

Astro dynamics Hw 2

- 1) a. C
- b. A
- c. D
- d. B
- e. A

2) $r = [2 \ 0.5 \ 1]_{DU_\theta} V = [0.5 \ 0.5 \ -0.5] \frac{DU_\theta}{TV}$

$$\vec{h} = \vec{r} \times \vec{V} = \begin{bmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 0.5 & 1 \\ 0.5 & 0.5 & -0.5 \end{bmatrix} = -(-1, -0.5) \hat{j} = [-0.75 \ 1.5 \ 0.75]$$

$$\vec{n} = \hat{k} \times \vec{h} = \begin{bmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & 1 \\ -0.75 & 1.5 & 0.75 \end{bmatrix} = -(0 + 0.75) \hat{j} = [-1.5 \ -0.75 \ 0]$$

$$\vec{e} = \frac{1}{\mu} \left[\left(V^2 - \frac{\mu}{r} \right) \vec{r} - (\vec{r} \cdot \vec{V}) \vec{V} \right] = \left(0.75 - \frac{1}{\sqrt{5.25}} \right) \vec{r} - (0.75) \vec{V} = [0.252 \ -0.28 \ 0.688]$$

$$|V| = \sqrt{0.75} = \frac{1}{2}\sqrt{3} \quad |e| = 0.765 \quad |h| = 1.8371$$

$$|r| = \sqrt{5.25} \quad |n| = 1.6771$$

$$i = \arccos \left[\frac{\hat{k} \cdot \vec{h}}{|\vec{h}|} \right] = \arccos \left[\frac{0.75}{1.8371} \right] = 65.9^\circ \quad \omega = 99.62^\circ$$

$$\Omega = \arccos \left[\frac{n_r}{n} \right] = \arccos \left[\frac{-1.5}{1.6771} \right] = 206.6^\circ \quad r = 51.81^\circ$$

$$e = 0.7651 \quad u = 151.4^\circ$$

$$3) \quad a = 6.3920 \\ e = 0.4880 \\ i = 63.5^\circ \\ \Omega = 96.4^\circ \\ \omega = 246^\circ \\ \gamma = 18^\circ$$

$$\vec{r} = |r| \cos(r) \hat{P} + |r| \sin(r) \hat{Q}$$

$$|r| = \frac{p}{1 + e \cos r}$$

$$\vec{V} = \sqrt{\frac{\mu}{p}} (-\sin(r)) \hat{P} + \sqrt{\frac{\mu}{p}} (e \cos(r)) \hat{Q}$$

$$\vec{a}_{ijk} = \tilde{R} \vec{a}_{pqw}$$

See Matlab $r_{ijk} = [1.5055 \ -0.1810 \ -2.9603]$

$$V_{ijk} = [-0.0466 \ 0.2454 \ 0.0379]$$

$$4) \quad a. \quad a = 1.624 \text{ AU} \quad V = 0.795 \frac{\text{AU}}{\text{TU}}$$

$$1 \text{ AU} = 1.4959965 \times 10^8 \text{ Km}$$

$$1 \frac{\text{AU}}{\text{TU}} = 29.784852 \frac{\text{Km}}{\text{s}}$$

$$a = 227989866.6 \text{ Km} \quad V = 23.67895734 \frac{\text{Km}}{\text{s}}$$

$$b. \quad r = 14154247356 \text{ mi} \quad V = 38027 \frac{\text{mi}}{\text{h}}$$

$$1 \text{ AU} = 4.9081250 \times 10^{11} \text{ ft} \quad 1 \frac{\text{AU}}{\text{TU}} = 9.7719329 \times 10^4 \frac{\text{ft}}{\text{s}}$$

$$1 \text{ mi} = 5280 \text{ ft} \quad 1 \text{ h} = 3600 \text{ s}$$

$$r = 152.2686 \text{ AU} \quad V = 5.67045 \times 10^{-5} \frac{\text{AU}}{\text{TU}}$$

5) $30^\circ N$ $97.5^\circ W$ 0930 GST

$$\rho = 637.814 \text{ Km}$$

$$A_Z = 30^\circ$$

$$E_I = 90^\circ$$

$$\dot{\rho} = 0 \frac{\text{Km}}{\text{s}}$$

$$\dot{A}_Z = 0 \frac{\text{rad}}{\text{s}}$$

$$E_L = 0.0123813 \frac{\text{rad}}{\text{s}}$$

$$\bar{\omega} = 7.212 \times 10^{-5} \frac{\text{rad}}{\text{s}}$$

$$r_{SEZ} = [0 \ 0 \ 7015.95] \text{ Km}$$

$$r_{ijk} = \tilde{D}^{-1} r_{SEZ}$$

$$\dot{r}_{SEZ} = [6.839 \ -3.9985 \ 0] \text{ m/s}$$

see Matlab

$$b. r_{ijk} = \tilde{D}^{-1} r_{SEZ} = [-1091.8287.3 \ -446] \text{ Km}$$

$$V_{ijk} = \tilde{D}^{-1} \dot{r}_{SEZ} + \vec{\omega}_\oplus \times \vec{r}_{ijk}$$

$$V_{ijk} = [-0.8327 \ -6.3446 \ -4.1633] \frac{\text{km}}{\text{s}}$$