$$a_{ij}n_j = \lambda n_i \tag{1.6.1}$$

$$\det[a_{ij} - \lambda\delta_{ij}] = -\lambda^3 + I_a\lambda^2 - II_a\lambda + III_a = 0 \tag{1.6.2}$$

where

$$\begin{aligned}
I_a &= a_{ii} = a_{11} + a_{22} + a_{33} \\
II_a &= \frac{1}{2}(a_{ii}a_{jj} - a_{ij}a_{ij}) = \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} + \begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} + \begin{vmatrix} a_{11} & a_{13} \\ a_{31} & a_{33} \end{vmatrix} \\
III_a &= \det[a_{ij}]
\end{aligned} \tag{1.6.3}$$

$$\begin{aligned}
&\textit{Gradient of a Scalar } \nabla\phi = \phi_{,i}\boldsymbol{e}_i \\
&\textit{Gradient of a Vector } \nabla\boldsymbol{u} = u_{i,j}\boldsymbol{e}_i\boldsymbol{e}_j \\
&\textit{Laplacian of a Scalar } \nabla^2\phi = \nabla\cdot\nabla\phi = \phi_{,ii} \\
&\textit{Divergence of a Vector } \nabla\cdot\boldsymbol{u} = u_{i,i} \\
&\textit{Curl of a Vector } \nabla\times\boldsymbol{u} = \varepsilon_{ijk}u_{k,j}\boldsymbol{e}_i \\
&\textit{Laplacian of a Vector } \nabla^2\boldsymbol{u} = u_{i,kk}\boldsymbol{e}_i
\end{aligned} \tag{1.8.4}$$

$$\iint_S \boldsymbol{u}\cdot\boldsymbol{n}\,dS = \iiint_V \nabla\cdot\boldsymbol{u}\,dV \tag{1.8.6}$$

$$\begin{aligned}
e_{ij} &= \frac{1}{2}(u_{i,j} + u_{j,i}) \\
\omega_{ij} &= \frac{1}{2}(u_{i,j} - u_{j,i})
\end{aligned} \tag{2.1.7}$$

$$e'_{ij} = Q_{ip}Q_{jq}e_{pq} \tag{2.3.1}$$

$$Q_{ij} = \cos(x'_i, x_j)$$

$$Q_{ij} = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \tag{2.3.4}$$

$$\tilde{e}_{ij} = \frac{1}{3}e_{kk}\delta_{ij} = \frac{1}{3}\vartheta\delta_{ij} \tag{2.5.1}$$

$$\hat{e}_{ij} = e_{ij} - \frac{1}{3}e_{kk}\delta_{ij} \tag{2.5.2}$$

$$e_{ij,kl} + e_{kl,ij} - e_{ik,jl} - e_{jl,ik} = 0 \tag{2.6.1}$$

$$
\begin{aligned}
&\frac{\partial^2 e_x}{\partial y^2} + \frac{\partial^2 e_y}{\partial x^2} = 2\frac{\partial^2 e_{xy}}{\partial x \partial y} \\
&\frac{\partial^2 e_y}{\partial z^2} + \frac{\partial^2 e_z}{\partial y^2} = 2\frac{\partial^2 e_{yz}}{\partial y \partial z} \\
&\frac{\partial^2 e_z}{\partial x^2} + \frac{\partial^2 e_x}{\partial z^2} = 2\frac{\partial^2 e_{zx}}{\partial z \partial x} \\
&\frac{\partial^2 e_x}{\partial y \partial z} = \frac{\partial}{\partial x}\left(-\frac{\partial e_{yz}}{\partial x} + \frac{\partial e_{zx}}{\partial y} + \frac{\partial e_{xy}}{\partial z}\right) \\
&\frac{\partial^2 e_y}{\partial z \partial x} = \frac{\partial}{\partial y}\left(-\frac{\partial e_{zx}}{\partial y} + \frac{\partial e_{xy}}{\partial z} + \frac{\partial e_{yz}}{\partial x}\right) \\
&\frac{\partial^2 e_z}{\partial x \partial y} = \frac{\partial}{\partial z}\left(-\frac{\partial e_{xy}}{\partial z} + \frac{\partial e_{yz}}{\partial x} + \frac{\partial e_{zx}}{\partial y}\right)
\end{aligned}
\tag{2.6.2}
$$

$$
T_i^n = \sigma_{ji} n_j \tag{3.2.6}
$$

$$
\tilde{\boldsymbol{\sigma}}_{ij} = \frac{1}{3}\sigma_{kk}\,\delta_{ij} \tag{3.5.1}
$$

$$
\hat{\boldsymbol{\sigma}}_{ij} = \sigma_{ij} - \frac{1}{3}\sigma_{kk}\,\delta_{ij} \tag{3.5.2}
$$

$$
\begin{aligned}
N = \sigma_{oct} &= \frac{1}{3}(\sigma_1 + \sigma_2 + \sigma_3) = \frac{1}{3}\sigma_{kk} = \frac{1}{3}I_1 \\
S = \tau_{oct} &= \frac{1}{3}\left[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2\right]^{1/2} \\
&= \frac{1}{3}\left(2I_1^2 - 6I_2\right)^{1/2}
\end{aligned}
\tag{3.5.4}
$$

$$
\sigma_e = \sigma_{vonMises} = \frac{1}{\sqrt{2}}\left[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2\right]^{1/2} \tag{3.5.5}
$$

$$
\sigma_{ij,j} + F_i = 0 \tag{3.6.8}
$$

$$
\sigma_{ij} = \lambda e_{kk}\delta_{ij} + 2\mu e_{ij} \tag{4.2.7}
$$

$$
e_{ij} = \frac{1+\nu}{E}\sigma_{ij} - \frac{\nu}{E}\sigma_{kk}\delta_{ij} \tag{4.2.10}
$$