FORMULARIO ASTRODINAMICA

Orbite ellittiche: 0 < e < 1

$$r=\frac{h^2}{\mu}\frac{1}{1+e\cos\theta} \qquad a=\frac{h^2}{\mu}\frac{1}{1-e^2} \qquad T=2\pi\sqrt{\frac{a^3}{\mu}}$$

$$M_e=E-e\sin E \qquad \tan\frac{E}{2}=\sqrt{\frac{1-e}{1+e}}\tan\frac{\theta}{2}$$

$$M_e=\frac{\mu^2}{h^3}(1-e^2)^{(3/2)}t=\frac{2\pi}{T}t=nt$$

Orbite iperboliche: e > 1

$$r=\frac{h^2}{\mu}\frac{1}{1+e\cos\theta} \qquad a=\frac{h^2}{\mu}\frac{1}{e^2-1} \qquad e=1+\frac{r_p v_\infty^2}{\mu_{planet}} \qquad M_h=\frac{\mu^2}{h^3}(e^2-1)^{(3/2)}t$$

$$\tanh\frac{F}{2}=\sqrt{\frac{e-1}{e+1}}\tan\frac{\theta}{2}$$

$$v_\infty=\frac{\mu}{h}e\sin\theta_\infty=\frac{\mu}{h}\sqrt{e^2-1} \qquad v_{bo}=v_p=\frac{h}{r_p}=\sqrt{v_\infty^2+\frac{2\mu}{r_p}} \qquad M_h=e\sinh F-F$$

$$\beta=\cos^{-1}(1/e) \qquad \theta_\infty=\cos^{-1}(-1/e)$$

Cambio piano

$$\Delta v=\sqrt{v_1^2+v_2^2-2v_1v_2[\cos\Delta\gamma-\cos\gamma_2\cos\gamma_1(1-\cos\delta)]} \qquad \cos i=\cos\phi\sin A$$

Flyby

$$\phi_2=\phi_1+\delta \quad \textit{dark side}$$
$$\phi_2=\phi_1-\delta \quad \textit{sunlit side}$$

Clohessy-Wiltshire

$$\Phi_{rr}(t)=\begin{bmatrix}4-3\cos(nt) & 0 & 0\\ 6(\sin(nt)-nt) & 1 & 0\\ 0 & 0 & \cos(nt)\end{bmatrix} \quad \Phi_{rv}(t)=\begin{bmatrix}\sin(nt)/n & 2(1-\cos(nt))/n & 0\\ 2(\cos(nt)-1)/n & 1(4\sin(nt)-3nt)/n & 0\\ 0 & 0 & 1\cos(nt)/n\end{bmatrix}$$

$$\Phi_{vr}(t)=\begin{bmatrix}3n\sin(nt) & 0 & 0\\ 6n(\cos(nt)-1) & 0 & 0\\ 0 & 0 & -n\sin(nt)\end{bmatrix} \quad \Phi_{vv}(t)=\begin{bmatrix}\cos(nt) & 2\sin(nt) & 0\\ -2\sin(nt) & 4\cos(nt)-3 & 0\\ 0 & 0 & \cos(nt)\end{bmatrix}$$

Trasformazione di coordinate:

$$^{Orb}_{Geo}R=\begin{bmatrix}\cos\Omega\cos\omega-\sin\Omega\sin\omega\cos i & \sin\Omega\cos\omega+\cos\Omega\cos i\sin\omega & \sin i\sin\omega\\ -\cos\Omega\sin\omega-\sin\Omega\cos i\cos\omega & -\sin\Omega\sin\omega+\cos\Omega\cos i\cos\omega & \sin i\cos\omega\\ \sin\Omega\sin\omega & \sin i\cos\omega & \cos i\end{bmatrix} \qquad ^{Orb}_{Geo}R={}^{Geo}_{Orb}R^T$$

Regressione linea dei nodi:

$$\dot\Omega=-\left[\frac{3}{2}\frac{\sqrt{\mu}J_2R^2}{(1-e^2)^2a^{\frac{7}{2}}}\cos i\right] \qquad \Delta\phi_1=\frac{-2\pi\tau}{\tau_e} \qquad \Delta\phi_2=\dot\Omega\tau \qquad n|\Delta\phi|=m2\pi$$

$$\textit{sunsincronismo}\ \dot\Omega=1.991*10^{-7}\frac{rad}{sec} \qquad \dot\omega=-\left[\frac{3}{2}\frac{\sqrt{\mu}J_2R^2}{(1-e^2)^2a^{\frac{7}{2}}}\right]\left(\frac{5}{2}\sin^2 i-2\right)$$