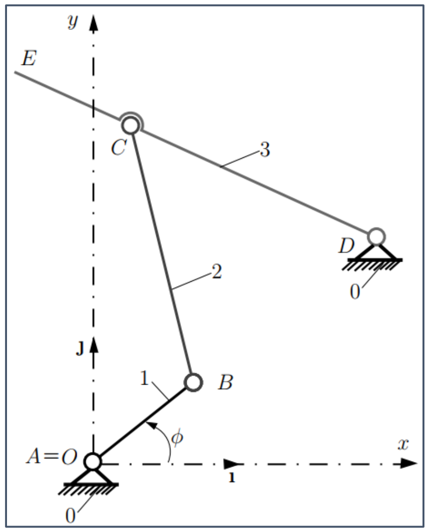

Figure 1:Four-bar (R-RRR) mechanism.

GROUP 2: Starting from a vector-loop closure equation of a four bar linkage shown in Figure 2 below, show that;

$K_1 \cos \theta_3 + K_4 \cos \theta_2 + K_5 = \cos \theta_2 \cos \theta_3 + \sin \theta_2 \sin \theta_3; c^2 - d^2 - a^2 - b^2$ **Eq.1**

Where; $\mathbf{K_1}= \frac{d}{a}$, $\mathbf{K_4} = \frac{d}{b}$, $\mathbf{K_5} = \frac{c^2-d^2-a^2-b^2}{2ab}$

Also show that Eq.1 above reduces to a quadratic equation of form;

$$\mathbf{D} \tan^2\frac{\theta_3}{2} + \mathbf{E} \tan\frac{\theta_3}{2} + \mathbf{F} = 0$$

Where; $D = (1 + K_4) \cos\theta_2 - K_1 + K_2$; $E = - 2\sin\theta_2$; $F = K_1 + (K4 - 1)\cos\theta_2 + K_5$

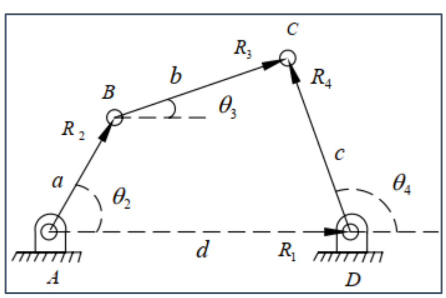

Figure 2:Position vector loop for a four-bar linkage.

(The sum of vectors in the loop is given by; $R_2 + R_3 - R_4 - R_1 = 0$)