ME/ECE 5463 Programming Assignment 1

Submission instruction:

- Your submission must include a brief report that contains specific results (numerical or graphical results) required in each assignment.
- You should also submit your MATLAB code (bold) required in the assignments.

The below figure shows the configuration $t = 0$ of a robot arm whose first joint is a screw joint of pitch $h = 2$, which is the vertical distance traveled along the screw when the joint rotates 1 rad. The arm's link lengths are $L_1 = 10$, $L_2 = L_3 = 5$, and $L_4 = 3$. Suppose that all joint angular velocities are constant, with values $\omega_1 = \pi/4$, $\omega_2 = \pi/8$, $\omega_3 = -\pi/4$. All units are rad/s.

(a). Write a MATLAB function, named **`Tsb = EEFrameConfig(t),`** which returns the configuration of end effector frame $\{b\}$ relative to the fixed frame $\{s\}$, $T_{sb}(t) \in SE(3)$ at any given time t. Please compute the configuration $T_{sb}(t)$ at $t = 4$ using the function `EEFrameConfig.` Write down your result in your report.

(b). Let q is a point rigidly attached to the end effector frame $\{b\}$. The position of q in the frame $\{b\}$ is (1,0,-1). Write a MATLAB function, named **`q = SpatialPositionQ(t)`**, which returns the position of point q in the fixed frame $\{s\}$ at any given time t. You can call **`Tsb = EEFrameConfig(t)`** from this function (in fact, it is recommended to do so.)

(c). Please plot the trajectory of position of point q for $t = [0,8]$. (Hint: you can `plot3` function in MATLAB to plot the 3D position.) Appropriately label all axes. Include the plot in your report.