ZADATAK 1.1

MARKO GULIN
0036428227
3. AUT 1

$$\ddot{r} = r\dot{\phi}^2 - \frac{k}{r^2} + u_1$$

$$\ddot{\phi} = -2\frac{\dot{\phi}\dot{r}}{r} + \frac{u_2}{r}$$

(a) $x_1 = r, \quad x_2 = \dot{r}, \quad x_3 = \dot{\phi} = \omega$

(1) $\dot{x}_1 = x_2$

(2) $\dot{x}_2 = x_1 x_3^2 - k\frac{1}{x_1^2} + u_1$

(3) $\dot{x}_3 = -2\frac{x_2 x_3}{x_1} + u_2\frac{1}{x_1}$

(b) $u_1 = u_2 = 0$

- $x_{20} = 0$

$$x_{10}x_{30}^2 - k\frac{1}{x_{10}} = 0 \rightarrow x_{10}^3 x_{30}^2 = k$$

- $x_{10} = \sqrt{\frac{k}{x_{30}^2}}$

$$-2\frac{x_{20}x_{30}}{x_{10}} + 0 = 0 \rightarrow 0 = 0$$

$\quad = 0$

(1) $\Delta\dot{x}_1 = \Delta x_2$

(2) $\Delta\dot{x}_2 = x_{10}\cdot 2x_{30}\Delta x_3 + x_{30}^2\Delta x_1 + 2k\frac{1}{x_{10}^3}\Delta x_1 + \Delta u_1$

$$\Delta\dot{x}_2 = \left(x_{30}^2 + 2\frac{k}{x_{10}^3}\right)\Delta x_1 + 2x_{10}x_{30}\Delta x_3 + \Delta u_1$$

(3) $\Delta\dot{x}_3 = -2\frac{x_{30}}{x_{10}}\Delta x_2 - 2\frac{\overset{0}{\overbrace{x_{20}}}}{x_{10}}\Delta x_3 + 2\frac{\overset{0}{\overbrace{x_{20}x_{30}}}}{x_{10}^2}\Delta x_1 + \overset{0}{\overbrace{+\frac{1}{x_{10}}\Delta u_2 - u_{20}\frac{1}{x_{10}^2}\Delta x_1}}$

$$\Delta\dot{x}_3 = -2\frac{x_{30}}{x_{10}}\Delta x_2 + \frac{1}{x_{10}}\Delta u_2$$