

MEEG 4703 [Quiz T3.073](#)

1. (10 pts) Using the *law of transformation of second-order tensors*, compute the value of the stress component σ'_{22} at O if the rotation matrix and the state of stress at O are given by

$$[a_{ij}] = \begin{bmatrix} 0.8 & 0.6 \\ -0.6 & 0.8 \end{bmatrix} \quad [\sigma_{ij}] = \begin{bmatrix} 5 & 3 \\ 3 & -2 \end{bmatrix} \text{ ksi}$$

2. (10 pts) Using index notation, prove the following identity:

$$(\mathbf{A} \times \mathbf{B}) \cdot (\mathbf{C} \times \mathbf{D}) = (\mathbf{A} \cdot \mathbf{C})(\mathbf{B} \cdot \mathbf{D}) - (\mathbf{A} \cdot \mathbf{D})(\mathbf{B} \cdot \mathbf{C})$$

1.

Law of transformation of second-order tensors: $\sigma'_{ij} = a_{ik} a_{jl} \sigma_{kl}$

$$\begin{aligned} \sigma'_{22} &= a_{2k} a_{2l} \sigma_{kl} = a_{2k} (a_{21} \sigma_{k1} + a_{22} \sigma_{k2}) = a_{21} (a_{2k} \sigma_{k1}) + a_{22} (a_{2k} \sigma_{k2}) \\ &= a_{21} (a_{21} \sigma_{11} + a_{22} \sigma_{21}) + a_{22} (a_{21} \sigma_{12} + a_{22} \sigma_{22}) \\ &= -0.6[-0.6(5) + 0.8(3)] + 0.8[-0.6(3) + 0.8(-2)] = -2.36 \end{aligned}$$

$$\sigma'_{22} = -2.36 \text{ ksi}$$