Recitation 3

Truss FEA code in Matlab; data file format

ME260 Indian Institute of Science

Structural Optimization: Size, Shape, and Topology

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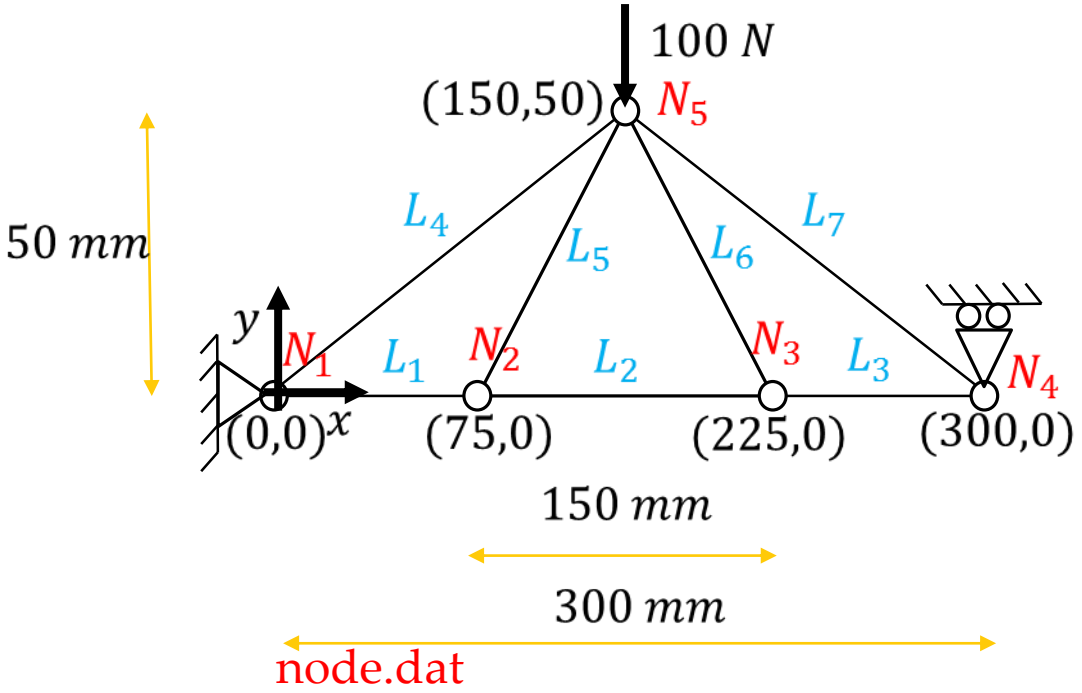
Data for Matlab truss FEA code; Homework 2, Problem 1



elem.dat

Element	Node 1	Node 2	Area	Young's Modulus
1	1	2	1e-4	210e9
2	2	3	1e-4	210e9
3	3	4	1e-4	210e9
4	1	5	1e-4	210e9
5	2	5	1e-4	210e9
6	3	5	1e-4	210e9
7	4	5	1e-4	210e9

node.dat

Node No.	X-coordinate	Y-coordinate
1	0	0
2	75	0
3	225	0
4	300	0
5	150	50

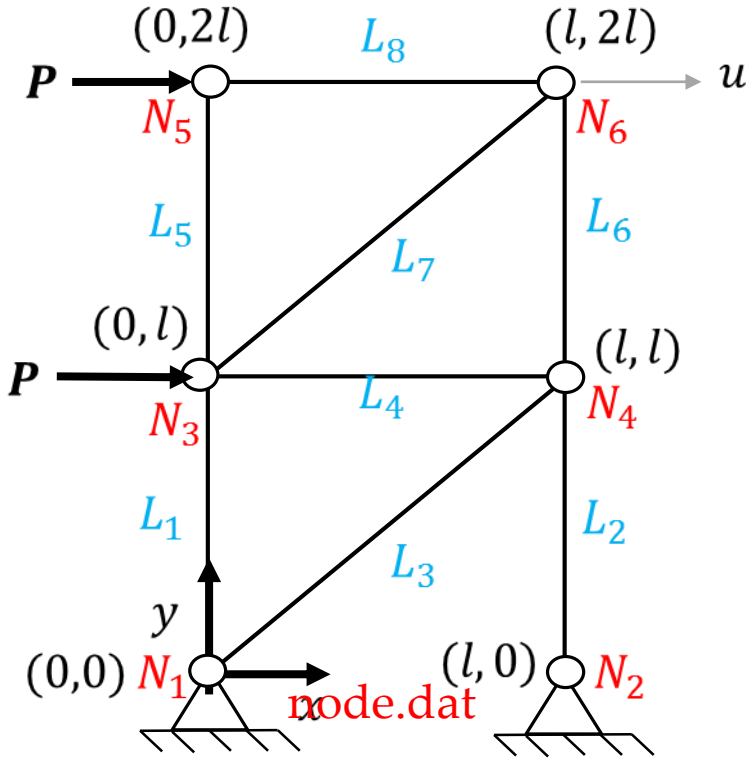
forces.dat

Sl. No	Node	Direction	Magnitude
1	5	2	100

dispbc.dat

Sl. No	Node	Direction	value
1	1	1	0
2	1	2	0
3	4	2	0

Data for Matlab truss FEA code for Homework 2, Problem 4



node.dat

Node No.	X-coordinate	Y-coordinate
1	0	0
2	l	0
3	0	l
4	l	l
5	0	$2l$
6	l	$2l$

elem.dat

Element	Node 1	Node 2	Area	Young's Modulus
1	1	3	1e-4	210e9
2	2	4	1e-4	210e9
3	1	4	1e-4	210e9
4	3	4	1e-4	210e9
5	3	5	1e-4	210e9
6	4	6	1e-4	210e9
7	3	6	1e-4	210e9
8	5	6	1e-4	210e9

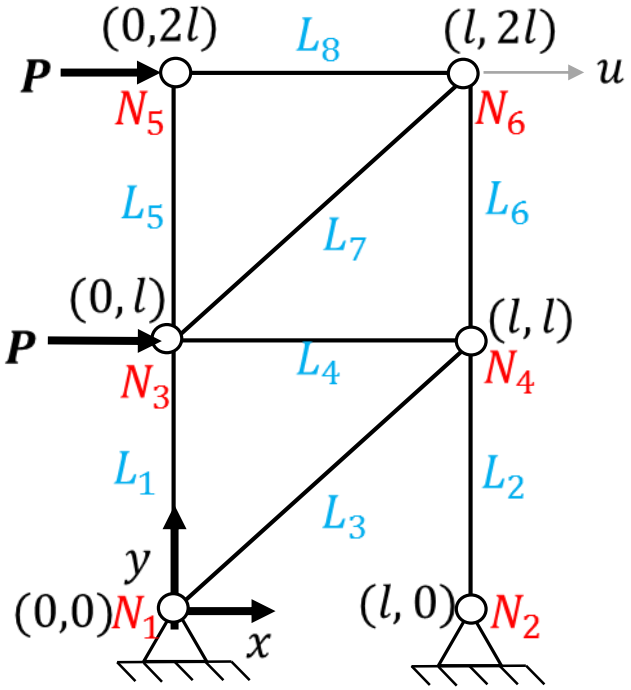
forces.dat

Sl. No	Node	Direction	Magnitude
1	3	1	P
2	5	1	P

dispbc.dat

Sl. No	Node	Direction	value
1	1	1	0
2	1	2	0
3	2	1	0
4	2	2	0

Homework 2, Problem 4



$$\underset{\mathbf{A}}{\text{Min}}\ f = \rho \sum A_i l_i = \rho \mathbf{A}^T \mathbf{L}$$

subject to:

$\boldsymbol{\lambda}$: $\mathbf{K}\mathbf{u} = \mathbf{p}$

$\boldsymbol{\lambda}_v$: $\mathbf{K}\mathbf{u}_v = \mathbf{p}_v$

μ : $\mathbf{u}^T \mathbf{K}\mathbf{u}_v - u^* \le 0$ (Mutual strain Energy)

Given: $\rho, \mathbf{L}, \mathrm{E}, u^*, \mathbf{p}, \mathbf{p}_v$

$\mathbf{A}$: Design variable

$\mathbf{u}, \mathbf{u}_v$: State variables

$$\mathbf{p}_v = \begin{Bmatrix} 0 \\ 0 \\ \vdots \\ 1 \\ 0 \\ \vdots \end{Bmatrix}$$

Non-zero only for the node where displacement is asked.