Skymaster (without motor and gearbox detail) UDK Solver

(1) Calculate the torque generated by the motor

$$\tau_m = A_d \cos\left(\frac{2\pi t}{T_d}\right)$$

(2) Calculate the total torque due to motor, pendulum weight and damping

$$\tau = -mgLsin(\theta) - b_a\omega + \tau_m$$

(3) Calculate angular acceleration

$$\alpha = \frac{\tau}{mL^2}$$

(4) Use to change angular velocity and arm angle

$$\Delta\omega = \alpha\Delta t$$
$$\omega = \omega + \Delta\omega$$
$$\Delta\theta = \omega\Delta t$$
$$\theta = \theta + \Delta\theta$$

These lines may appear a little strange. The first two will be coded as **omega += alpha*dT;** and the last two will be coded as **theta += omega*dT;**

Variables

Math	Code	Meaning	ICs
Δt	deltaT		0.01
t	time		0
u	drive	drive signal to the motors	
τ_m	torqueM	Torque exerted on the ride from the motors	
τ	torque	Total torque on the ride	
α	alpha	Angular acceleration of the ride	
ω	omega	Angular speed of the ride	0
θ	theta	Angle of the ride at any time	0

Parameters

Math	Code	Default	Meaning
m	mmass	1	mass of pendulum
g	gravity	9.8	gravity
L	armLength	0.2824	length of arm from car to centre
b_a	armDamp	0.1	damping of arm bearings

Sinusoidal drive equation parameters

A_d	driveAmp	2.0	amplitude of drive
T_d	drivePeriod	1.0	period of drive in seconds

It will be useful to send the maximum value of the amplitude to the HUD. Here's the code to do this which you can place in the function **sendValuesToHUDX()**

```
if(theta > maxTheta) maxTheta = theta;
if(theta < 0) maxTheta = 0.0;
```

then write **maxTheta** to the HUD.