Useful Information

$$\mathbf{F}(d\mathbf{A}) = \mathbf{\Sigma}\, d\mathbf{A}$$

$$\epsilon_{ij} = \frac{1}{2}\left(\frac{\partial u_i}{\partial r_j} + \frac{\partial u_j}{\partial r_i}\right)$$

$$\mathbf{E} = \alpha e \mathbf{1} + \mathbf{E}'$$

$$\begin{aligned} \mathbf{\Sigma} &= \alpha e \mathbf{1} + \beta \mathbf{E}' \\ &= (\alpha - \beta) e \mathbf{1} + \beta \mathbf{E} \end{aligned}$$

$$\alpha = 3B_M \qquad \beta = 2S_M$$

$$e = \frac{1}{3}\,\mathrm{Tr}(\mathbf{E})$$

$$d\mathbf{u} = \mathbf{D}\, d\mathbf{r} \longrightarrow \mathbf{E}\, d\mathbf{r}$$

$$\rho \frac{\partial^2 \mathbf{u}}{\partial t^2} = \rho \mathbf{g} + \left(B_M + \frac{1}{3} S_M\right) \boldsymbol{\nabla}(\boldsymbol{\nabla} \cdot \mathbf{u}) + S_M \nabla^2 \mathbf{u}$$

$$\mathbf{F}_{\text{inertial}} = \mathbf{F}_{\text{fictitious}} = -m\mathbf{A}$$

$$\mathbf{v} = \boldsymbol{\omega} \times \mathbf{r}$$

$$\left(\frac{d\mathbf{Q}}{dt}\right)_{\mathcal{S}_0} = \left(\frac{d\mathbf{Q}}{dt}\right)_{\mathcal{S}} + \mathbf{\Omega} \times \mathbf{Q}$$

$$\mathbf{F}_{\text{cor}} = 2m\dot{\mathbf{r}} \times \mathbf{\Omega} \quad \text{and} \quad \mathbf{F}_{\text{cf}} = m(\mathbf{\Omega} \times \mathbf{r}) \times \mathbf{\Omega}$$

$$R_{\text{earth}} = 6.4 \times 10^6 \, \text{m}$$

$$\mathbf{R} = \frac{1}{M} \int \mathbf{r} \, dm$$

$$\mathbf{L} = \mathbf{L}(\text{motion of CM}) + \mathbf{L}(\text{motion relative to CM})$$

$$T = T(\text{motion of CM}) + T(\text{motion relative to CM})$$

$$\mathbf{L} = \mathbf{I}\boldsymbol{\omega}$$

$$I_{xx} = \sum_\alpha m_\alpha (y_\alpha^2 + z_\alpha^2), \;\; \text{etc.} \quad \text{and} \quad I_{xy} = -\sum_\alpha m_\alpha x_\alpha y_\alpha, \;\; \text{etc.}$$

$$\text{Principal Axis:} \quad \mathbf{L} = \lambda \boldsymbol{\omega}$$

$$\dot{\mathbf{L}} + \boldsymbol{\omega} \times \mathbf{L} = \boldsymbol{\Gamma}$$

$$T = \frac{1}{2} \sum_{j,k} M_{jk} \dot{q}_j \dot{q}_k \quad \text{and} \quad U = \frac{1}{2} \sum_{j,k} K_{jk} q_j q_k$$

$$(\mathbf{K} - \omega^2 \mathbf{M})\mathbf{a} = 0$$

$$\mathcal{L} = \mathcal{L}(q_i, \dot{q}_i, t)$$

$$\mathcal{L} = T - U$$

$$\frac{\partial \mathcal{L}}{\partial q_i} = \frac{d}{dt} \frac{\partial \mathcal{L}}{\partial \dot{q}_i}$$

$$p_i = \frac{\partial \mathcal{L}}{\partial \dot{q}_i}$$

$$\mathcal{H} = \sum_{i=1}^{n} p_i \dot{q}_i - \mathcal{L}$$

$$r(\phi) = \frac{c}{1 + \epsilon \cos \phi}$$

$$E = \frac{\gamma^2 \mu}{2\ell^2}(\epsilon^2 - 1)$$

$$\mathbf{r} = \mathbf{r}_1 - \mathbf{r}_2 \quad \text{and} \quad \mathbf{R} = \frac{m_1 \mathbf{r}_1 + m_2 \mathbf{r}_2}{m_1 + m_2}$$

$$\mu = \frac{m_1 m_2}{m_1 + m_2}$$

$$U_{\text{eff}} = U(r) + \frac{\ell^2}{2\mu r^2}$$

$$\tau^2 = \frac{4\pi^2}{GM} R^3$$

$$(\gamma_{n+1} - \gamma_n) \simeq \frac{1}{\delta}(\gamma_n - \gamma_{n-1}), \quad \text{where} \quad \delta = 4.6692016\ldots$$

$$f(x) = f(x_0) + (x - x_0) \left. \frac{df}{dx} \right|_{x=x_0} + \frac{1}{2}(x - x_0)^2 \left. \frac{d^2 f}{dx^2} \right|_{x=x_0} + \cdots$$

$$\mathbf{a} \cdot \mathbf{b} = a_i b_i$$

$$(\boldsymbol{\nabla} f)_i = \partial_i f$$

$$(\mathbf{a} \times \mathbf{b})_i = \epsilon_{ijk} a_j b_k$$

$$\epsilon_{ijk} \epsilon_{ilm} = \delta_{jl} \delta_{km} - \delta_{jm} \delta_{kl}$$

For tensor **M** and vector **a**:

$$(\mathbf{M}\mathbf{a})_i = M_{ij} a_j$$