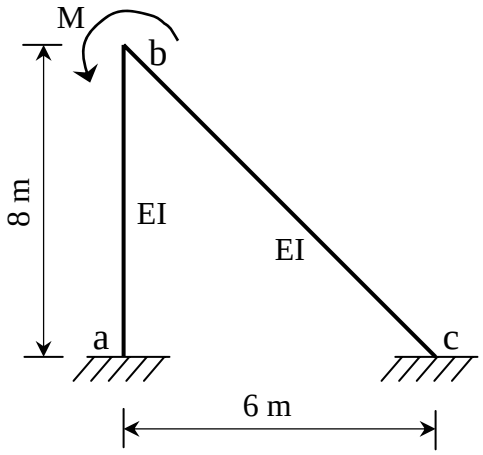
Department of Civil Engineering, IIT Bombay

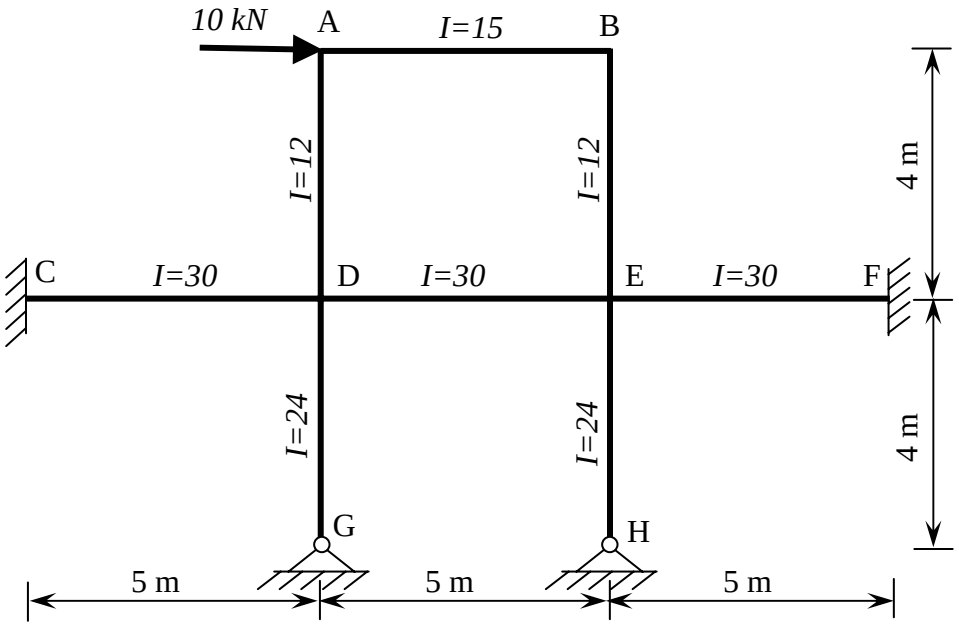
CE317 Structural Mechanics –II Tutorial 3

Use moment distribution method. Draw BMD, SFD, and deflected shape.

P1

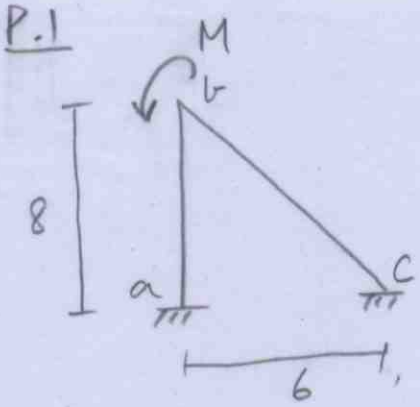


P2



Tutorial-3 CE317

P.1

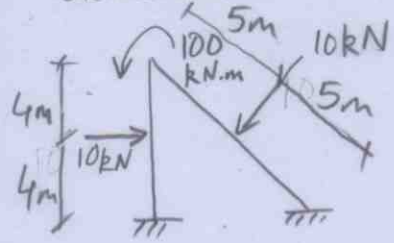


jt	a	b	b	c
mem end	ab	ba	bc	cb
rel stiff	k	k	0.8k	0.8k
df	0	0.555	0.444	0
fem	0	0	0	0
	-0.277 M	-0.555M	-0.444M	-0.222M
conv BM	-0.277	-0.555	-0.444	-0.222 *M

$K = \frac{EI}{8}$

→ here the distribution is such that an imbalance of M is maintained at jt. b.

extension:



No sway possible in this problem

jt	a	b	b	c
mem end	ab	ba	bc	cb
df	0	0.555	0.444	0
fem	-10	10	-12.5	12.5
	-27.06	(1.3875 -55.5)	(1.11 -44.4)	-21.65
	-37.06	-44.11	-55.8	-9.15

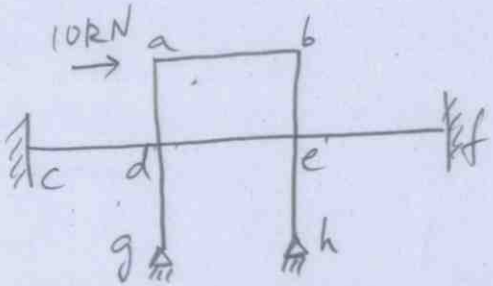
TUTORIAL-3

P2

<Result matches p2, tutorial 2, done by slope-defl>

jt	a	a	d	d	d	d	c	
mem end	ab	aq	da	de	dg	dc	cd	
rel stiff	0.5	0.5	0.5	1	1	1	1	*k
mod stiff	0.75	0.5	0.5	1.5	0.75	1	1	*k
df	0.6	0.4	0.133333	0.4	0.2	0.266667	0	
fem		-100	-100					
	60	40	13.33333	40	20	26.66667		
		6.666667	20				13.33333	
	-4	-2.666667	-2.666667	-8	-4	-5.333333		
		-1.333333	-1.333333				-2.666667	
	0.8	0.533333	0.177778	0.533333	0.266667	0.355556		
		0.088889	0.266667				0.177778	
	-0.053333	-0.035556	-0.035556	-0.106667	-0.053333	-0.071111		
convg BM	56.74667	-56.74667	-70.25778	32.42667	16.21333	21.61778	10.84444	
dx	31.75111	from momt equil of da, left +ve						
ex	31.75111	from antisymm, or momt equil of be, left +ve						
r	63.50222	right +ve						
scaled BM	8.93617	-8.93617	-11.06383	5.106383	2.553191	3.404255	1.707727	

No no-sway part of soln here.
4*e*30/5=k



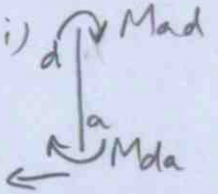
(i) No no-sway part of soln in this problem, ie only sway part.

(ii) Simultaneous distribution at all jts followed by simultaneous c.o. to all jts (ie method-2).

(iii) Only half structure considered since antisymmetric modified stiffnesses used.

(iv) Jt. g excluded (zero BM). If dg was loaded then modified FEM (RHS table, Hibbeler) can be used.

(iv) No distribution at c and no c.o. from c.

(vi) 

$\Sigma M_a = 0$, get d_x.
Then $d_x + e_x = 10$. Scale d_x, e_x, to satisfy this, and then use this scaling to get final BM's

Relative stiffnesses

$k_{cd} = \frac{4E \cdot 30}{5} = K = k_{dc} = k_{de}$

$k_{ab} = k_{ba} = \frac{4E \cdot 15}{5} = \frac{K}{2}$

$k_{ad} = k_{da} = \frac{4E \cdot 12}{4} = \frac{K}{2}$

$k_{dg} = k_{gd} = \frac{4E \cdot 24}{4} = K$

Modified stiffnesses

use modifications for pinned ends g, h, and antisymmetry of members ab, de.

$k'_{ab} = \frac{K}{2} \cdot \frac{6}{4} = 0.75K$

$k'_{dg} = K \cdot \frac{3}{4} = 0.75K$

$k'_{de} = K\frac{6}{4} = 1.5K$