Ohm's law on a lattice:

$$j_i = \sigma_{ij} E_j$$

Conductivity tensor

$$\hat{\sigma} = \begin{pmatrix} \sigma_{xx} & \sigma_{xy} \\ \sigma_{yx} & \sigma_{yy} \end{pmatrix} \tag{1}$$

How many independent components does an oblique lattice have?

The only symmetry operation is the 180 rotation about z.

Matrix of rotation about z by θ:

$$U_\theta = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix} \Rightarrow \tag{2}$$

$$U_{180} = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} = -1 \times \mathbb{1} \tag{3}$$

Transformation of the Ohm's law under rotation

$$\hat{U}\vec{j} = \hat{U}\hat{\sigma}\hat{U}^{-1}\hat{U}\vec{E} \Rightarrow \hat{\sigma} \to \hat{U}\hat{\sigma}\hat{U}^{-1} \tag{4}$$

For rotations, $\hat{U} \hat{=} U^{-1} \Rightarrow$

$$\hat{\sigma} = \hat{U}\hat{\sigma}\hat{U} \tag{5}$$