Preprocessing Fix

Tuesday, August 2, 2022 11:29 AM

Calc Raw (Clipped) Velocity

< old version, as written >

$$\omega = \sqrt{[a^2 - g^2] / [r + (b)(\sqrt{1 - (g/a)^2})]}$$

Simply: $A_r = r(\omega^2) \longrightarrow$ Acc relative to earth

$a_{earth} = A_r + g$

$a_{earth} = r(\omega^2) + g$

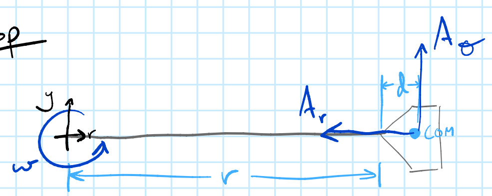
$a - g = r(\omega^2)$

$\omega = \sqrt{\frac{a-g}{r}}$

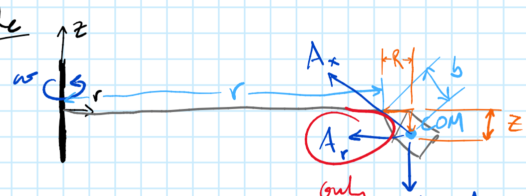
```
%% ---------- Velocity Profile Conversion ---------- %%
%% Calculate Raw (Clipped) Velocity

omega_raw = [];
for i = 1:length(ax_clip)
    omega_raw(i) = sqrt((ax_clip(i)^2 - g^2)/(r + b*sqrt(1 - (g/ax_clip(i))^2)));
end


%% Calculate Processed Velocity

omega_proc = [];
for i = 1:length(ax_proc)
    omega_proc(i) = sqrt((ax_proc(i)^2 - g^2)/(r + b*sqrt(1 - (g/ax_proc(i))^2)));
end

```

why?

Top



Side



$A_x^2 = A_r^2 + A_g^2$

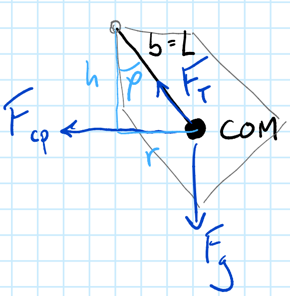
what measures @ low Ar?

$$\omega_{new} = \sqrt{A_r / [r + (b)(\sqrt{1 - (g/A_r)^2}]}$$

got how? $= R$

Get to

$r + R$



$\sin(\varphi) = \frac{F_{cp}}{F_T}$ $\quad F_T \sin(\varphi) = F_{cp} = m\vec{a}_r = m[r(\omega^2)]$

$\cos(\varphi) = \frac{F_g}{F_T}$ $\quad F_T \cos(\varphi) = F_g = m\vec{a}_g$

$\sin(\varphi) = \frac{r}{L} \longrightarrow$ $\quad F_T = m[\cancel{r}(\omega^2)]\left(\frac{L}{\cancel{r}}\right)$

$\cos(\varphi) = \frac{z}{L}$ $\quad F_T = \frac{m(\vec{a}_g)L}{\ldots}$

$\cos(\gamma) = \frac{z}{L}$

$F_T = \frac{m(\vec{a}_g)L}{z}$

make equal

$\cancel{m}L(\omega^2) = \frac{\cancel{m}L(\vec{a}_g)}{z}$

$\omega^2 = \frac{\vec{a}_g}{z} \therefore z = \frac{\vec{a}_g}{\omega^2} \rightarrow = \frac{A_g}{\left\{\frac{A_r}{r}\right.} = \frac{rg}{A_r}$

from $A_r = r(\omega^2)$

$b^2 = R^2 + z^2$

plug in z

$b^2 = R^2 + \left(\frac{rg}{A_r}\right)^2$

$r = R$

$b^2 = R^2 + R^2\left(\frac{g}{A_r}\right)^2$

$\sqrt{b^2 = R^2\left[1 + (g/A_r)^2\right]}$

$b = R\sqrt{1 + (g/A_r)^2}$

$\boxed{R = b/\sqrt{1 + (g/A_r)^2}}$

Numerical testing shows these to be the same

Though the bottom expression currently in the code is confusing,
as my intuition says that if a < g, where a is the input/desired
acceleration, the last term becomes nonreal/imaginary

$\omega = \sqrt{[a^2 - g^2]/[r + (b)(\sqrt{1 - (g/a)^2})]}$

From: $A_x^2 = A_r^2 + A_g^2 \rightarrow A_r^2 = A_x^2 - A_g^2$

However, this is saying we want ω where A_x experiences target Accel (via Data.csv)

If we wanted A_r to be representative of target Accel, then:

$\omega_{new} = \sqrt{(A_r - A_g)/[r + (b)(\sqrt{1 - (g/A_r)^2})]}$

Where the Ag term is kept to account for the steady-state presence of gravity. Though it is normal to the radial acceleration, it is still present to the system and compounds to create the overall acceleration vector.