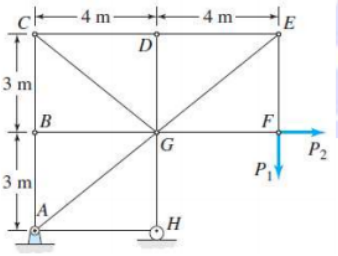
Question: 3. The pin displacements of the truss were computed by the fi...

3. The pin displacements of the truss were computed by the finite-element method. The displacements in x and y directions given by u and v are given in Table P2.63.Determine the axial strains in members BC, CG, GB, and CD.



$u_B = 7.00$ mm	$v_B = 1.500$ mm
$u_C = 17.55$ mm	$v_C = 3.000$ mm
$u_D = 20.22$ mm	$v_D = -4.125$ mm
$u_E = 22.88$ mm	$v_E = -32.250$ mm
$u_F = 9.00$ mm	$v_F = -33.750$ mm
$u_G = 7.00$ mm	$v_G = -4.125$ mm
$u_H = 0$	$v_H = 0$

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Expert Answer

Anonymous answered this
575 answers

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Element	i	j
BC	B	C
CG	C	G
GB	B	G
CD	C	D

⇒

Element	length	cosine(C)	sine(S)
BC	3000	0	1
CG	5000	4/5	-3/5
GB	4000	1	0
CD	4000	1	0

⇒ $\varepsilon_{BC} = \frac{1}{l}[-C \ -S \ C \ S]\begin{bmatrix} u_B \\ v_B \\ u_C \\ v_C \end{bmatrix}$

$= \frac{1}{3000}[0 \ -1 \ 0 \ 1][7 \ 1.5 \ 17.55 \ 3]^T$

$= \frac{-1.5 + 3}{3000}$

$\boxed{\varepsilon_{BC} = 5 \times 10^{-4}}$

⇒ $\varepsilon_{CG} = \frac{1}{l}[-C \ -S \ C \ S][u_C \ v_C \ u_G \ v_G]^T$

$= \frac{1}{5000}[-4/5 \ +3/5 \ 4/5 \ -3/5][17.55 \ 3 \ 7 \ -4.125]^T$

$= \frac{-14.04 + 1.8 + 5.6 + 2.475}{5000}$

$\boxed{\varepsilon_{CG} = -8.33 \times 10^{-4}}$

$\varepsilon_{GB} = \frac{1}{l}[-C \ -S \ C \ S][u_B \ v_B \ u_G \ v_G]^T$

$= \frac{1}{4000}[-1 \ 0 \ 1 \ 0][7 \ 1.5 \ 7 \ -4.125]^T$

$= \frac{-7 + 7}{4000}$

$\boxed{\varepsilon_{GB} = 0}$

$\varepsilon_{CD} = \frac{1}{l}[-C \ -S \ C \ S][u_C \ v_C \ u_D \ v_D]^T$

$= \frac{1}{4000}[-1 \ 0 \ 1 \ 0][17.55 \ 3 \ 20.22 \ -4.125]^T$

$= \frac{-17.55 + 20.22}{4000}$

$\boxed{\varepsilon_{CD} = 6.675 \times 10^{-4}}$

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