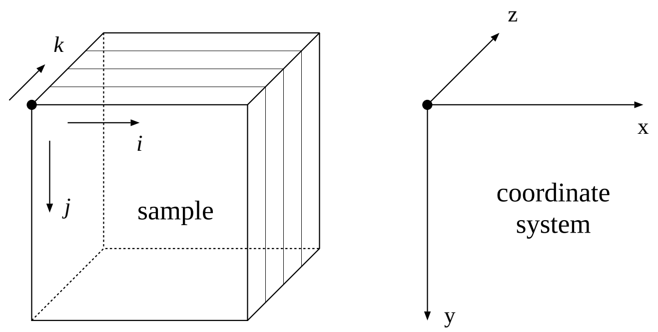
configuration



transform formula used in slice*

$$\begin{pmatrix} h \\ v \\ d \end{pmatrix} = \begin{pmatrix} -\cos\theta, & -\sin\theta, & 0 \\ \sin\theta, & -\cos\theta, & 0 \\ 0, & 0, & 1 \end{pmatrix} \begin{pmatrix} 1, & 0, & 0 \\ 0, & \sin\phi, & \cos\phi \\ 0, & -\cos\phi, & \sin\phi \end{pmatrix} \begin{pmatrix} -\sin\lambda, & \cos\lambda, & 0 \\ -\cos\lambda, & -\sin\lambda, & 0 \\ 0, & 0, & 1 \end{pmatrix} \begin{pmatrix} i \\ j \\ k \end{pmatrix}$$

$$= \begin{pmatrix} \cos\lambda\,\sin\phi\,\sin\theta + \sin\lambda\,\cos\theta, & \sin\lambda\,\sin\phi\,\sin\theta - \cos\lambda\,\cos\theta, & -\cos\phi\,\sin\theta \\ \cos\lambda\,\sin\phi\,\cos\theta - \sin\lambda\,\sin\theta, & \sin\lambda\,\sin\phi\,\cos\theta + \cos\lambda\,\sin\theta, & -\cos\phi\,\cos\theta \\ \cos\lambda\,\cos\phi, & \sin\lambda\,\cos\phi, & \sin\phi \end{pmatrix} \begin{pmatrix} i \\ j \\ k \end{pmatrix}$$

transform formula used in T3D

$$\begin{pmatrix} h \\ v \\ d \end{pmatrix} = \begin{pmatrix} \cos Z, & -\sin Z, & 0 \\ \sin Z, & \cos Z, & 0 \\ 0, & 0, & 1 \end{pmatrix} \begin{pmatrix} \cos Y, & 0, & \sin Y \\ 0, & 1, & 0 \\ -\sin Y, & 0, & \cos Y \end{pmatrix} \begin{pmatrix} 1, & 0, & 0 \\ 0, & \cos X, & -\sin X \\ 0, & \sin X, & \cos X \end{pmatrix} \begin{pmatrix} i \\ j \\ k \end{pmatrix}$$

$$= \begin{pmatrix} \cos Y\,\cos Z, & \sin X\,\sin Y\,\cos Z - \cos X\,\sin Z, & \cos X\,\sin Y\,\cos Z + \sin X\,\sin Z \\ \cos Y\,\sin Z, & \sin X\,\sin Y\,\sin Z + \cos X\,\cos Z, & \cos X\,\sin Y\,\sin Z - \sin X\,\cos Z \\ -\sin Y, & \sin X\,\cos Y, & \cos X\,\cos Y \end{pmatrix} \begin{pmatrix} i \\ j \\ k \end{pmatrix}$$

$$\begin{pmatrix} \cos\lambda\,\sin\phi\,\sin\theta + \sin\lambda\,\cos\theta, & \sin\lambda\,\sin\phi\,\sin\theta - \cos\lambda\,\cos\theta, & -\cos\phi\,\sin\theta \\ \cos\lambda\,\sin\phi\,\cos\theta - \sin\lambda\,\sin\theta, & \sin\lambda\,\sin\phi\,\cos\theta + \cos\lambda\,\sin\theta, & -\cos\phi\,\cos\theta \\ \cos\lambda\,\cos\phi, & \sin\lambda\,\cos\phi, & \sin\phi \end{pmatrix} \equiv$$

$$\begin{pmatrix} \cos Y\,\cos Z, & \sin X\,\sin Y\,\cos Z - \cos X\,\sin Z, & \cos X\,\sin Y\,\cos Z + \sin X\,\sin Z \\ \cos Y\,\sin Z, & \sin X\,\sin Y\,\sin Z + \cos X\,\cos Z, & \cos X\,\sin Y\,\sin Z - \sin X\,\cos Z \\ -\sin Y, & \sin X\,\cos Y, & \cos X\,\cos Y \end{pmatrix}$$

$(X, Y, Z) \ \rightarrow \ (\lambda, \phi, \theta)$

from the equality of (3, 3) elements of the above matrices

$\sin\phi = \cos X \ \cos Y$

assuming $|\phi| \leq 90\,°$ ($\cos\phi \geq 0$)

if $\cos X \ \cos Y = \pm 1$ ($\sin X = 0$ and $\sin Y = 0$)

$\phi = \pm 90\,°$ ($\cos\phi = 0$)

from (1, 1) and (1, 2) elements

$\sin(\lambda \pm \theta) = \cos Y \ \cos Z$

$\cos(\lambda \pm \theta) = \cos X \ \sin Z$

assuming $\theta \equiv 0$

$$\tan\lambda = \frac{\cos Y \ \cos Z}{\cos X \ \sin Z}$$

else ($\cos\phi > 0$)

from (3, 2) and (3, 1) elements

$$\tan\lambda = \frac{\sin\lambda \ \cos\phi}{\cos\lambda \ \cos\phi} = \frac{\sin X \ \cos Y}{-\sin Y}$$

from (1, 3) and (2, 3) elements

$$\tan\theta = \frac{\cos\phi \ \sin\theta}{\cos\phi \ \cos\theta} = \frac{-\cos X \ \sin Y \ \cos Z - \sin X \ \sin Z}{-\cos X \ \sin Y \ \sin Z + \sin X \ \cos Z}$$

$(\lambda, \phi, \theta) \ \rightarrow \ (X, Y, Z)$

from (3, 1) elements

$\sin Y = -\cos\lambda \ \cos\phi$

assuming $|Y| \leq 90\,°$ ($\cos Y \geq 0$)

if $\cos\lambda \ \cos\phi = \pm 1$ ($\sin\lambda = 0$ and $\sin\phi = 0$)

$Y = \mp 90\,°$ ($\cos Y = 0$)

from (2, 3) and (2, 2) elements

$\sin(X \pm Z) = \cos\phi \ \cos\theta$

$\cos(X \pm Z) = \cos\lambda \ \sin\theta$

assuming $Z \equiv 0$

$$\tan X = \frac{\cos\phi \ \cos\theta}{\cos\lambda \ \sin\theta}$$

else ($\cos Y > 0$)

from (3, 2) and (3, 3) elements

$$\tan X = \frac{\sin X \ \cos Y}{\cos X \ \cos Y} = \frac{\sin\lambda \ \cos\phi}{\sin\phi}$$

from (2, 1) and (1, 1) elements

$$\tan Z = \frac{\cos Y \ \sin Z}{\cos Y \ \cos Z} = \frac{\cos\lambda \ \sin\phi \ \cos\theta - \sin\lambda \ \sin\theta}{\cos\lambda \ \sin\phi \ \sin\theta + \sin\lambda \ \cos\theta}$$