

Structural Mechanics (1)

Week No-07

Deflection in Determinate Structures

Deflections of Trusses, Beams, & Frames: Work-Energy Methods

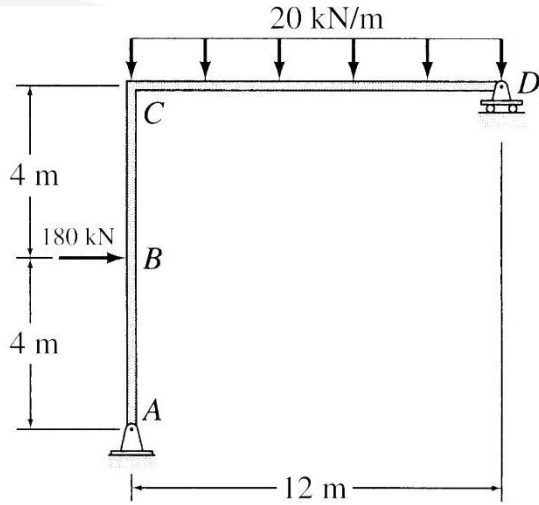
- Deflection of trusses by Work & Strain energy principle
- Principle of Virtual Work
- Deflections of Trusses by the V. W. M.
- Deflections of Beams by the V. W. M.
- Deflections of Frames by the V. W. M.

Ex.1. Compute the Rotation at joint C of the shown frame

08/01/2023

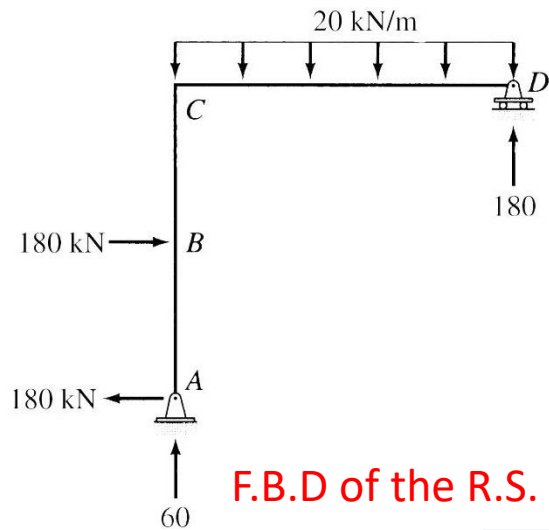
B. Haidar

Structural Mechanics

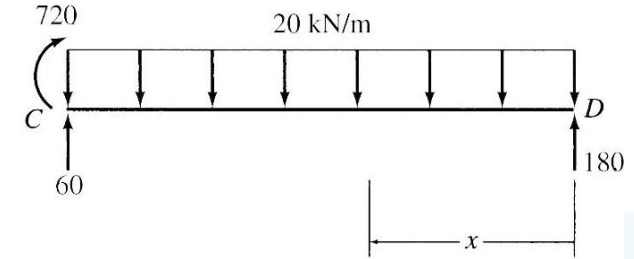
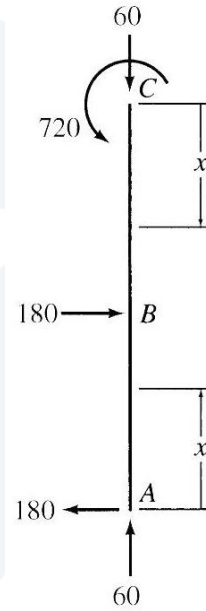


$EI = \text{constant}$
 $E = 200 \text{ GPa}$
 $I = 1000(10^6) \text{ mm}^4$

The Frame

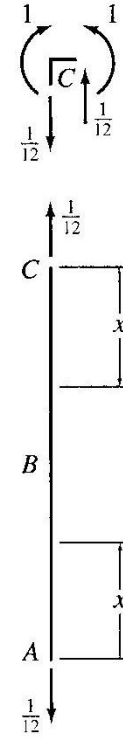
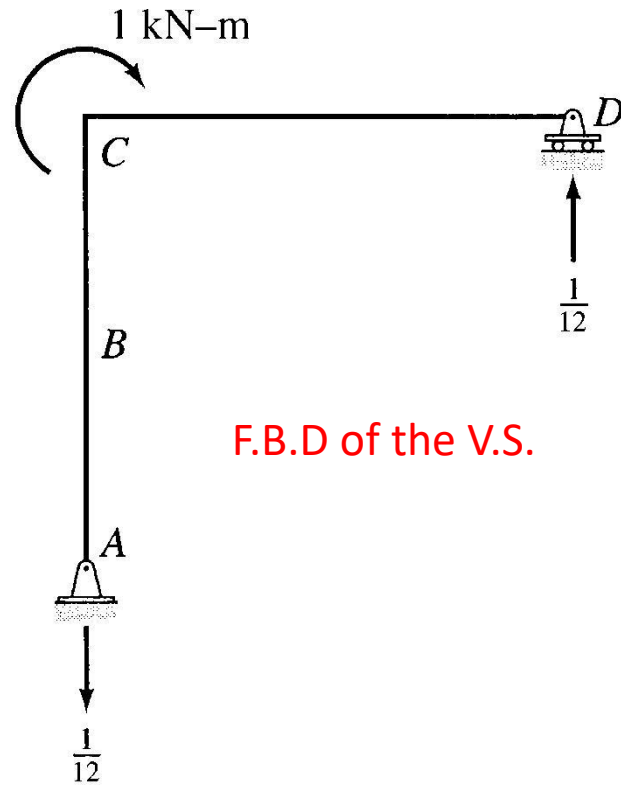


F.B.D of the R.S.



bending moment of the real system: M

Ex.1. Cont.



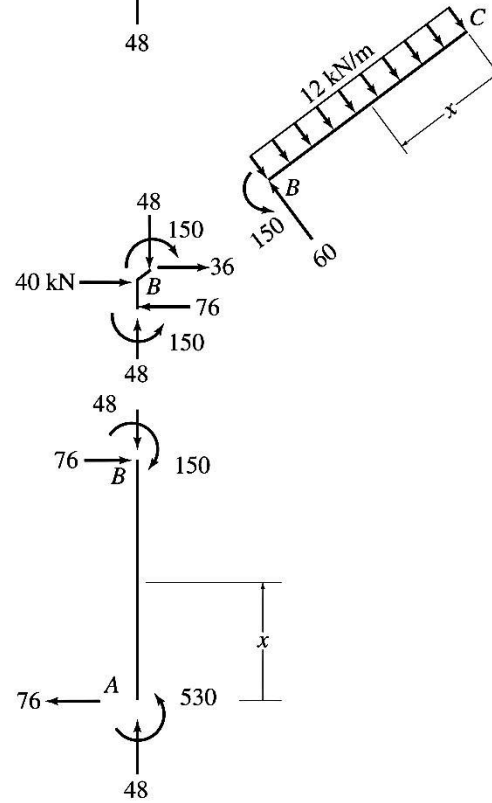
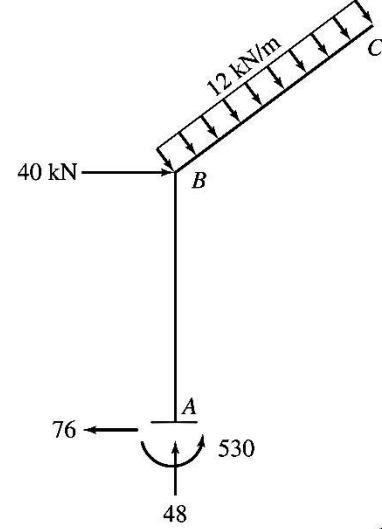
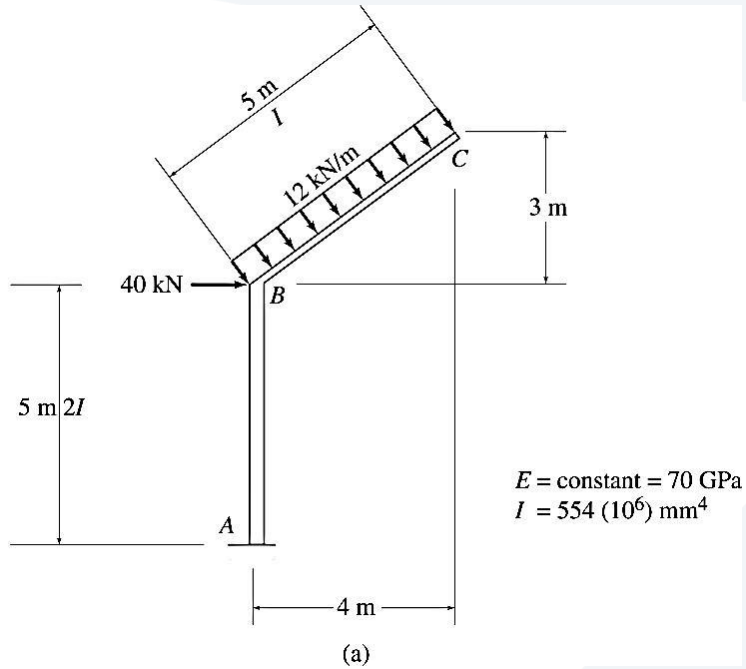
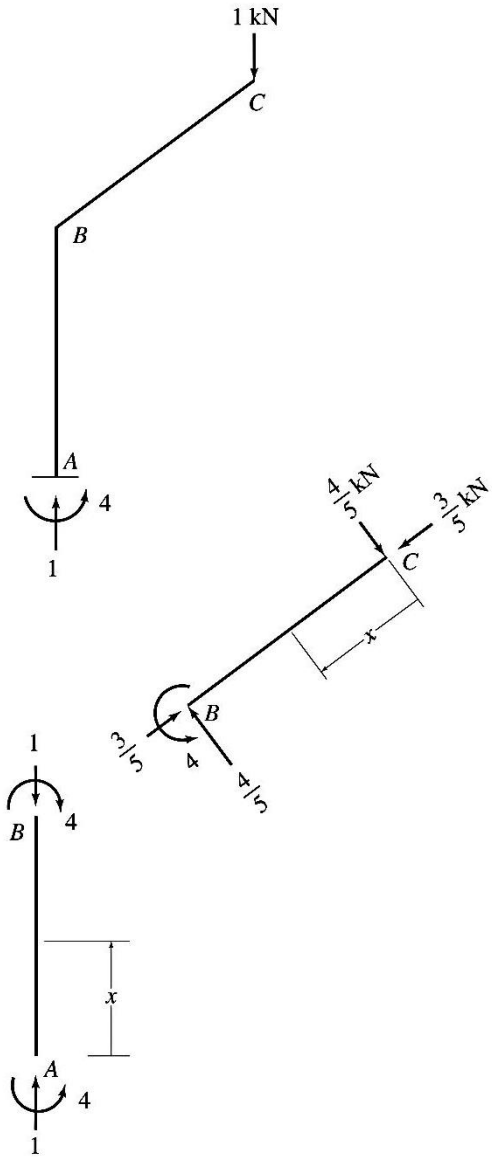
bending moment of the
virtual system: M_v

(c) Virtual System — M_v

Segment	x Coordinate		M (kN-m)	M_v (kN-m)
	Origin	Limits (m)		
AB	A	0–4	$180x$	0
CB	C	0–4	720	0
DC	D	0–12	$180x - 20\frac{x^2}{2}$	$\frac{x}{12}$

$$\theta_C = 0.0216 \text{ Rad}$$

Ex.2. Compute the vertical deflection at joint C of the shown frame

(b) Real System — M (c) Virtual System — M_v

Segment	x Coordinate		EI ($I = 554 \times 10^6 \text{ mm}^4$)	M (kN-m)	M_v (kN-m)
	Origin	Limits (m)			
AB	A	0-5	$2EI$	$76x - 530$	-4
CB	C	0-5	EI	$-12\frac{x^2}{2}$	$-\frac{4}{5}x$

$$\Delta_C = 107 \text{ mm}$$