Piezoresistivity in Mechanical APDL

In piezoresistive materials, stress or strain cause a change of electric resistivity:

$$= [\rho^o]([I] + [r])$$

$$[\rho] \qquad (1)$$

where:

$[\rho]$= electric resistivity of a loaded material = $\begin{bmatrix} \rho_{XX} & \rho_{XY} & \rho_{XZ} \\ & \rho_{YY} & \rho_{YZ} \\ symm & & \rho_{ZZ} \end{bmatrix}$

$[\rho^o]$= electric resistivity of an unloaded material

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$[I]$=identity matrix = $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$[r]$=relative change in resistivity = $\begin{bmatrix} r_X & r_{XY} & r_{XZ} \\ & r_Y & r_{YZ} \\ sym & & r_Z \end{bmatrix}$ calculated as

$$\{r\} = [m]\{\varepsilon^{el}\} \qquad (2)$$

where

$\{r\}$=vector matrix $[r]$ components = $[r_x \quad r_y \quad r_z \quad r_{xy} \quad r_{yz} \quad r_{xz}]^T$;

$[m]$= piezoresistive strain matrix, as supplied in Mechanical ANSYS PDL;

	X	Y	Z	XY	YZ	XZ
X						
Y						
Z						
XY						
YZ						
XZ						

$\{\varepsilon^{el}\}$ = the elastic strain vector.