

Matrixes of DL-50

Stiffness Matrix

$$\begin{pmatrix} C_{11} & C_{12} & C_{13} & 0 & 0 & 0 \\ C_{12} & C_{11} & C_{13} & 0 & 0 & 0 \\ C_{13} & C_{13} & C_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & C_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & C_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & C_{66} \end{pmatrix}^E = \begin{pmatrix} 13.9 & 9.2 & 9.2 & 0 & 0 & 0 \\ 9.2 & 13.9 & 9.2 & 0 & 0 & 0 \\ 9.2 & 9.2 & 12.2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2.0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2.0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2.3 \end{pmatrix}^E 10^{10} N/m^2$$

$$\begin{pmatrix} C_{11} & C_{12} & C_{13} & 0 & 0 & 0 \\ C_{12} & C_{11} & C_{13} & 0 & 0 & 0 \\ C_{13} & C_{13} & C_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & C_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & C_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & C_{66} \end{pmatrix}^D = \begin{pmatrix} 14.6 & 9.9 & 8.6 & 0 & 0 & 0 \\ 9.9 & 14.6 & 8.6 & 0 & 0 & 0 \\ 8.6 & 8.6 & 15.6 & 0 & 0 & 0 \\ 0 & 0 & 0 & 3.7 & 0 & 0 \\ 0 & 0 & 0 & 0 & 3.7 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2.3 \end{pmatrix}^D 10^{10} N/m^2$$

Elastic Matrix

$$\begin{pmatrix} S_{11} & S_{12} & S_{13} & 0 & 0 & 0 \\ S_{12} & S_{11} & S_{13} & 0 & 0 & 0 \\ S_{13} & S_{13} & S_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & S_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & S_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & S_{66} \end{pmatrix}^E = \begin{pmatrix} 16.1 & -5.2 & -8.2 & 0 & 0 & 0 \\ -5.2 & 16.1 & -8.2 & 0 & 0 & 0 \\ -8.2 & -8.2 & 20.5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 50.6 & 0 & 0 \\ 0 & 0 & 0 & 0 & 50.6 & 0 \\ 0 & 0 & 0 & 0 & 0 & 42.6 \end{pmatrix}^E 10^{-12} m^2/N$$

$$\begin{pmatrix} S_{11} & S_{12} & S_{13} & 0 & 0 & 0 \\ S_{12} & S_{11} & S_{13} & 0 & 0 & 0 \\ S_{13} & S_{13} & S_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & S_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & S_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & S_{66} \end{pmatrix}^D = \begin{pmatrix} 14.0 & -7.3 & -3.7 & 0 & 0 & 0 \\ -7.3 & 14.0 & -3.7 & 0 & 0 & 0 \\ -3.7 & -3.7 & 10.5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 27.2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 27.2 & 0 \\ 0 & 0 & 0 & 0 & 0 & 42.6 \end{pmatrix}^D 10^{-12} m^2/N$$

Matrix of Clamp Dielectric Constant

$$\begin{pmatrix} \epsilon_{11} & 0 & 0 \\ 0 & \epsilon_{11} & 0 \\ 0 & 0 & \epsilon_{33} \end{pmatrix}^s = \begin{pmatrix} 900 & 0 & 0 \\ 0 & 900 & 0 \\ 0 & 0 & 850 \end{pmatrix}^s$$

Matrix of Free Dielectric Constant

$$\begin{pmatrix} \epsilon_{11} & 0 & 0 \\ 0 & \epsilon_{11} & 0 \\ 0 & 0 & \epsilon_{33} \end{pmatrix}^t = \begin{pmatrix} 1680 & 0 & 0 \\ 0 & 1680 & 0 \\ 0 & 0 & 1800 \end{pmatrix}^t$$

Piezoelectric Constant Matrixes

$$\begin{pmatrix} 0 & 0 & 0 & 0 & d_{15} & 0 \\ 0 & 0 & 0 & d_{24} & 0 & 0 \\ d_{31} & d_{31} & d_{33} & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 & 590 & 0 \\ 0 & 0 & 0 & 590 & 0 & 0 \\ -180 & -180 & 400 & 0 & 0 & 0 \end{pmatrix} 10^{-12} C/N$$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & g_{15} & 0 \\ 0 & 0 & 0 & g_{24} & 0 & 0 \\ g_{31} & g_{31} & g_{33} & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 & 40.0 & 0 \\ 0 & 0 & 0 & 40.0 & 0 & 0 \\ -11.3 & -11.3 & 25.0 & 0 & 0 & 0 \end{pmatrix} 10^{-3} Vm/N$$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & e_{15} & 0 \\ 0 & 0 & 0 & e_{24} & 0 & 0 \\ e_{31} & e_{31} & e_{33} & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 & 11.8 & 0 \\ 0 & 0 & 0 & 11.8 & 0 & 0 \\ -4.8 & -4.8 & 15.7 & 0 & 0 & 0 \end{pmatrix} C/m^2$$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & h_{15} & 0 \\ 0 & 0 & 0 & h_{24} & 0 & 0 \\ h_{31} & h_{31} & h_{33} & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 & 14.8 & 0 \\ 0 & 0 & 0 & 14.8 & 0 & 0 \\ -6.2 & -6.2 & 19.5 & 0 & 0 & 0 \end{pmatrix} 10^8 V/m$$