ECE 417 --- ROBOTICS
Homework 7 and 8

Solve the inverse kinematics problem for the Lab-Volt robot. We assume ${}^{0}\mathbf{T}_5$ is known and we need to compute θ_i. The following method is suggested (use my solution to Homework 6 as a starting point):

Homework 7:

1. Write ${}^{0}\mathbf{T}_1$, ${}^{1}\mathbf{T}_2$, ${}^{2}\mathbf{T}_3$, ${}^{3}\mathbf{T}_4$, and ${}^{4}\mathbf{T}_5$ as functions of θ_i (suggestion: leave nonzero d_i and a_i as symbols --- don't substitute their values).
2. Write ${}^{0}\mathbf{T}_3$ and ${}^{3}\mathbf{T}_5$ and their inverses as functions of θ_i.

Homework 8:

1. Solve for the **translation components** of ${}^{0}\mathbf{T}_3$ by multiplying ${}^{0}\mathbf{T}_5\,{}^{5}\mathbf{T}_3$ (you are only interested in the translation portion). Note that ${}^{0}\mathbf{T}_5$ and the other link parameters are known. Equate these translation components to the translation components of ${}^{0}\mathbf{T}_3$ (expressions we found above involving θ_1, θ_2, and θ_3). Solve for θ_1 (using x and y components), then θ_3 (using r and z), and finally θ_2 (using r and z) where r is the square root of x squared plus y squared.
2. With θ_1, θ_2, and θ_3 now solved for, we know the elements of ${}^{0}\mathbf{T}_3$ and can now solve for ${}^{3}\mathbf{T}_5 = {}^{3}\mathbf{T}_0\,{}^{0}\mathbf{T}_5$ (known values). By equating elements of this to our expression for ${}^{3}\mathbf{T}_5$ found above, we can now solve for θ_4 and θ_5.