Axial Loading

\[ S_{AD} = S_{AB} + S_{BC} + S_{CD} \]

\[ S_{AD} = \frac{P_{AB}L_{AB}}{A_{AB}E_{AB}} + \frac{P_{BC}L_{BC}}{A_{BC}E_{BC}} + \frac{P_{CD}L_{CD}}{A_{CD}E_{CD}} \]

\[ S = \sum_{i=1}^{n} \frac{P_i L_i}{A_i E_i} \]

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\[ \sigma = \frac{P}{A} \]

\[ \epsilon = \frac{\sigma}{E} \]

\[ P = \frac{5.5A}{L} \]

\[ S = \frac{PL}{AE} \]

1) \[ P + P_{AL} + P_{COP} = 0 \]

\[ \sigma_{AL} = \frac{P_{AL}}{A_{AL}} \leq \sigma_{all_{AL}} \]

\[ \sigma_{COP} = \frac{P_{COP}}{A_{COP}} \leq \sigma_{all_{COP}} \]

2) \[ \frac{P_{ALL_{AL}}}{A_{AL} E_{AL}} = \frac{P_{C_{Lc}}}{A_{c} E_{c}} \]
1) \[ \sum F_h = 0 = -P_{cd} + 60k \\
\frac{P_{cd}}{60k} = \frac{60k}{600N^2} = \frac{10k}{1N^2} \]

2) To solve for stress in BC:
\[ \sum F_h = \sigma = +60k - 80k - P_{bc} \]
\[ P_{bc} = 20k \]
\[ \sigma_{bc} = \frac{20k}{101in^2} = 2 \frac{k}{in^2} \text{ shortening} \]

\[ S_{cd} = \frac{P_{cd}L_{cd}}{A_{cd}E_{cd}} = \frac{(60k)(30in)}{(600N^2)(30 \times 10k/in^2)} = 0.01 \text{ in} \]

\[ S_{bc} = \frac{P_{bc}L_{bc}}{A_{bc}E_{bc}} = 0.01 \text{ in} \]
\[ S_{ab} = \frac{P_{ab}L_{ab}}{A_{ab}E_{bc}} = \frac{P_{ab}}{A_{ab}E_{bc}} \]

\[ 0 = 50k - 80k + 60k - P_{ab} \]
\[ P_{ab} = 50 - 80 + 60k = 10k \]

\[ S_d = S_{ab} + S_{bc} + S_{cd} \]