Mechanics of Materials

Lecture 20 - Superposition

Dr. Nicholas Smith

Wichita State University, Department of Aerospace Engineering

26 April, 2021

schedule

- 26 April - Beam Deflection (superposition), HW 7 Self-grade Due, HW 8 Due
- 28 April - Exam 3 (will only cover through strain transformation)
- 3 May - Stress concentration, buckling
- 5 May - Final exam review
- 6 May - Project 3 Due
- Homeworks 9-11 (posted to blackboard) are optional and provide some practice for exam

- superposition

superposition

superposition

- The differential equation $EI\frac{d^4v}{dx^4} = w(x)$ satisfies the requirements for superposition
- $w(x)$ is linearly related to $v(x)$
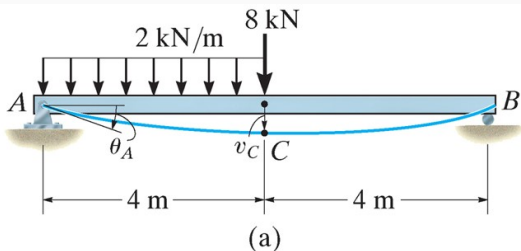- Load does not significantly change the shape of the beam

superposition

- This means we can superpose multiple deflection solutions from simpler cases
- Appendix C in the text has many solutions that can be superposed
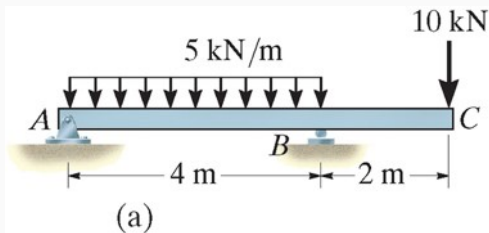
example 12.13

8 kN

2 kN/m

θ_A

$v_C|C$

A

B

4 m

4 m

(a)

Use superposition to find the displacement at C and the slope at A

6

example 12.15

10 kN

5 kN/m

A

B

C

4 m

2 m

(a)

Use superposition to find the displacement at C

7

example 12.16

3 kip

3 ft | 6 ft

A | | B

C $\quad k = 15$ kip/ft

(a)
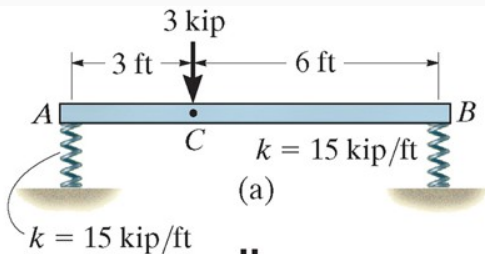
$k = 15$ kip/ft

The steel bar is supported by springs with k=15 kip/ft originally unstretched. For the force shown, determine the displacement at C. Take $E_{st} = 29$ Msi and $I = 12$ in^4.

8