AE333

Mechanics of Materials

Lecture 29 - Statically Indeterminate Beams

Dr. Nicholas Smith
Wichita State University, Department of Aerospace Engineering

15 Apr, 2019

schedule

- 15 Apr - Statically Indeterminate Beams, HW 9 Due
- 17 Apr - Statically Indeterminate Beams
- 19 Apr - Statically Indeterminate Beams
- 22 Apr - Exam 3 Review, HW 10 Due
- 24 Apr - Exam 3

outline

- superposition
- statically indeterminate beams

superposition

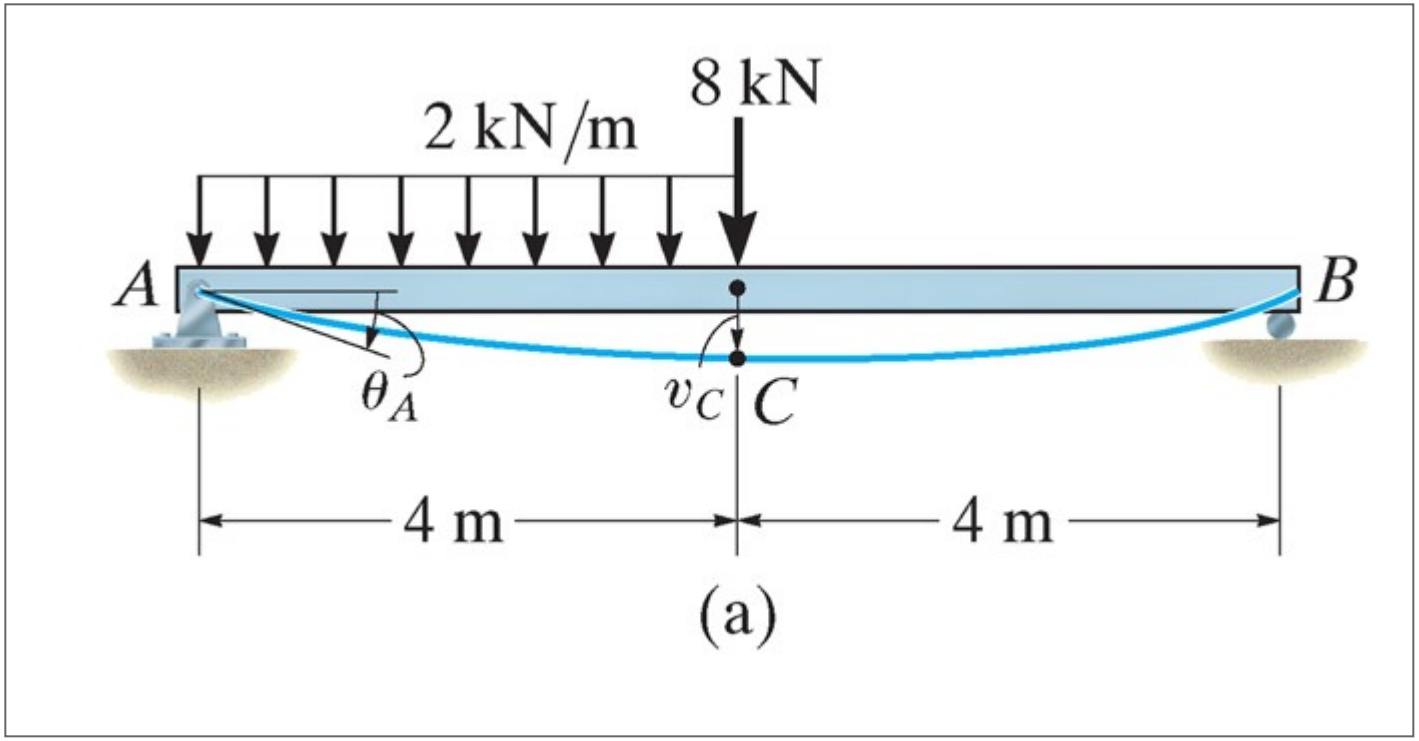
superposition

- The differential equation $EId^4v/dx^4 = w(x)$ satisfies the requirements for superposition
- $w(x)$ is linearly related to $v(x)$
- Load does not significantly change the shape of the beam

superposition

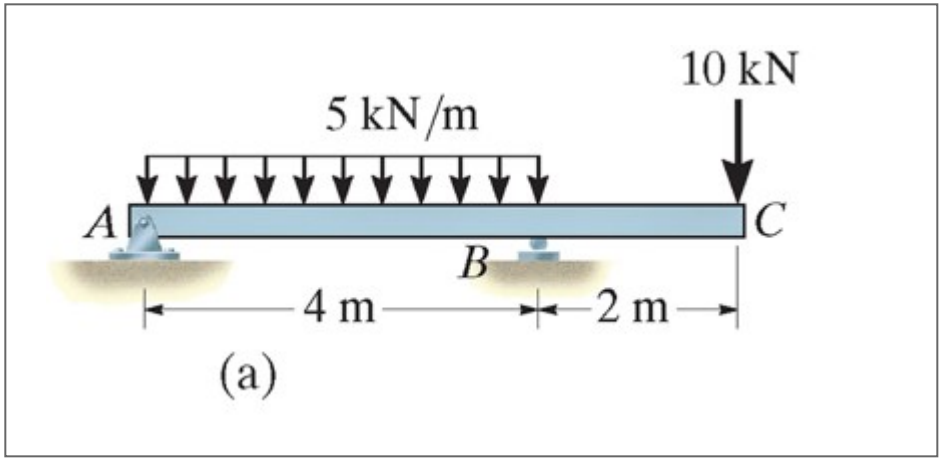
- This means we can superpose multiple deflection solutions from simpler cases
- Appendix C in the text has many solutions that can be superposed

example 12.13



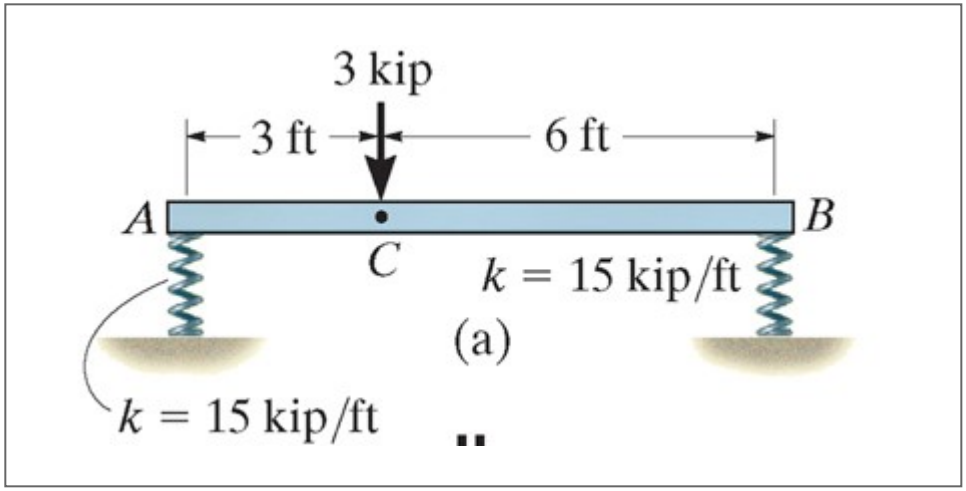
Use superposition to find the displacement at C and the slope at A

example 12.15



Use superposition to find the displacement at C

example 12.16



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.

statically indeterminate beams

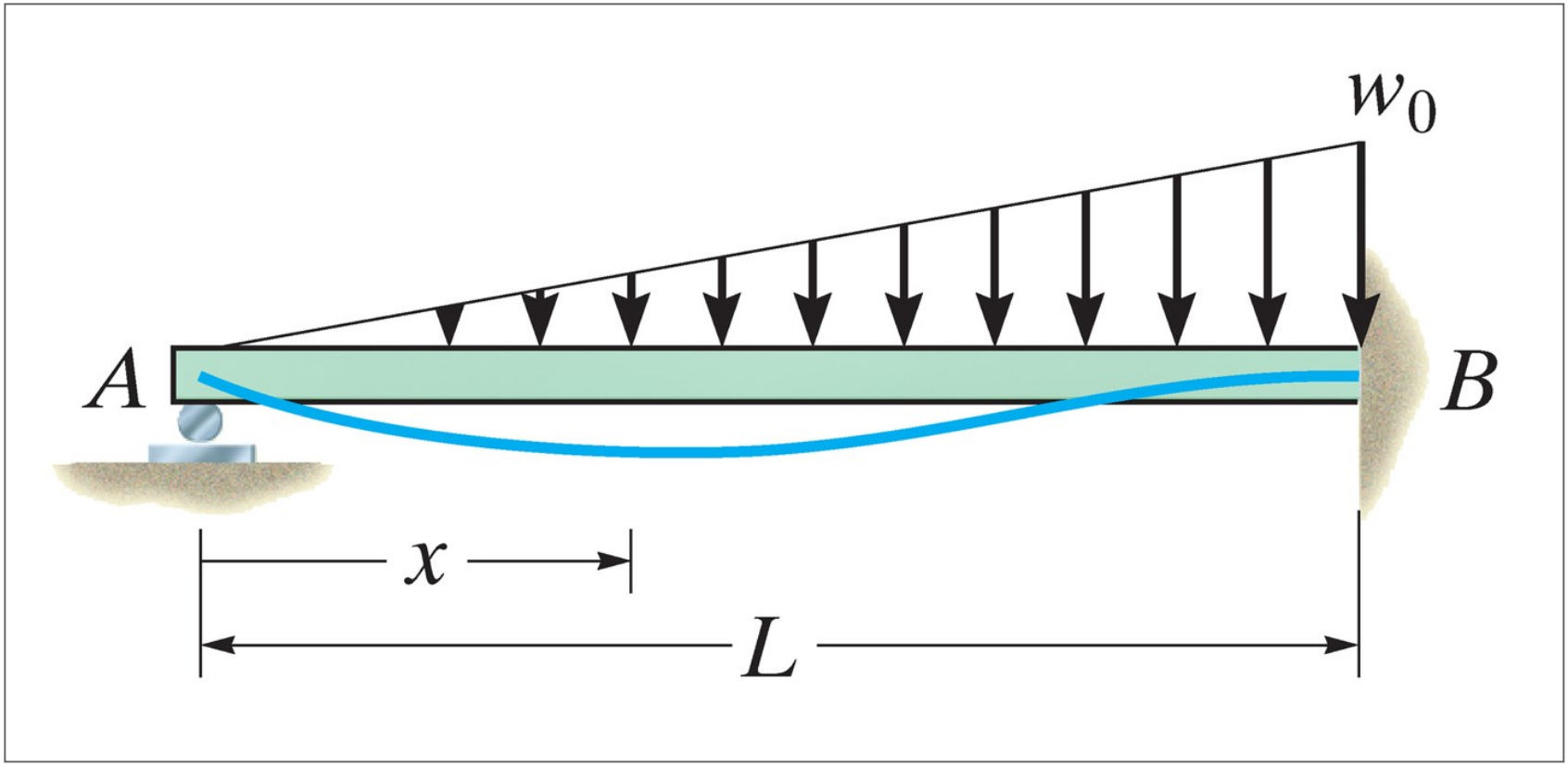
statically indeterminate

- If we have redundant supports, we can have some difficulty finding the displacement
- There are several approaches to solve these problems, we will consider direct integration and superposition

integration

- We can take the extra unknowns and include them in our formulation for $M(x)$
- They will be solved for with the extra boundary conditions applied

example 12.17



example 12.18