MECA-H303 TP1

Kinematics & Statics

Simple lift mechanism

For the following mechanism, we ask you to:

1. Calculate the number of degrees of freedom
2. Write the constraint equations
3. Using the principle of virtual work, express the ratio between F_x and F_y as a function of the system's coordinates, when the system is in static equilibrium.

Additional details for the exercise:

- Use the coordinate system centered on point C
- Lengths $|AE| = |BE| = |CE| = |DE| = L$
- The mass of all bars is negligible

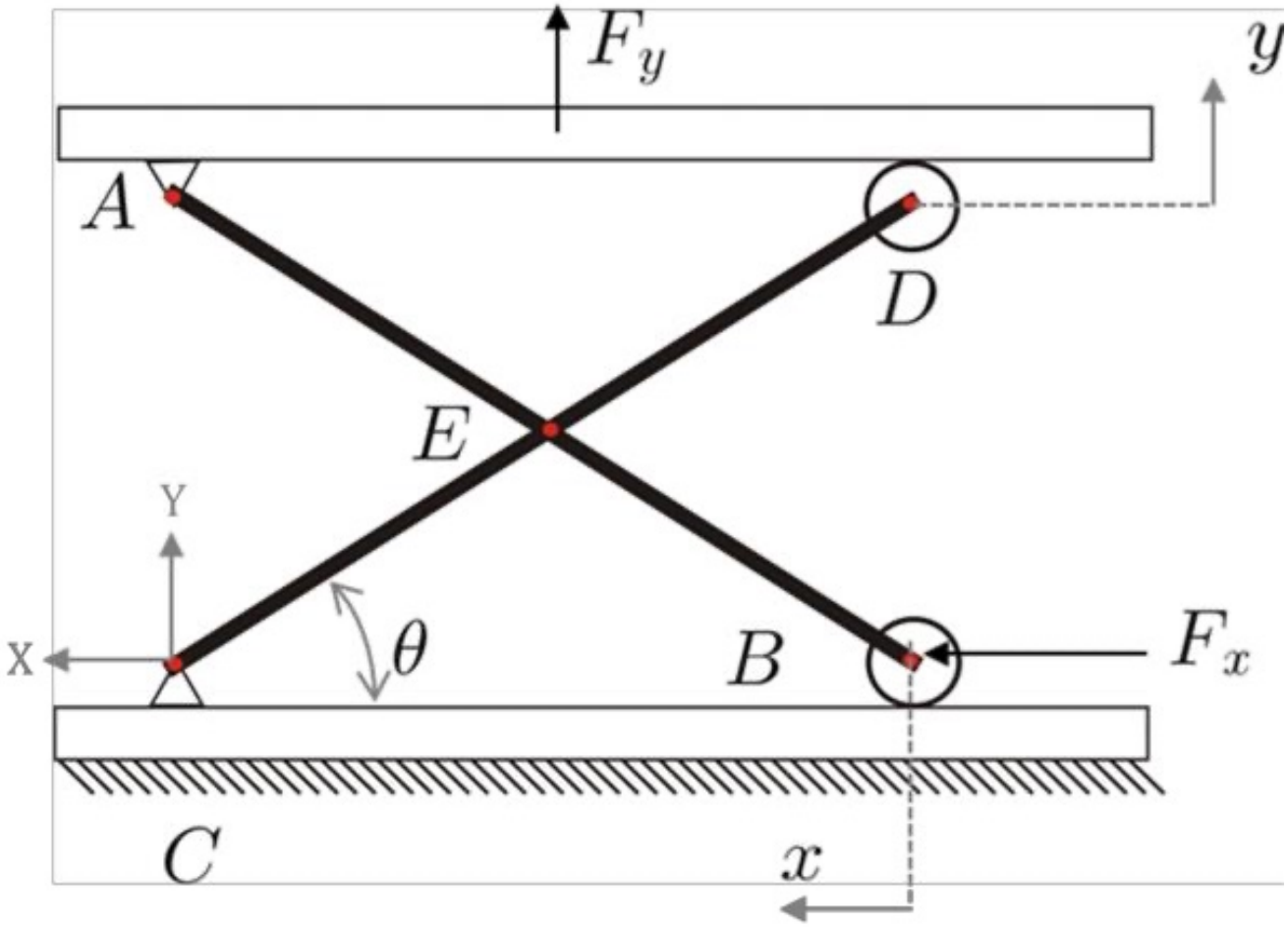

Figure 1: simple lift mechanism

Crank and slider

For the following mechanism, we ask you to:

1. Calculate the number of degrees of freedom
2. Write the constraint equations
3. Using the principle of virtual work, express the ratio between the force F and the torque C applied as a function of the system's coordinates, when the system is in static equilibrium.

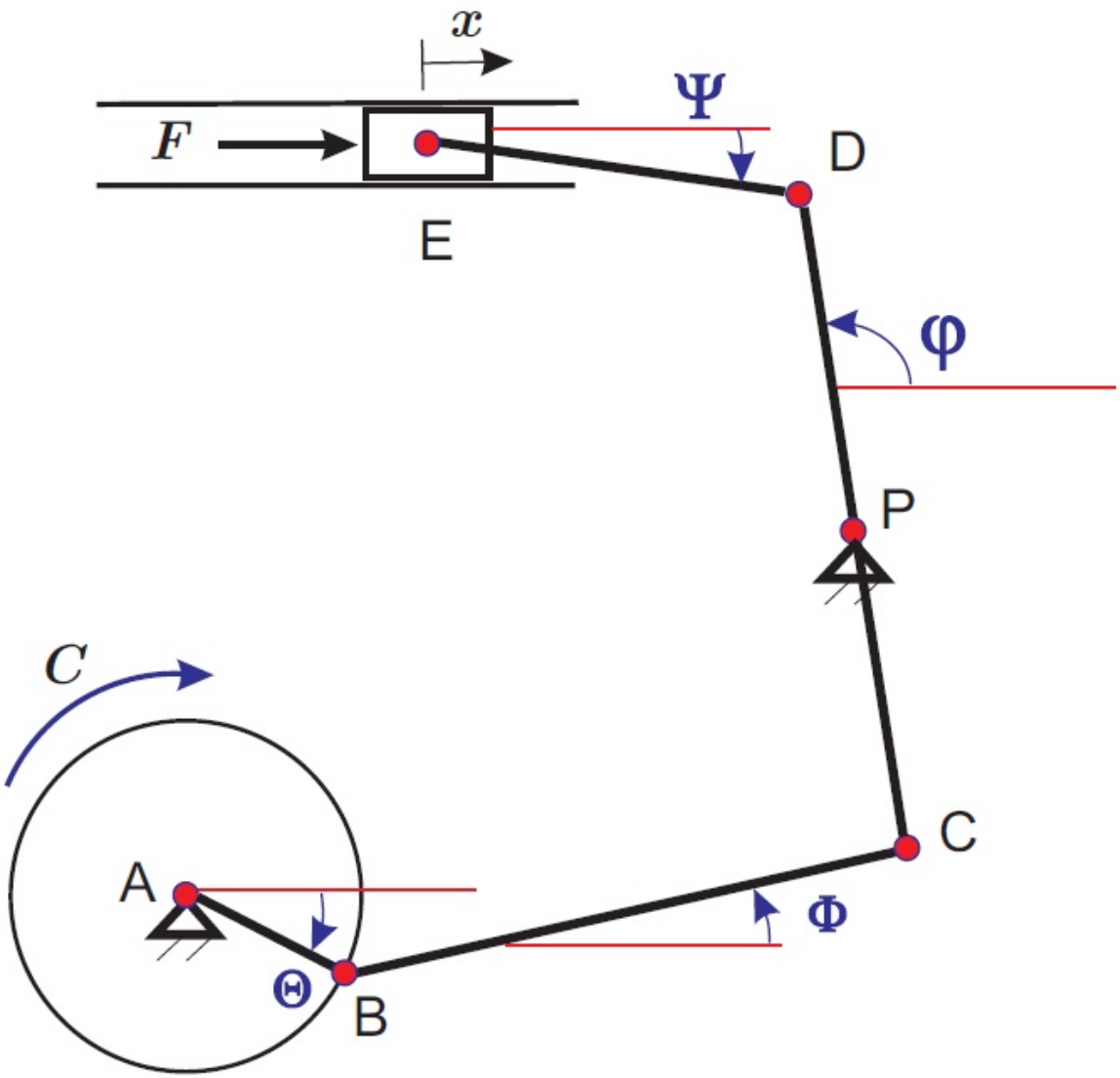

Figure 2: Crank and slider

Newtonian dynamics & SDOF

Pinned rigid bar system

For the following mechanism:

1. If you had to choose, would you derive the equation of movement using Newtonian or Lagrangian dynamics? Why?
2. Write the equation of motion of the system assuming small angles of rotation.
3. From the equation of motion, give the expression of the damped resonant frequency of the system.

Additional details for the exercise:

- Z represents an imposed displacement
- The moment of inertia of the bar is $I = (ml^2)/3$ when computed at its edge.

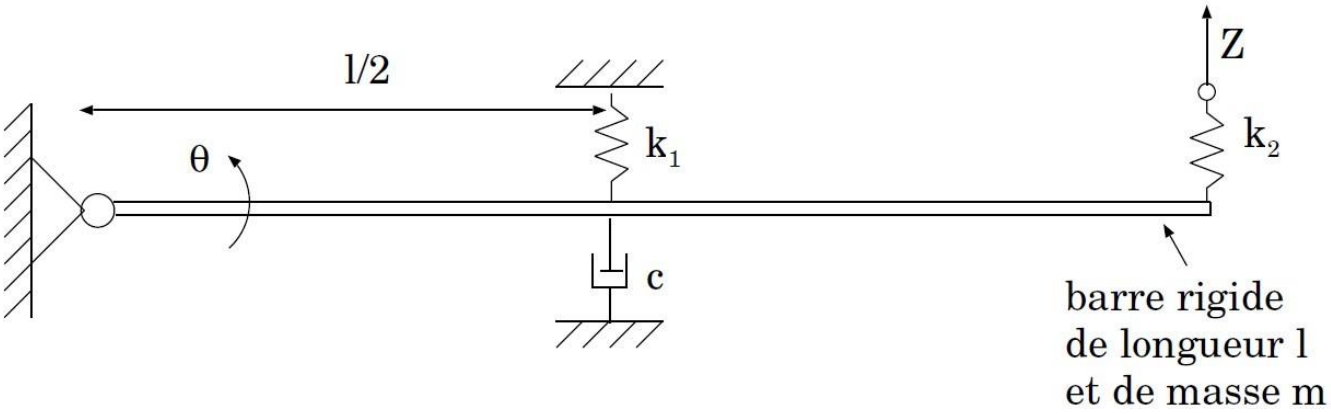

Figure 3: Rigid bar pinned