Bの慣性系での運動方程式

$$\frac{d^2 l^2}{dt^2} = -\frac{GM_1}{r_1^3} l^2 - \frac{GM_2}{r_2^3} l^2 = -\frac{\partial U}{\partial l^2} \qquad (4.1)$$

$$LI = -\frac{GM_1}{r_1} - \frac{GM_2}{r_2} - (4.2)$$

(3,1,5)座標と(X,Y,Z)座標の関係は.

(3.1.5) 建轴轨》1:6回転 (X, Y, Z) 如7:

$$\begin{pmatrix} \frac{2}{3} \\ 1 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & -\frac{2}{3} & 0 \\ \frac{2}{3} & -\frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ \frac{2}{3} & 0 \\ \frac{2}{3} & 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & 0 \\ 0$$

$$\begin{pmatrix} X \\ Y \\ Z \end{pmatrix} = \begin{pmatrix} CA(-0) & -Ain(-0) & 0 \\ Ain(-0) & CA(-0) & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 3 \\ 4 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{3}{5} & \text{CAB} + \text{NAMB} \\ -\frac{3}{5} & \text{AnB} + \text{NCAB} \end{pmatrix} \cdots (4.6)$$

$$= \begin{pmatrix} \frac{4}{5} & \text{CAB} + \text{NCAB} \\ \frac{4}{5} & \text{CAB} \end{pmatrix} \cdots (4.7)$$

···(4.13)

(4.3)(4.4)より、それぞれの時間微分は

3 = X CAO - X & Linb - Y Linb - Y & CAO = X ado-Ydino-n'X dino-n'Y ado ... (4.8)

N=XLn0+X6al0+Yal0-Y6lin0 = X Ano + Yado + n'X CAO - n'Y Ano ... (4.9)

さらに(4.8)(4.9)を時間(数分

3 = X ado - X Lino - N'Y cao - N'X Lino - N'Y cado - N' th/27. Lind

= X CLO - Y Lino - 2n' X Lino - 2n' Y alo - n'2 X alo + n'2 Y Lino ... (4.10)

n = X Ling + N'X CAO + Y CAO - N'Y Ling + N'X CAO - N'Y Ling - N'Y = X Lind + Y cas + 2n'X cas - 2n'Y Lind - N2 X Lind - N2 Y case ... (4.11)

当、当txxxx、いれの偏微なた書き直す

 $\frac{\partial \mathcal{L}}{\partial \mathcal{L}} = \frac{\partial \mathcal{L}}{\partial \mathcal{L}} \frac{\partial \mathcal{L}}{\partial \mathcal{L}} + \frac{\partial \mathcal{L}}{\partial \mathcal{L}} \cdot \frac{\partial \mathcal{L}}{\partial \mathcal{L}}$ 31 - 3X - 31 - 3Y - 31 = 21 · Colo + 21 · (-Long) (:46) OY · (-4.7) = Of Line + Of alo = 211 ado - 211 Ano ... (4.12)

慣性系(3.1.5)でn運動方程式かり回転座標系(XY,Z) 41-3 でn運動方程式を導出する

· まずは. 慣性系での運動方程式(4.1)の左辺た(4.10)(4.11)右辺に(4.12)(4.13) を代入する

$$\frac{d^{2}h}{dt^{2}} = -\frac{\partial L}{\partial h}$$

$$\left[\frac{d^{2}\frac{3}{3}}{dt^{2}}\right] = -\frac{\partial L}{\partial 3}$$

$$\frac{d^{2}h}{dt^{2}} = -\frac{\partial L}{\partial 3}$$

(4.12) (413)/17

 $\begin{cases}
\dot{x} \cdot (4.10) (4.11) f(x) \\
\dot{x} \cdot (2.40 - 1) \cdot (4.11) f(x) \\
\dot{x} \cdot (2.40 - 1) \cdot (4.11) f(x) \\
\dot{x} \cdot (2.40 - 1) \cdot (4.11) f(x) \\
\dot{x} \cdot (4.10) (4.11) f(x) \\
\dot{x} \cdot$

・の②参を用いて、

1) x Calo + 2) x Lino

 $\ddot{X} CA^{2}\Theta - \ddot{Y} And CA\Theta - 2n' \ddot{X} And CAO - 2n' \dot{Y} CA^{2}O + n'^{2}X CA^{2}O + n'^{2}X And CAO = -\frac{\partial U}{\partial X} CA^{2}O + \frac{\partial U}{\partial Y} And CAO = -\frac{\partial U}{\partial X} And CAO = -\frac{\partial U}{$

1)x(-Ano)+2)xcdo

 $-\ddot{X} \text{ Lino CAB} + \ddot{Y} \text{ Lin^2O} + 2\text{N}'\dot{X} \text{ Lin^2O} + 2\text{N}'\dot{Y} \text{ Lino CAB} + \text{N'^2} \chi \text{ Lino CAB} - \text{N'^2} \chi \text{ Lino CAB} - \frac{2\text{L}}{2\text{X}} \text{ Lino CAB} - \frac{2\text{L}}{2\text{L}} \text{ Lino CAB} - \frac{2\text{L}}{2\text{X}} \text{ Lino CAB} - \frac{2\text{L}}{2\text{Lino CAB}} - \frac{2\text{L}}{2\text{Lino CAB}} - \frac{2\text{Lino CAB} - \frac{2\text{Lino$

$$\Box = -\frac{GM_1}{\Gamma_1} - \frac{GM_2}{\Gamma_2} \qquad \left(\frac{N'^2 Q'^3}{G_2} - \frac{G(M_1 + M_2)}{G_2} \right) \\
= -\frac{M_1}{\Gamma_1} \cdot \frac{N'^2 Q'^3}{M_1 + M_2} - \frac{M_2}{\Gamma_2} \cdot \frac{N'^2 Q'^3}{M_1 + M_2} \\
= -\left(\frac{M_1}{M_1 + M_2} \cdot \frac{Q'^3}{\Gamma_1} + \frac{M_2}{M_1 + M_2} \cdot \frac{Q'^3}{\Gamma_2} \right) N'^2 \qquad (4.17)$$

図41よ).

$$f_1 = \sqrt{(X + \frac{M_2}{M_1 + M_2} \alpha')^2 + Y^2 + Z^2} \quad ... \quad (4.18)$$

$$f_2 = \sqrt{(X - \frac{M_1}{M_1 + M_2} \alpha')^2 + Y^2 + Z^2} \quad ... \quad (4.19)$$

運動方程式(4/4)と(4/5)の遠心力項を右辺に移して、

$$\ddot{X} - 2n'\dot{Y} = -\frac{\partial Ll^*}{\partial X} \qquad \left(= -\frac{\partial Ll}{\partial X} + n'^2 X \right) \qquad (4.20)$$

$$\ddot{Y} + 2n'\dot{X} = -\frac{\partial Ll^*}{\partial Y} \qquad \left(= -\frac{\partial Ll}{\partial Y} + n'^2 Y \right) \qquad (4.21)$$

$$\ddot{Z} = -\frac{\partial Ll^*}{\partial Z} \qquad (4.22)$$

(4.20)(4.21) 2)

$$\Box^* = \Box - \frac{1}{2} N'^2 (X^2 + Y^2) \quad ... \quad (4.23)$$