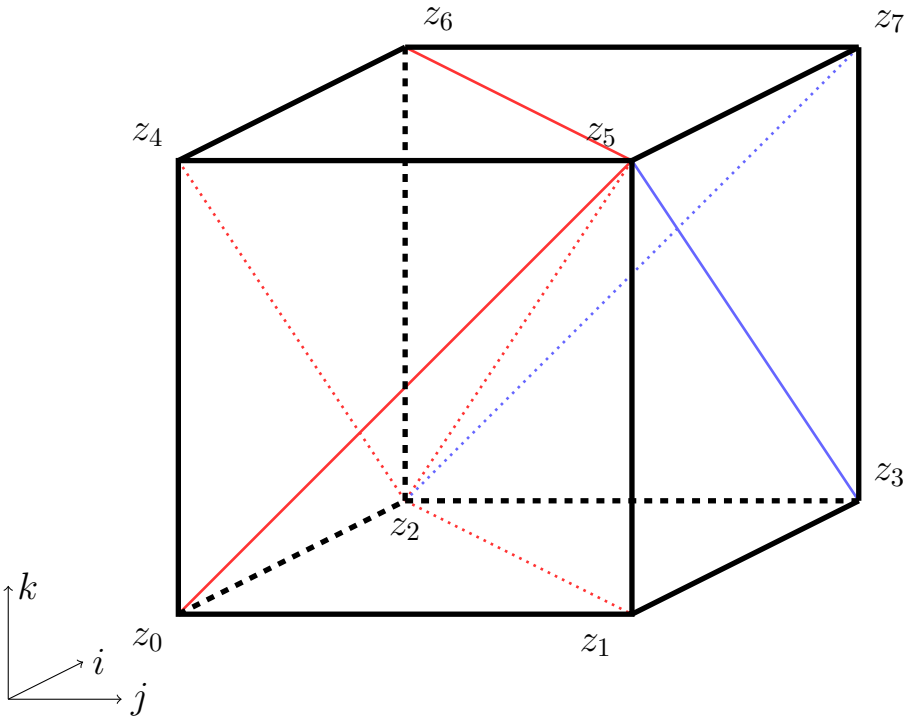
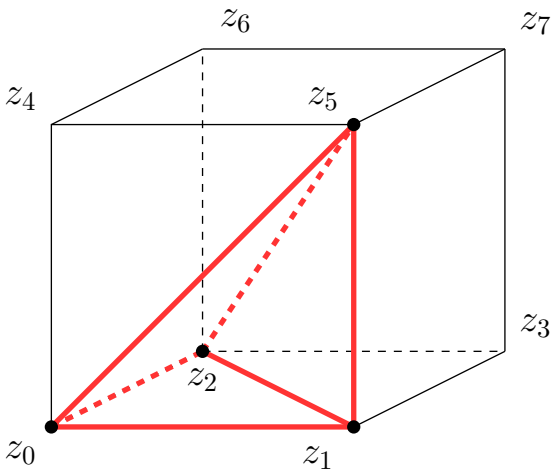
1 Geometry



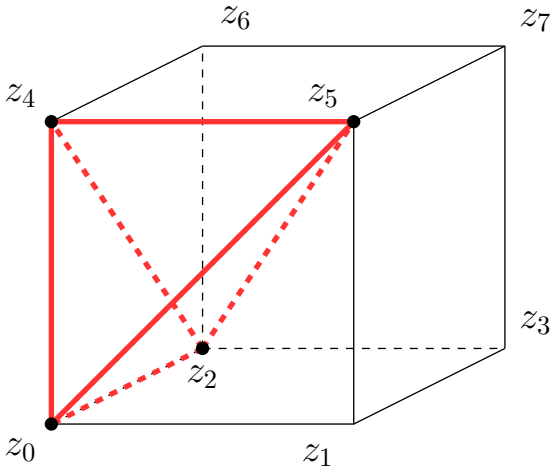
2 Element stiffness matrix

$$
\begin{array}{c}
 \\ z_0 \\ z_1 \\ z_2 \\ z_3 \\ z_4 \\ z_5 \\ z_6 \\ z_7
\end{array}
\begin{array}{c}
\begin{array}{cccccccc} z_0 & z_1 & z_2 & z_3 & z_4 & z_5 & z_6 & z_7 \end{array} \\
\left(\begin{array}{cccccccc}
4 & -1 & -2 & & -1 & & & \\
-1 & 4 & & -1 & & -2 & & \\
-2 & & 6 & -2 & & & -2 & \\
 & -1 & -2 & 4 & & & & -1 \\
-1 & & & & 4 & -2 & -1 & \\
 & -2 & & & -2 & 6 & & -2 \\
 & & -2 & & -1 & & 4 & -1 \\
 & & & -1 & & -2 & -1 & 4
\end{array}\right)
\end{array}
$$



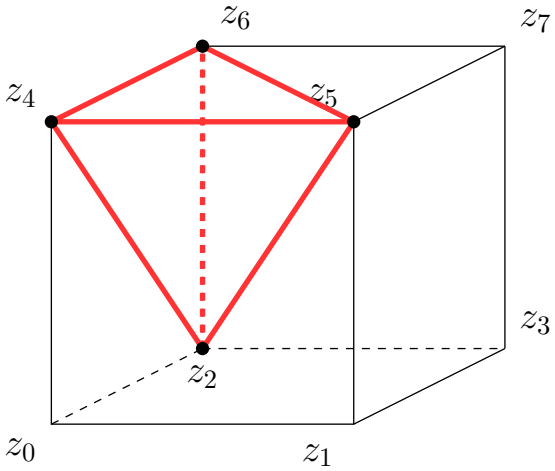
$(z_0\ z_1\ z_2\ z_5)$

$$\begin{array}{c} \\ z_0 \\ z_1 \\ z_2 \\ z_5 \end{array} \begin{array}{c} \begin{array}{cccc} z_0 & z_1 & z_2 & z_5 \end{array} \\ \begin{pmatrix} 2 & -1 & -1 & \\ -1 & 2 & & -1 \\ -1 & & 1 & \\ & -1 & & 1 \end{pmatrix} \end{array}$$



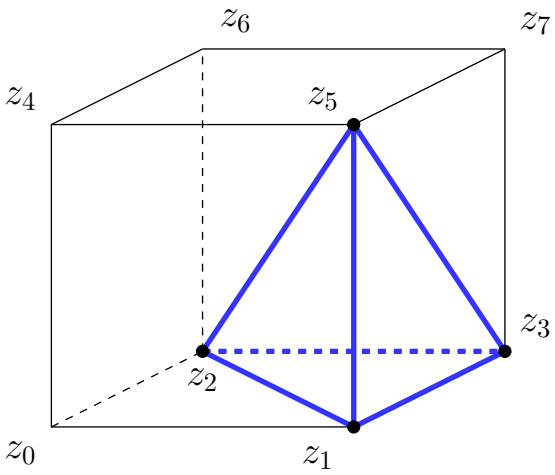
$(z_0\ z_2\ z_4\ z_5)$

$$\begin{array}{c} \\ z_0 \\ z_2 \\ z_4 \\ z_5 \end{array} \begin{array}{c} \begin{array}{cccc} z_0 & z_2 & z_4 & z_5 \end{array} \\ \begin{pmatrix} 2 & -1 & -1 & \\ -1 & 1 & & \\ -1 & & 2 & -1 \\ & & -1 & 1 \end{pmatrix} \end{array}$$



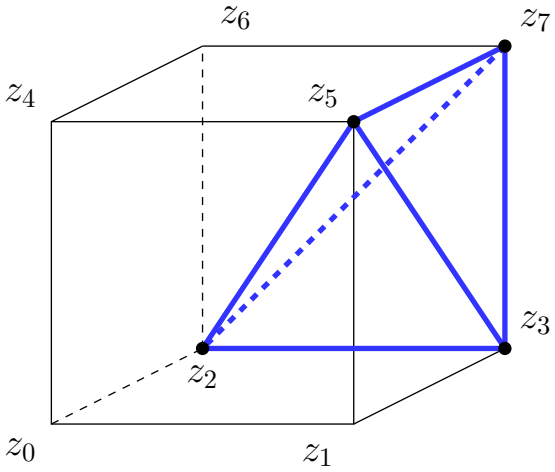
$(z_2\ z_4\ z_5\ z_6)$

$$\begin{array}{c} \\ z_2 \\ z_4 \\ z_5 \\ z_6 \end{array} \begin{array}{c} \begin{array}{cccc} z_2 & z_4 & z_5 & z_6 \end{array} \\ \begin{pmatrix} 1 & & & -1 \\ & 2 & -1 & -1 \\ & -1 & 1 & \\ -1 & -1 & & 2 \end{pmatrix} \end{array}$$



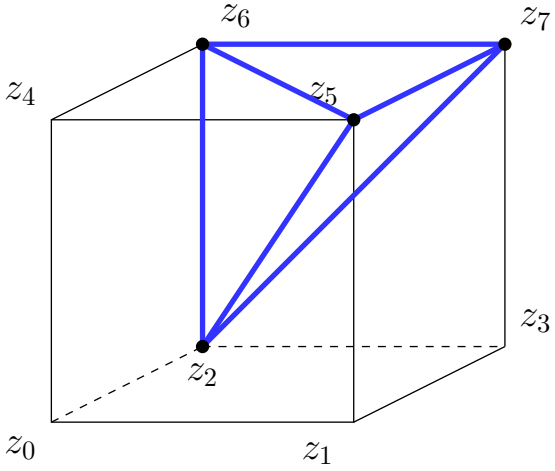
$(z_1\ z_2\ z_3\ z_5)$

$$\begin{array}{c} \\ z_1 \\ z_2 \\ z_3 \\ z_5 \end{array} \begin{array}{c} \begin{array}{cccc} z_1 & z_2 & z_3 & z_5 \end{array} \\ \begin{pmatrix} 2 & & -1 & -1 \\ & 1 & -1 & \\ -1 & -1 & 2 & \\ -1 & & & 1 \end{pmatrix} \end{array}$$



$(z_2\ z_3\ z_5\ z_7)$

$$\begin{array}{c} \\ z_2 \\ z_3 \\ z_5 \\ z_7 \end{array} \begin{array}{c} \begin{array}{cccc} z_2 & z_3 & z_5 & z_7 \end{array} \\ \begin{pmatrix} 1 & -1 & & \\ -1 & 2 & & -1 \\ & & 1 & -1 \\ & -1 & -1 & 2 \end{pmatrix} \end{array}$$



$(z_2\ z_5\ z_6\ z_7)$

$$\begin{array}{c} \\ z_2 \\ z_5 \\ z_6 \\ z_7 \end{array} \begin{array}{c} \begin{array}{cccc} z_2 & z_5 & z_6 & z_7 \end{array} \\ \begin{pmatrix} 1 & & -1 & \\ & 1 & & -1 \\ -1 & & 2 & -1 \\ & -1 & -1 & 2 \end{pmatrix} \end{array}$$