

Rigid Body Rotation of Finite Strain Hooke's Law

$$\underline{\underline{\tau}} = -G \delta(t, t') \quad \text{tr} \delta = 0$$

replace

$$? \rightarrow \underline{\underline{C}}^{-1} = (\underline{\underline{F}}^{-1})^T \underline{\underline{F}}^{-1}$$

Finite Strain
Tensor

$$\underline{\underline{C}}^{-1} = (\underline{\underline{F}}^{-1})^T \underline{\underline{F}}^{-1}$$

Note: $\lim_{t' \rightarrow t} \underline{\underline{C}}^{-1} = \underline{\underline{I}} - \underline{\underline{\delta}}(t, t')$

$$\underline{\underline{\tau}} = +G \underline{\underline{C}}^{-1}$$

$$\underline{\underline{\epsilon}} = + G \underline{\underline{C}}^{-1}$$

$$\underline{\underline{C}}^{-1} = (\underline{\underline{F}}^{-1})^T \cdot \underline{\underline{F}}^{-1}$$

$$\underline{\underline{F}}^{-1} = \begin{pmatrix} \cos\psi & \sin\psi & 0 \\ -\sin\psi & \cos\psi & 0 \\ 0 & 0 & 1 \end{pmatrix}_{123}$$

$$\underline{\underline{C}}^{-1} = \begin{pmatrix} \cos\psi & -\sin\psi & 0 \\ \sin\psi & \cos\psi & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \cos\psi & \sin\psi & 0 \\ -\sin\psi & \cos\psi & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}_{123}$$

stress same as when you started

$$\underline{\underline{\epsilon}} = G \underline{\underline{C}}^{-1} = G \underline{\underline{I}}$$

SHEAR PREDICTIONS

$$\underline{\underline{\sigma}} = + G \underline{\underline{C}}^{-1}$$

$$\underline{\underline{C}}^{-1} = (\underline{\underline{F}}^{-1})^T \cdot \underline{\underline{F}}^{-1}$$

$$\underline{\underline{F}}^{-1} = \begin{pmatrix} 1 & 0 & 0 \\ \gamma & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad 123$$

$$\underline{\underline{C}}^{-1} = \begin{pmatrix} 1 & \gamma & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ \gamma & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\underline{\underline{C}}^{-1} = \begin{pmatrix} 1+\gamma^2 & \gamma & 0 \\ \gamma & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad 123$$

$$\underline{G} = G \begin{pmatrix} 1+\gamma^2 & \gamma & 0 \\ \gamma & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}_{123}$$

ARE THESE GOOD PREDICTIONS?
CHECK WITH EXPERIMENT,

