4 Homework: Velocity and Acceleration Analysis

Part I

Problem 4.1: four-bar mechanism

The four-bar mechanism shown in Fig. P4.1 has the dimensions: AB=CD=0.04 m and AD=BC=0.09 m. The driver link AB rotates with a constant angular speed of 120 rpm. Find the velocities and the accelerations of the four-bar mechanism for the case when the angle of the driver link AB with the horizontal axis is ϕ=30°. For ϕ=30° the position of the mechanism is given by: x_B=0.034641 m, y_B=0.02 m, x_C=0.103859 m, y_C=-0.0375222 m, ϕ_2=-39.7274°, ϕ_3=-69.7274°.

Results

$\dot{x}_B$=-0.251327 m/s, $\dot{y}_B$=0.435312 m/s, $\ddot{x}_B$=-5.47029 m/s^2, $\ddot{y}_B$=-3.15827 m/s^2,
$\dot{x}_C$=-0.884619 m/s, $\dot{y}_C$=-0.32675 m/s, $\ddot{x}_C$=3.84741 m/s^2, $\ddot{y}_C$=25.1222 m/s^2,
ω_2=$\dot{\phi}_2$=-11.0095 rad/s, α_2=$\ddot{\phi}_2$=307.84 rad/s^2,
ω_3=$\dot{\phi}_3$=-23.5759 rad/s, α_3=$\ddot{\phi}_3$=307.84 rad/s^2.

Problem 4.2: slider crank mechanism

The slider crank mechanism shown in Fig. P4.2 has the dimensions: AB = 0.1 m and BC = 0.2 m. The driver link 1 rotates with a constant angular speed of n = 60 rpm. Find the velocity and acceleration of the slider 3 when the angle of the driver link with the horizontal axis is ϕ = 45°. For ϕ=45° the position of the mechanism is given by: x_B=0.0707107 m, y_B=0.0707107 m, x_C=0.257794 m, y_C=0 m, ϕ_2=-0.361367 rad.

Results

$\dot{x}_B$=-0.444288 m/s, $\dot{y}_B$=0.444288 m/s, $\ddot{x}_B$=-2.79155 m/s^2, $\ddot{y}_B$=-2.79155 m/s^2,
$\dot{x}_C$=-0.612213 m/s, $\dot{y}_C$=0 m/s, $\ddot{x}_C$=-2.94227 m/s^2, $\ddot{y}_C$=0 m/s^2,
ω_2=$\dot{\phi}_2$=-2.37482 rad/s, α_2=$\ddot{\phi}_2$=12.7898 rad/s^2.

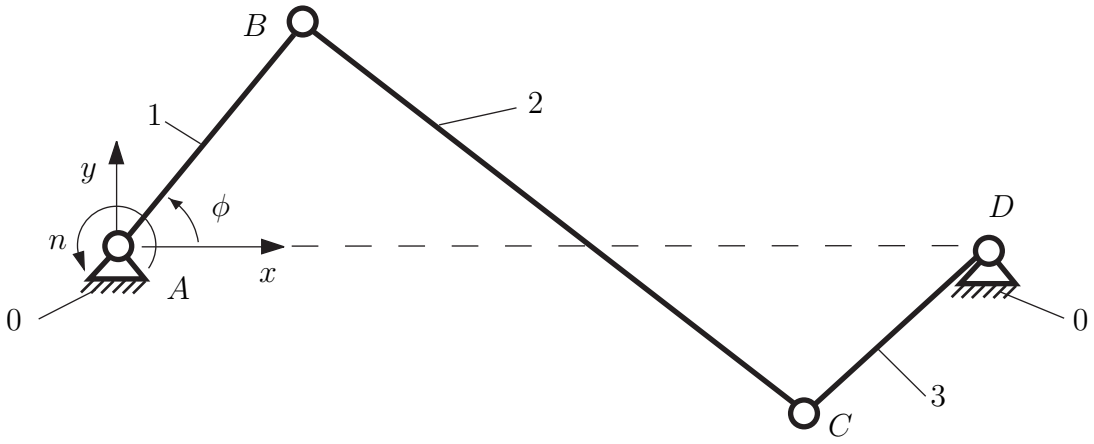

Figure P4.1

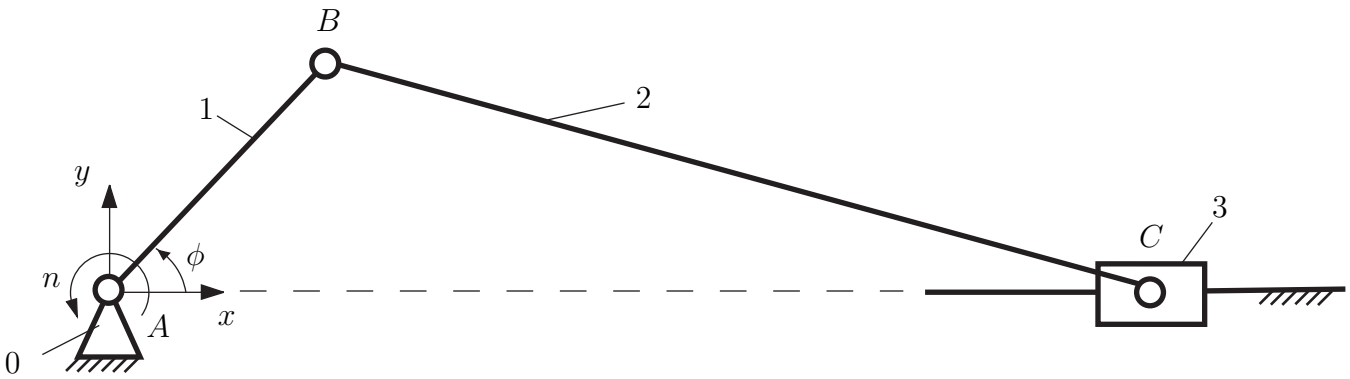

Figure P4.2