Direct Kinematics

The aim of this TP is to solve the direct kinematic problem on a 3 joint leg, using simple trigonometry. Then implement the solution. The implementation will be tested on a robotic leg later on.

The key here is to have a good Kinematic drawing and some Conventions.

1. Solve the direct kinematic problem : Knowing theta1, theta2, theta3, L1, L2 and L3, find P1(x1, y1, z1), P2(x2, y2, z2) and P3(x3, y3, z3).
2. Adapt your solution to your robotic leg, i.e. make sure that your solution is valid if you replace thetaX by motorX.currentPosition. What is the (x=0, y=0, z=0) point of the real leg?
3. Find L1, L2, L3 and any other needed measure. Use the information provided by the "origin.pdf" document.
4. Implement your solution using python.

NOTES: The answers to 1. 2. and 3. shall be written on a paper version of "leg.pdf". Your work will be collected (1 per student). Clean work expected. A solution will be given afterwards.

Expected format for task 4.: A file named "direct_kinematics.py" with a function `leg_dk(theta1, theta2, theta3, l1=L1, l2=L2, l3=L3, other needed parameters)` that returns the position [x, y, z] of the end of the leg.

l1 = 51 mm, l2 = 63.7 mm, l3 = 93 mm, alpha = 20.69°, beta = 5.06°

As a quick verification here are the solutions for some values of Theta1, Theta2, Theta3 (in mm with an accepted error of +/- 1mm):

0°,0°,0°: [118.79, 0.0, -115.14]

90°,0°,0°: [0.0, 118.79, -115.14]

180°, -30.501°, -67.819°: [-64.14, 0.0, -67.79]

0°, -30.645°, 38.501°: [203.23, 0.0, -14.30]