

## GIVEN DATA

Lower Boom ( $\alpha$ )  $\alpha := 30\text{deg}$

Upper Boom ( $\beta$ )  $\beta := 40\text{deg}$

$$E := \begin{pmatrix} 263.96 \\ 4.00 \\ 0 \end{pmatrix} \text{in}$$

$$O := \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

$$R_{lb}(\alpha) := \begin{pmatrix} \cos(\alpha) & -\sin(\alpha) & 0 \\ \sin(\alpha) & \cos(\alpha) & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$R_{ub}(\beta) := \begin{pmatrix} \cos(-\beta) & -\sin(-\beta) & 0 \\ \sin(-\beta) & \cos(-\beta) & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$E_1(\alpha) := R_{lb}(\alpha) \cdot (E - O) + O$$

$$E_1(\alpha) = \begin{pmatrix} 226.6 \\ 135.44 \\ 0 \end{pmatrix} \cdot \text{in}$$

$$CL1 := \begin{pmatrix} -75.94 \\ 4.00 \\ 0 \end{pmatrix} \text{in} \quad CL2 := \begin{pmatrix} 169.52 \\ 4.00 \\ 0 \end{pmatrix} \text{in} \quad CL3 := \begin{pmatrix} 180.06 \\ 4.00 \\ 0 \end{pmatrix} \text{in} \quad CL4 := \begin{pmatrix} 192.68 \\ 4.00 \\ 0 \end{pmatrix} \text{in}$$

$$CL5 := \begin{pmatrix} 238.05 \\ 4.00 \\ 0 \end{pmatrix} \text{in} \quad CL6 := \begin{pmatrix} 247.55 \\ 4.00 \\ 0 \end{pmatrix} \text{in} \quad CL7 := \begin{pmatrix} 252.55 \\ 4.00 \\ 0 \end{pmatrix} \text{in} \quad CL8 := \begin{pmatrix} 267.76 \\ 4.00 \\ 0 \end{pmatrix} \text{in}$$

$$CL9 := \begin{pmatrix} 236.97 \\ 4.00 \\ 0 \end{pmatrix} \text{in} \quad CL10 := \begin{pmatrix} 116.00 \\ 4.00 \\ 0 \end{pmatrix} \text{in} \quad CL11 := \begin{pmatrix} 95.97 \\ 4.00 \\ 0 \end{pmatrix} \text{in} \quad CL12 := \begin{pmatrix} 17.75 \\ 4.00 \\ 0 \end{pmatrix} \text{in}$$

## EVALUATION

### Upper Boom

$$CL1_1(\beta) := R_{ub}(\beta) \cdot (CL1 - E) + E_1(\alpha) \qquad CL1_1(\beta) = \begin{pmatrix} -33.782 \\ 353.928 \\ 0 \end{pmatrix} \text{ in}$$

$$CL2_1(\beta) := R_{ub}(\beta) \cdot (CL2 - E) + E_1(\alpha) \qquad CL2_1(\beta) = \begin{pmatrix} 154.251 \\ 196.149 \\ 0 \end{pmatrix} \text{ in}$$

$$CL3_1(\beta) := R_{ub}(\beta) \cdot (CL3 - E) + E_1(\alpha) \qquad CL3_1(\beta) = \begin{pmatrix} 162.325 \\ 189.374 \\ 0 \end{pmatrix} \text{ in}$$

$$CL4_1(\beta) := R_{ub}(\beta) \cdot (CL4 - E) + E_1(\alpha) \qquad CL4_1(\beta) = \begin{pmatrix} 171.992 \\ 181.262 \\ 0 \end{pmatrix} \text{ in}$$

$$CL5_1(\beta) := R_{ub}(\beta) \cdot (CL5 - E) + E_1(\alpha) \qquad CL5_1(\beta) = \begin{pmatrix} 206.748 \\ 152.099 \\ 0 \end{pmatrix} \text{ in}$$

$$CL6_1(\beta) := R_{ub}(\beta) \cdot (CL6 - E) + E_1(\alpha) \qquad CL6_1(\beta) = \begin{pmatrix} 214.025 \\ 145.992 \\ 0 \end{pmatrix} \text{ in}$$

$$CL7_1(\beta) := R_{ub}(\beta) \cdot (CL7 - E) + E_1(\alpha) \qquad CL7_1(\beta) = \begin{pmatrix} 217.855 \\ 142.778 \\ 0 \end{pmatrix} \text{ in}$$

### Lower Boom

$$CL9_1(\alpha) := R_{lb}(\alpha) \cdot (CL9 - O) + O \qquad CL9_1(\alpha) = \begin{pmatrix} 203.22 \\ 121.95 \\ 0 \end{pmatrix} \text{ in}$$

$$\text{CL10}_1(\alpha) := R_{\text{lb}}(\alpha) \cdot (\text{CL10} - \text{O}) + \text{O} \qquad \text{CL10}_1(\alpha) = \begin{pmatrix} 98.46 \\ 61.46 \\ 0 \end{pmatrix} \cdot \text{in}$$

$$\text{CL11}_1(\alpha) := R_{\text{lb}}(\alpha) \cdot (\text{CL11} - \text{O}) + \text{O} \qquad \text{CL11}_1(\alpha) = \begin{pmatrix} 81.11 \\ 51.45 \\ 0 \end{pmatrix} \cdot \text{in}$$

$$\text{CL12}_1(\alpha) := R_{\text{lb}}(\alpha) \cdot (\text{CL12} - \text{O}) + \text{O} \qquad \text{CL12}_1(\alpha) = \begin{pmatrix} 13.37 \\ 12.34 \\ 0 \end{pmatrix} \cdot \text{in}$$