Matrixes of DL-43

Stiffness Matrix

$$\begin{pmatrix} C_{11} & C_{12} & C_{13} & 0 & 0 & 0 \\ C_{12} & C_{11} & C_{13} & 0 & 0 & 0 \\ C_{13} & C_{13} & C_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & C_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & C_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & C_{66} \end{pmatrix}^{E} = \begin{pmatrix} 14.4 & 7.8 & 7.8 & 0 & 0 & 0 \\ 7.8 & 14.4 & 7.8 & 0 & 0 & 0 \\ 7.8 & 7.8 & 12.4 & 0 & 0 & 0 \\ 0 & 0 & 0 & 3.0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 3.0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 3.3 \end{pmatrix}^{E} 10^{10}\, N/m^2$$

$$\begin{pmatrix} C_{11} & C_{12} & C_{13} & 0 & 0 & 0 \\ C_{12} & C_{11} & C_{13} & 0 & 0 & 0 \\ C_{13} & C_{13} & C_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & C_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & C_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & C_{66} \end{pmatrix}^{D} = \begin{pmatrix} 15.3 & 8.6 & 6.7 & 0 & 0 & 0 \\ 8.6 & 15.3 & 6.7 & 0 & 0 & 0 \\ 6.7 & 6.7 & 16.4 & 0 & 0 & 0 \\ 0 & 0 & 0 & 4.9 & 0 & 0 \\ 0 & 0 & 0 & 0 & 4.9 & 0 \\ 0 & 0 & 0 & 0 & 0 & 3.3 \end{pmatrix}^{D} 10^{10}\, N/m^2$$

Elastic Matrix

$$\begin{pmatrix} S_{11} & S_{12} & S_{13} & 0 & 0 & 0 \\ S_{12} & S_{11} & S_{13} & 0 & 0 & 0 \\ S_{13} & S_{13} & S_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & S_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & S_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & S_{66} \end{pmatrix}^{E} = \begin{pmatrix} 11.5 & -3.5 & -5.0 & 0 & 0 & 0 \\ -3.5 & 11.5 & -5.0 & 0 & 0 & 0 \\ -5.0 & -5.0 & 14.3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 33.8 & 0 & 0 \\ 0 & 0 & 0 & 0 & 33.8 & 0 \\ 0 & 0 & 0 & 0 & 0 & 30.0 \end{pmatrix}^{E} 10^{-12}\, m^2/N$$

$$\begin{pmatrix} S_{11} & S_{12} & S_{13} & 0 & 0 & 0 \\ S_{12} & S_{11} & S_{13} & 0 & 0 & 0 \\ S_{13} & S_{13} & S_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & S_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & S_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & S_{66} \end{pmatrix}^{D} = \begin{pmatrix} 10.2 & -4.8 & -2.2 & 0 & 0 & 0 \\ -4.8 & 10.2 & -2.2 & 0 & 0 & 0 \\ -2.2 & -2.2 & 7.9 & 0 & 0 & 0 \\ 0 & 0 & 0 & 20.4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 20.4 & 0 \\ 0 & 0 & 0 & 0 & 0 & 30.0 \end{pmatrix}^{D} 10^{-12}\, m^2/N$$

Matrix of Clamp Dielectric Constant

$$\begin{pmatrix} \varepsilon_{11} & 0 & 0 \\ 0 & \varepsilon_{11} & 0 \\ 0 & 0 & \varepsilon_{33} \end{pmatrix}^{S} = \begin{pmatrix} 770 & 0 & 0 \\ 0 & 770 & 0 \\ 0 & 0 & 550 \end{pmatrix}^{S}$$

Matrix of Free Dielectric Constant

$$\begin{pmatrix} \varepsilon_{11} & 0 & 0 \\ 0 & \varepsilon_{11} & 0 \\ 0 & 0 & \varepsilon_{33} \end{pmatrix}^{T} = \begin{pmatrix} 1280 & 0 & 0 \\ 0 & 1280 & 0 \\ 0 & 0 & 1050 \end{pmatrix}^{T}$$

Piezoelectric Constant Matrixes

$$\begin{pmatrix} 0 & 0 & 0 & 0 & d_{15} & 0 \\ 0 & 0 & 0 & d_{24} & 0 & 0 \\ d_{31} & d_{31} & d_{33} & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 & 390 & 0 \\ 0 & 0 & 0 & 390 & 0 & 0 \\ -105 & -105 & 245 & 0 & 0 & 0 \end{pmatrix} 10^{-12} C/N$$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & g_{15} & 0 \\ 0 & 0 & 0 & g_{24} & 0 & 0 \\ g_{31} & g_{31} & g_{33} & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 & 34.0 & 0 \\ 0 & 0 & 0 & 34.0 & 0 & 0 \\ -11.0 & -11.0 & 26.0 & 0 & 0 & 0 \end{pmatrix} 10^{-3} Vm/N$$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & e_{15} & 0 \\ 0 & 0 & 0 & e_{24} & 0 & 0 \\ e_{31} & e_{31} & e_{33} & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 & 11.7 & 0 \\ 0 & 0 & 0 & 11.7 & 0 & 0 \\ -4.2 & -4.2 & 14.0 & 0 & 0 & 0 \end{pmatrix} C/m^{2}$$

$$\begin{pmatrix} 0 & 0 & 0 & 0 & h_{15} & 0 \\ 0 & 0 & 0 & h_{24} & 0 & 0 \\ h_{31} & h_{31} & h_{33} & 0 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 & 16.7 & 0 \\ 0 & 0 & 0 & 16.7 & 0 & 0 \\ -8.9 & -8.9 & 27.9 & 0 & 0 & 0 \end{pmatrix} 10^{8} V/m$$