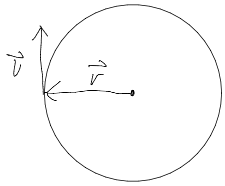
$\dot{j} =$ turnrate



I $\frac{360}{\dot j} = T$

II $2\vec r \pi = |\vec v| \cdot T$

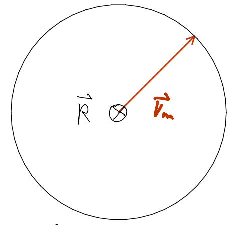
III $a_{max} = \frac{|\vec v|^2}{|\vec r|}$

$\Rightarrow a_{max} = \left(\frac{2\vec r \pi \dot j}{360}\right)^2 \frac{1}{|\vec r|}$ $\quad |\vec r^2 = |\vec r|^2$

$= |\vec r| \left(\frac{\pi}{180}\right)^2 \cdot \dot j^2$

Not in use:

rate of rotation of $\vec v_m$ in relation to a_m:



rot axis $= \vec R$

$\vec v_m$

$\vec v = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$; $q = (a + bi + cj + dk)$

I $\vec a = -|\vec a| \frac{\vec r}{|\vec r|} \Leftrightarrow \frac{\vec a}{|\vec a|} = -\frac{\vec r}{|\vec r|}$ $\quad | \ \vec a$ zentripetal force

II $|\vec a| = \frac{|\vec v|^2}{|\vec r|}$

$\Rightarrow |\vec r| = \frac{|\vec v|^2}{|\vec a|}$

$\Rightarrow |\vec r| \cdot \frac{-\vec r}{|\vec r|} = \frac{|\vec v|^2}{|\vec a|} \cdot \frac{\vec a}{|\vec a|}$

$\Leftrightarrow \boxed{\vec r = - \frac{|\vec v|^2}{|\vec a|^2} \cdot \vec a}$ 1*

~~III~~ $\vec v = \vec r \times \vec a$

$\begin{pmatrix} v_x \\ v_y \\ v_z \end{pmatrix} = \begin{pmatrix} v_y w_z - v_z w_y \\ v_z w_x - v_x w_z \\ v_x w_y - v_y w_x \end{pmatrix}$

$\begin{pmatrix} 0 & -v_z & v_y \\ v_z & 0 & -v_x \\ -v_y & v_x & 0 \end{pmatrix} \begin{pmatrix} v_x \\ v_y \\ v_z \end{pmatrix}$ | under defined!!!

$\vec v = \vec r \times \vec a \quad | \times \vec r$

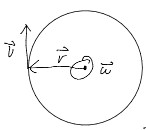
$\Rightarrow \vec v \times \vec r = (\vec r \times \vec \omega) \times \vec r \quad | \ (\vec a \times \vec b) \times \vec c = \vec b(\vec c \cdot \vec a) - \vec a(\vec b \cdot \vec c)$

$\Rightarrow \vec v \times \vec r = \vec \omega(\vec r \cdot \vec r) - \vec r(\vec \omega \cdot \vec r)$

$\Leftrightarrow \vec v \times \vec r = \vec \omega |\vec r|^2 - 0$

$\Leftrightarrow \vec \omega = \frac{\vec v \times \vec r}{|\vec r|^2}$

Direct approach:



$\frac{\vec \omega}{|\vec \omega|} = \vec v \times \vec r \cdot \frac{1}{|\vec v||\vec r|} \quad | \ |\vec v| = |\vec r| \cdot |\vec \omega|$

$\Rightarrow \frac{\vec \omega}{|\vec \omega|} \cdot |\vec \omega| = \vec v \times \vec r \cdot \frac{1}{|\vec v||\vec r|} \cdot \frac{|\vec v|}{|\vec r|}$

$\Leftrightarrow \vec \omega = \frac{\vec v \times \vec r}{|\vec r|^2}$ q.e.d.

1* $\vec r = - \frac{|\vec v|^2}{|\vec a|^2} \cdot \vec a$

$\Rightarrow \vec \omega = \vec v \times \vec a \cdot \frac{|\vec v|^2}{|\vec a|^2} \frac{1}{\left(\frac{|\vec v|^2}{|\vec a|^2} \cdot |\vec a|\right)^2}$

$$\Leftrightarrow \vec{\omega} = \vec{V} \times \vec{a} \cdot \frac{|\vec{V}|^2}{|\vec{a}|^2} \cdot \frac{|\vec{a}|^2}{|\vec{V}|^4}$$

$$\Leftrightarrow \boxed{\vec{\omega} = \vec{V} \times \vec{a} \cdot \frac{1}{|\vec{V}|^2}} \quad 2*$$

APN

AUTOMATIC PROPORTIONAL NAVIGATION

I $\vec{a} = N(\vec{V}_r \times \vec{\Omega})$

II $\vec{V}_r = \vec{V}_T - \vec{V}_m$

III $\vec{R} = \vec{R}_T - \vec{R}_m$

IV $\vec{\Omega} = \frac{\vec{R} \times \vec{V}_r}{|\vec{R}|^2}$

$N \hat{=}$ proportional const.

$\vec{\Omega} \hat{=}$ rotation of line of sight

$\vec{V}_T \hat{=}$ Velocity of target

$\vec{V}_m \hat{=}$ Velocity of missile

$\vec{R}_T \hat{=}$ Position of target

$\vec{R}_m \hat{=}$ Position of missile

$$\longrightarrow \vec{a} = N(\vec{V}_T - \vec{V}_m) \times \left[(\vec{R}_T - \vec{R}_m) \times (\vec{V}_T - \vec{V}_m)\right] |\vec{R}_T - \vec{R}_m|^{-2}$$

$$2* \quad \vec{\omega} = \vec{V} \times \vec{a} \cdot \frac{1}{|\vec{V}|^2}$$

$$\Rightarrow \boxed{\vec{\omega} = \frac{1}{|\vec{V}_m|^2} \vec{V}_m \times \left[N(\vec{V}_T - \vec{V}_m) \times \left[(\vec{R}_T - \vec{R}_m) \times (\vec{V}_T - \vec{V}_m)\right] |\vec{R}_T - \vec{R}_m|^{-2}\right]}$$