Homework 2

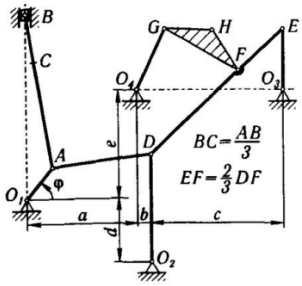
Week HW 2, Task 1 (Coding)

You should find:

1. simulate this mechanism (obtain all positions.)
2. velocities for *A, B, C, E, F, D*. Find angular velocities for all links.
3. acc. for *A* and *B* and ang. vel for *AB*
4. draw plots for previous statements.

Needed variables:

$\omega_{O_1A} = 2\ rad/s$;
$\phi = 52°$; $a = 32$; $b = 4$; $c = 39$; $d = 19$; $e = 32$;
$O_1A = 12$; $O_2D = 32$; $O_3E = 18$; $AB = 46$; $AD = 29$;
$GH = 14$; $DE = 53$; $GF = 25$; $FH = 14$; $O_4G = 20$.



Week HW 2, Task 1
(Yablonskii (rus) K4)

Let us obtain positions of all points:

$$O_1 = (0, 0)$$

$$A = (O_1 A cos(\omega_{O_1A}\phi), O_1 A sin(\omega_{O_1A}\phi))$$

We can get point B from the following system:

$$\begin{cases} (x_B - x_A)^2 + (y_B - y_A)^2 = AB^2 \\ x_B = 0 \end{cases}$$

We will get 2 solutions for this system, we will take the one with the higher y_B
This system can be solved numerically using libraries in Python like Sympy
We can obtain C from the following equation:

$$\vec{AC} = \vec{AB}\frac{AC}{AB}$$

$$O_2 = (a + b, -d)$$

We can get point D from the following system:

$$\begin{cases} (x_D - x_A)^2 + (y_D - y_A)^2 = AD^2 \\ (x_D - x_{O_2})^2 + (y_D - y_{O_2})^2 = O_2D^2 \end{cases}$$

We will get 2 solutions for this system, we will take the one with the higher y_D.
This system can be solved numerically.

$$O_3 = (a + b + c, e)$$

We can get point E from the following system:

$$\begin{cases} (x_D - x_E)^2 + (y_D - y_E)^2 = DE^2 \\ (x_E - x_{O_3})^2 + (y_D - y_{O_3})^2 = O_2D^2 \end{cases}$$

We will get 2 solutions for this system, we will take the one with the higher y_E.
This system can be solved numerically.
We can obtain F from the following equation:

$$\vec{DF} = \frac{3}{5}\vec{DE}$$

$$O_4 = (a, e)$$

We can get point G from the following system:

$$\begin{cases} (x_G - x_F)^2 + (y_G - y_F)^2 = FG^2 \\ (x_G - x_{O_4})^2 + (y_G - y_{O_4})^2 = O_3G^2 \end{cases}$$

We will get 2 solutions for this system, we will take the one with the higher y_G.
This system can be solved numerically.
Finally,
We can get point H from the following system:

$$\begin{cases} (x_H - x_F)^2 + (y_H - y_F)^2 = FH^2 \\ (x_G - x_H)^2 + (y_G - y_H)^2 = HG^2 \end{cases}$$

We will get 2 solutions for this system, we will take the one with the higher y_H.
This system can be solved numerically.

Since we have functions of coordinates for all points, we will find the velocities of these points by derivating these functions numerically.