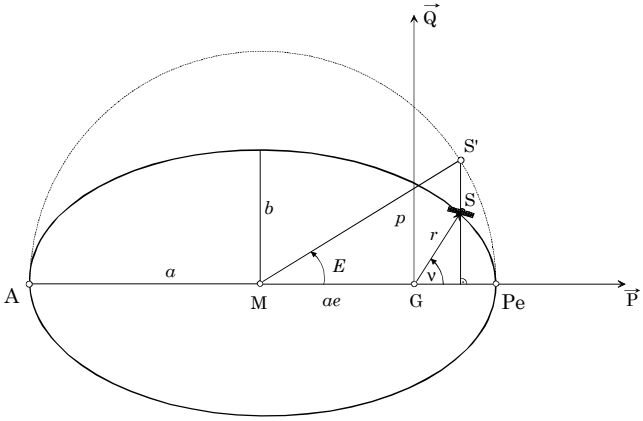
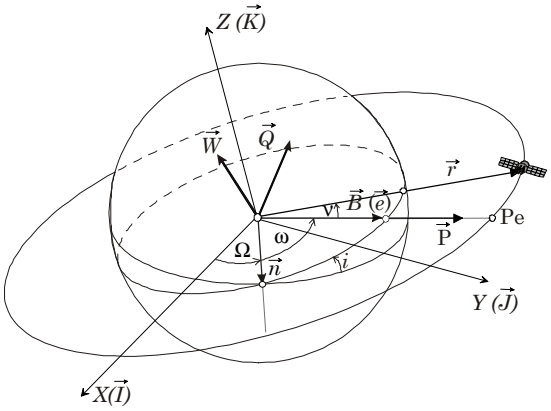
Uporabne enačbe in zveze



geometrija eliptične tirnice



Keplerjevi elementi

$$r = \frac{p}{1 + e\cos\nu} \qquad r = \frac{\frac{h^2}{\mu}}{1 + \frac{B}{\mu}\cos\nu}$$

$$p = a(1 - e^2) \qquad p = \frac{h^2}{\mu} \qquad e = \frac{r_A - r_{Pe}}{r_A + r_{Pe}} \qquad a = \frac{r_{Pe} + r_A}{2}$$

vektor ekscentricitete:

$$\boldsymbol{e} = \frac{1}{\mu}\left[\left(v^2 - \frac{\mu}{r}\right)\boldsymbol{r} - (\boldsymbol{r}\cdot\boldsymbol{v})\boldsymbol{v}\right]$$

ali $$\boldsymbol{e} = \frac{\boldsymbol{B}}{\mu};$$

Laplaceov vektor: $$\boldsymbol{B} = \boldsymbol{v}\times\boldsymbol{h} - \mu\frac{\boldsymbol{r}}{r}$$

Celotna mehanska energija sistema: $E_M = \frac{v^2}{2} - \frac{\mu}{r}$ $E_M = -\frac{\mu}{2a}$ (za elipse)

Vrtilna količina: $\boldsymbol{h} = \boldsymbol{r}\times\boldsymbol{v}$ $h = \sqrt{\mu p}$ $h = r_{\mathrm{A}}\, v_{\mathrm{A}} = r_{\mathrm{Pe}}\, v_{\mathrm{Pe}}$

Vis-viva enačba: $v^2 = \mu\left(\frac{2}{r} - \frac{1}{a}\right)$

III. Keplerjev zakon: $\frac{T^2}{a^3} = \frac{4\pi^2}{\mu}$ $n = \frac{2\pi}{T} = \sqrt{\frac{\mu}{a^3}}$

Anomalije:

Prava anomalija je kot med vektorjema $\boldsymbol{e}$ in $\boldsymbol{r}$:

$$\cos\nu = \frac{\boldsymbol{e}\cdot\boldsymbol{r}}{er}$$

Keplerjeva enačba: $M = E - e\sin E$ oz. $n\,(t - t_o) = E - e\sin E$

$$\cos E = \frac{e + \cos\nu}{1 + e\cos\nu} \qquad \tan\frac{E}{2} = \sqrt{\frac{1-e}{1+e}}\tan\frac{\nu}{2}$$ (enolična rešitev za E)

Krožna tirnica (namig za rešitev 1. naloge četrte vaje)

hitrost: $v = \sqrt{\frac{\mu}{r}} = \sqrt{\frac{\mu}{R_\oplus + h}}$

obhodni čas: $T^2 = \frac{4\pi^2}{\mu}r^3$