Assignment 2

ELEC 442 - Introduction to Robotics

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Solving the inverse kinematics problem for the PUMA 560 robot

For the first angle, θ_1 we know that it only depends on the origin of the spherical wrist, $\underset{\sim}{o_4}$. Given this we can use the implemented function `KahanP2` with $s = \boldsymbol{k}_0$, $\hat{\boldsymbol{u}} = \boldsymbol{i}_0$ and $\boldsymbol{w} = \underset{\sim}{o_4} - \underset{\sim}{o_0}$. The function is implemented as shown in Listing 1. In this implementation the function itself normalizes the vectors such that we do not have to think about feeding this into the function.

```
function theta = KahanP2(s,u,w)
    s_hat = s/norm(s);
    u_hat = u/norm(u);
    w_hat = w/norm(w);
    if s_hat'*cross(s_hat,u_hat) == s_hat'*cross(s_hat,w_hat
       )
        theta = 2*atan(norm(cross(s_hat,(u_hat-w_hat)))/norm
           (cross(s_hat,(u_hat+w_hat))));
        if w_hat'*cross(s_hat,(u_hat-w_hat)) < 0
            theta = -theta;
        end
    else
        theta = 'The solution does not exist';
    end
end
```

Listing 1: MATLAB implementation of the Kahan P2 problem