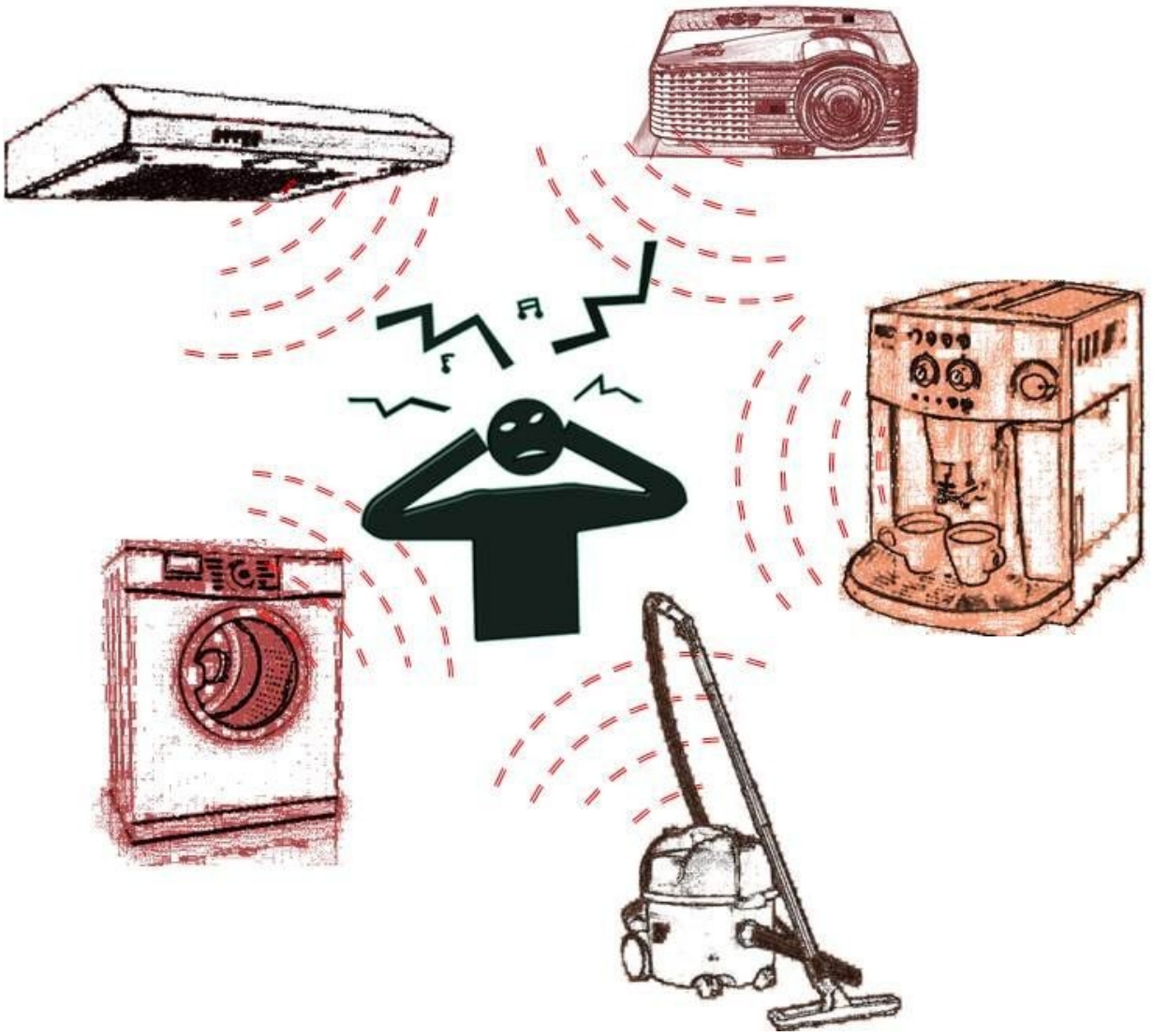
Mechanical Vibrations

Prof. Paulo J. Paupitz Gonçalves

We are often subjected to vibration in our life

We are often subjected to vibration problems in our life



The importance of the study of Vibration

Figure 1.7

Tacoma Narrows bridge during wind-induced vibration. The bridge opened on July 1, 1940, and collapsed on November 7, 1940. (Farquharson photo, Historical Photography Collection, University of Washington Libraries).

The importance of the study of Vibration

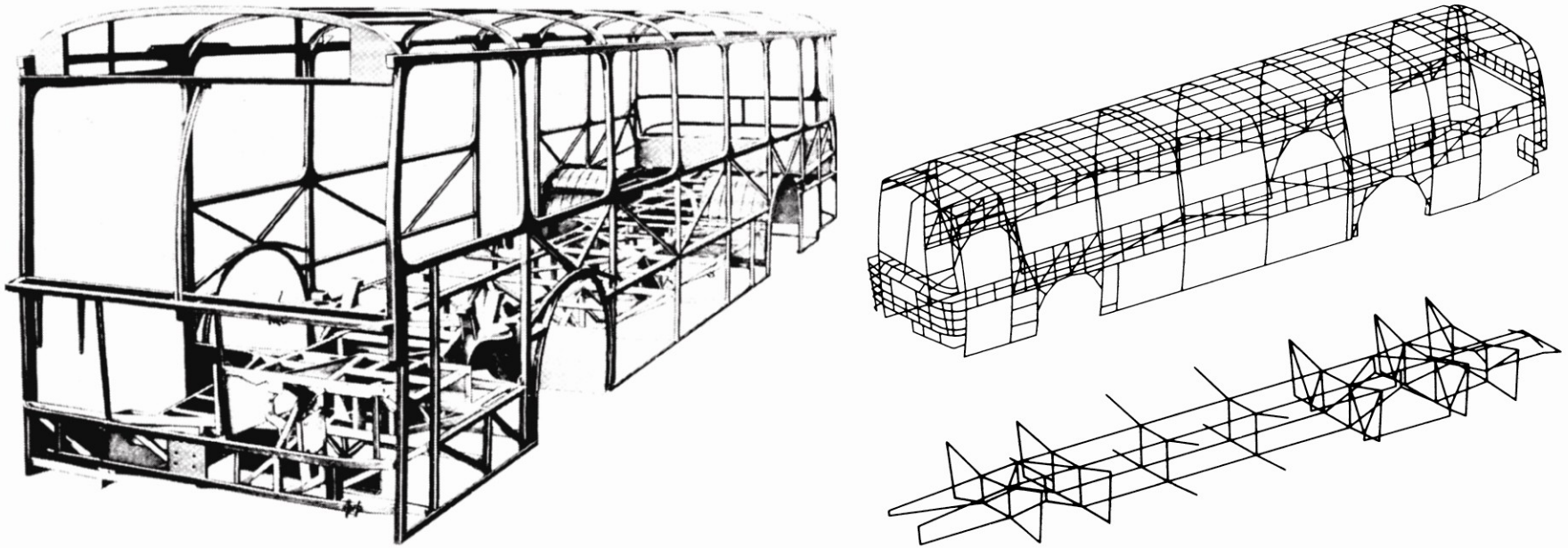
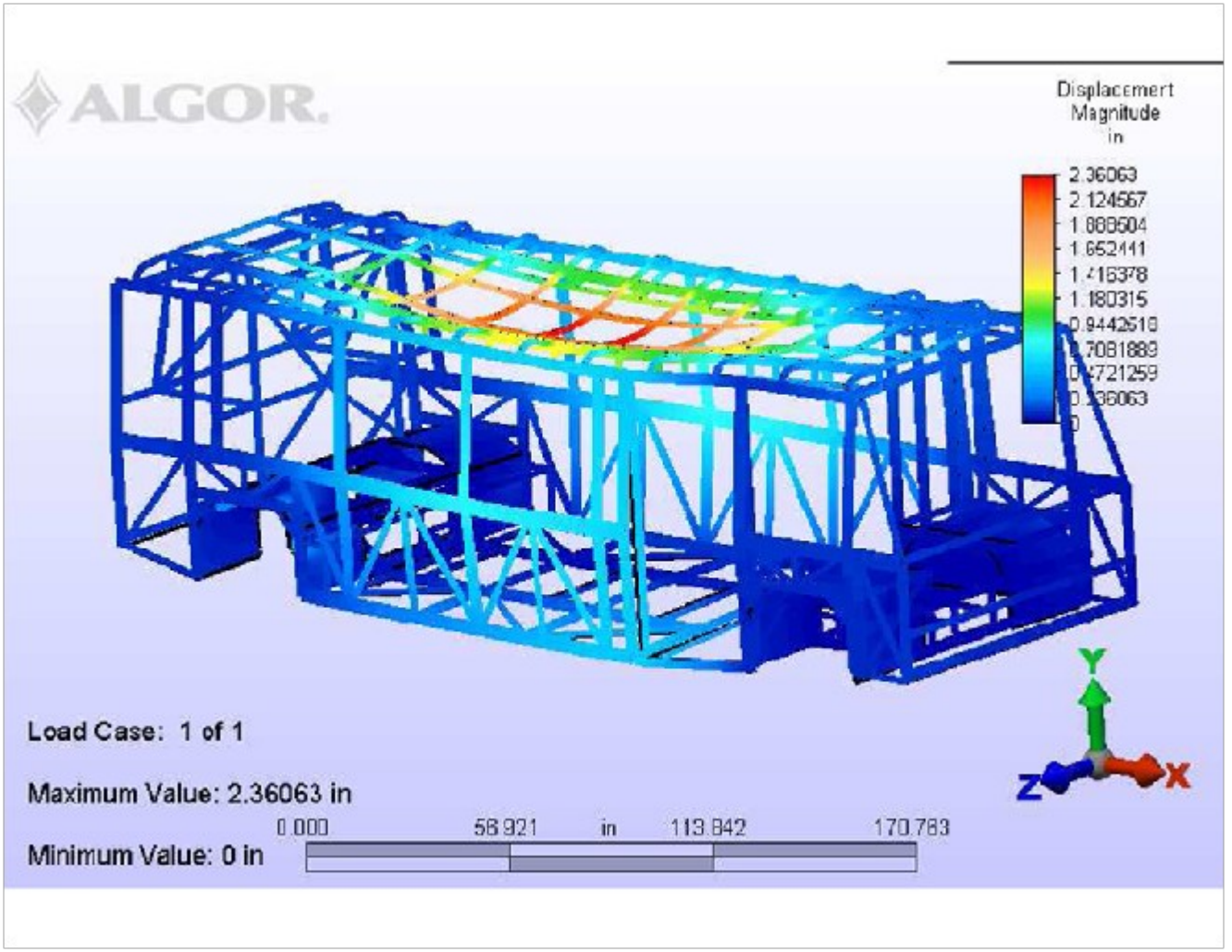


Figure 1.6

Finite element idealization of the body of a bus [1.16].

The importance of the study of Vibration



The importance of the study of Vibration

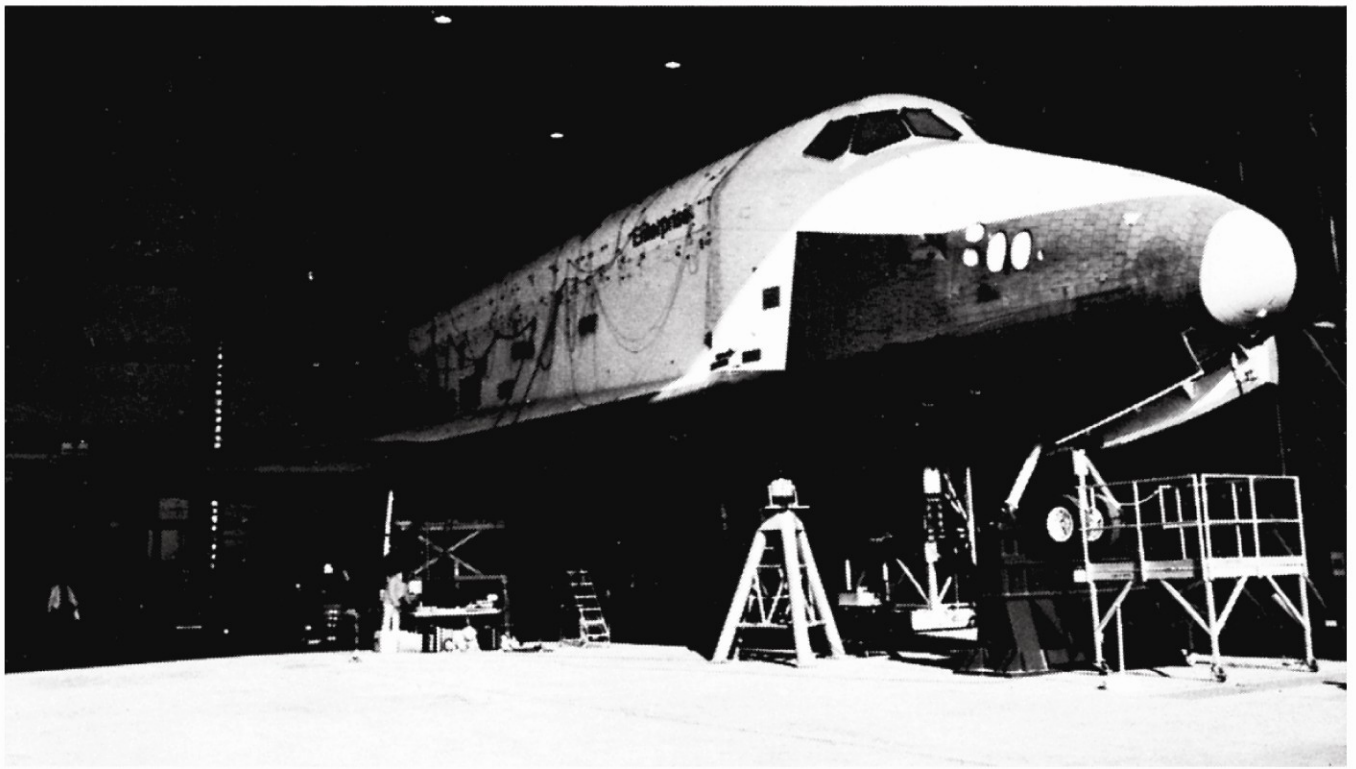
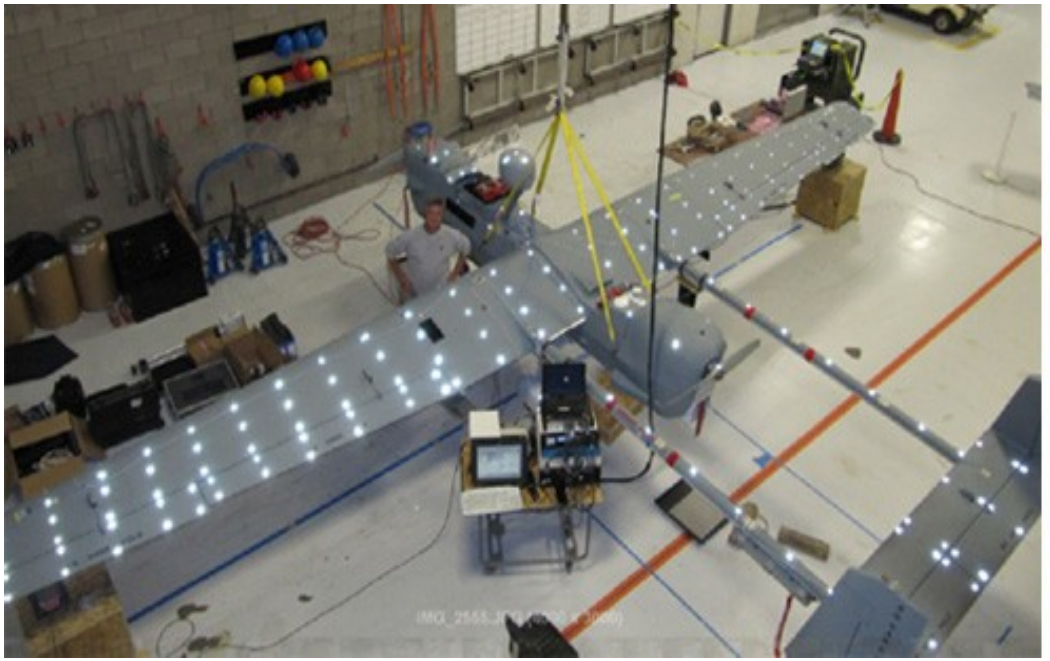
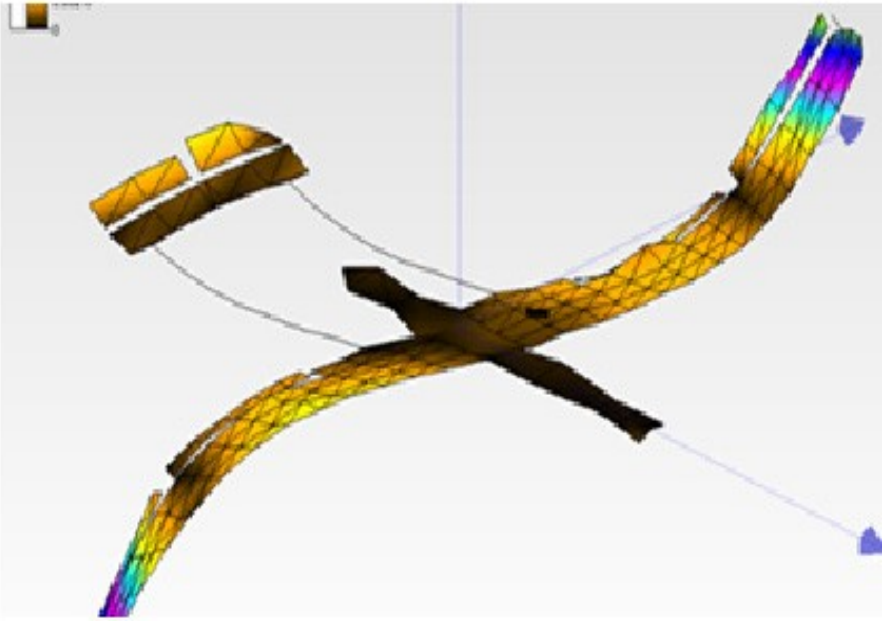


Figure 1.8
Vibration testing of the space shuttle *Enterprise*. (Courtesy of NASA).

The importance of the study of Vibration

The importance of the study of Vibration

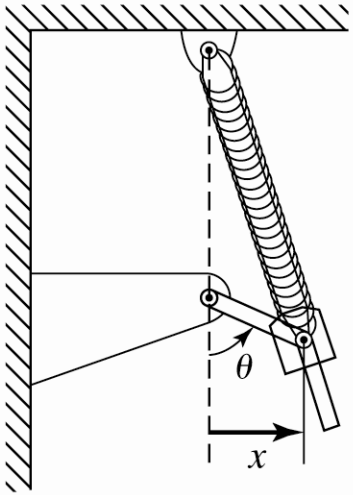




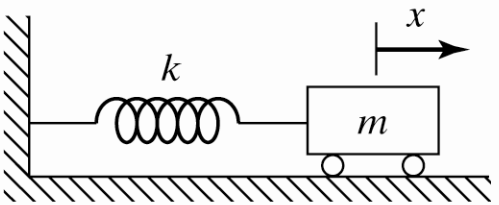
Vibration Videos

Basic Concepts

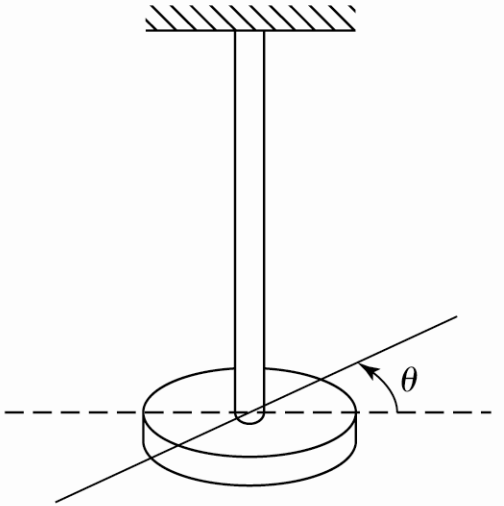
Degrees of Freedom



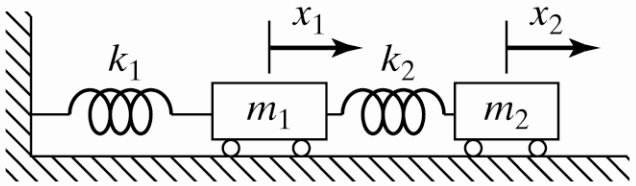
(a) Slider-crank-spring mechanism



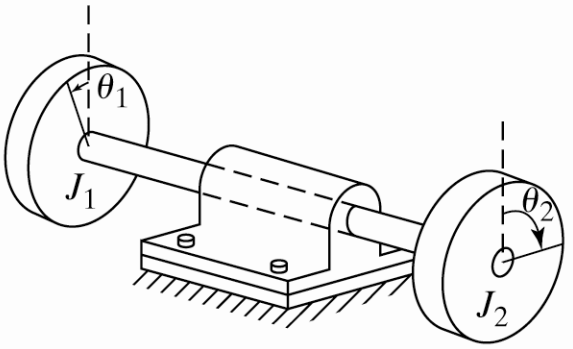
(b) Spring-mass system



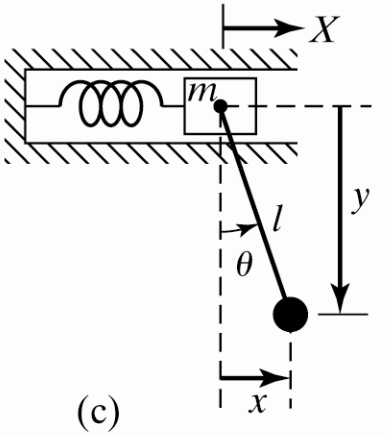
(c) Torsional system



(a)



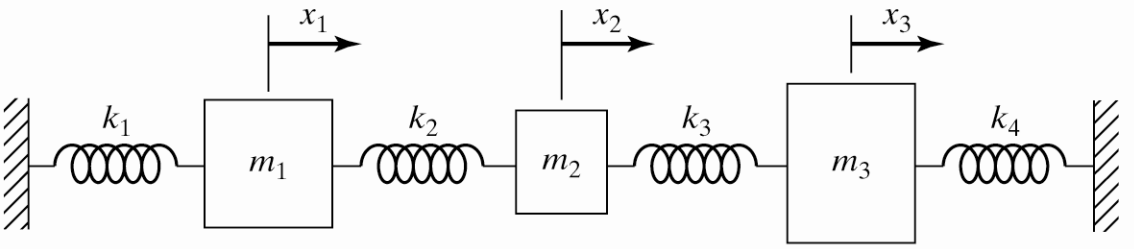
(b)



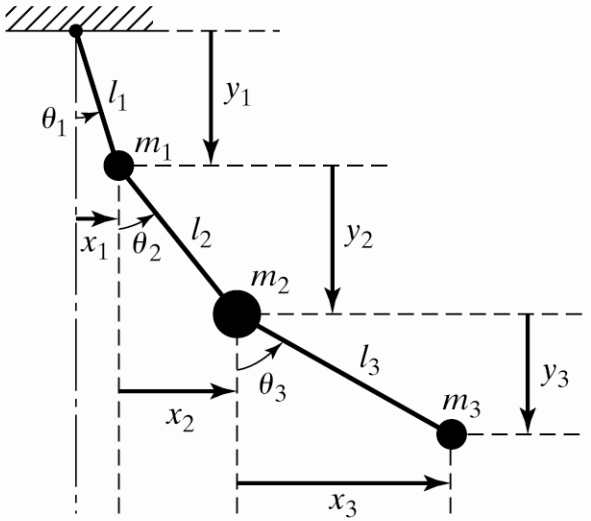
(c)

Basic Concepts

Degrees of Freedom



(a)



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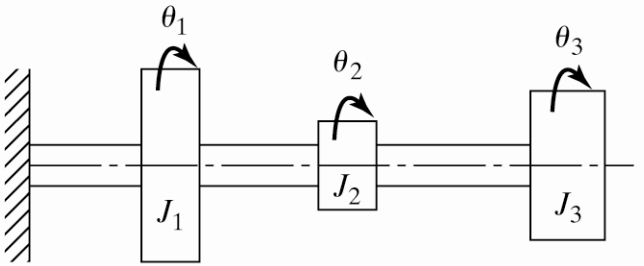
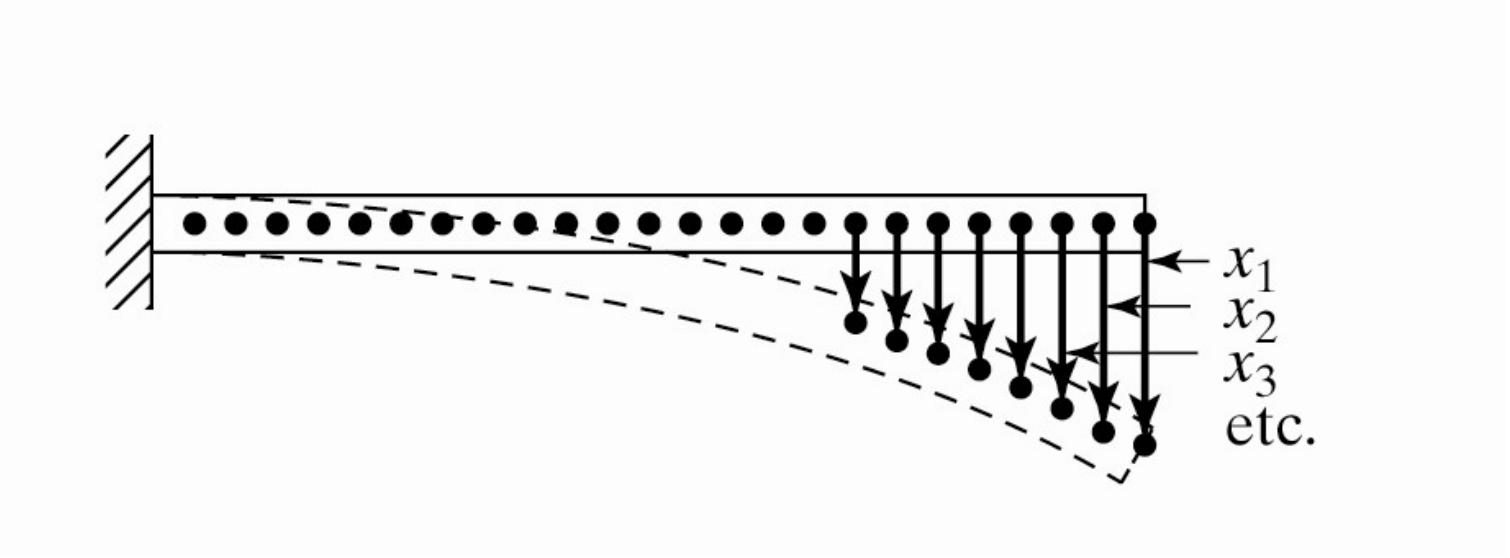


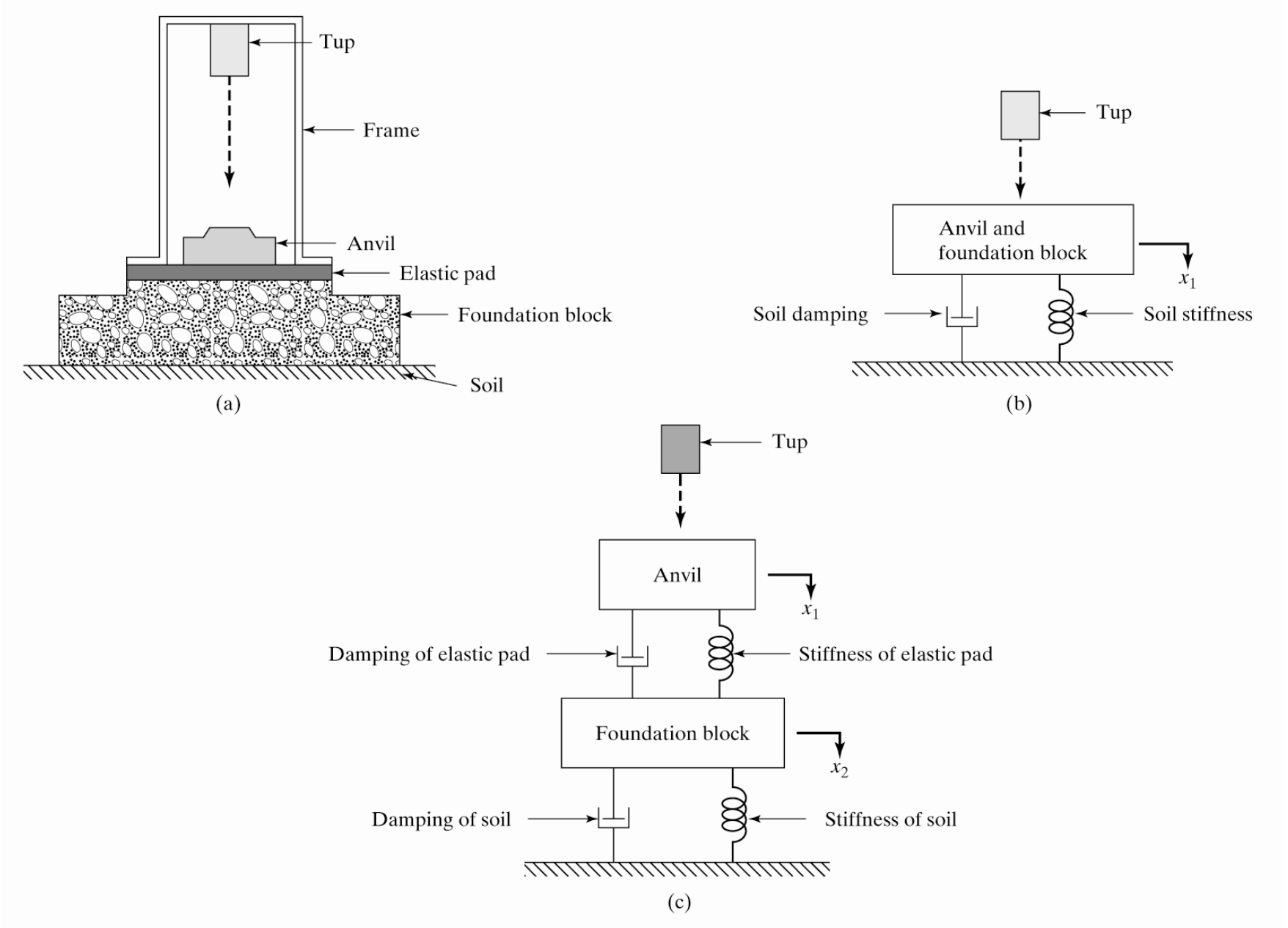
(c)

Basic Concepts

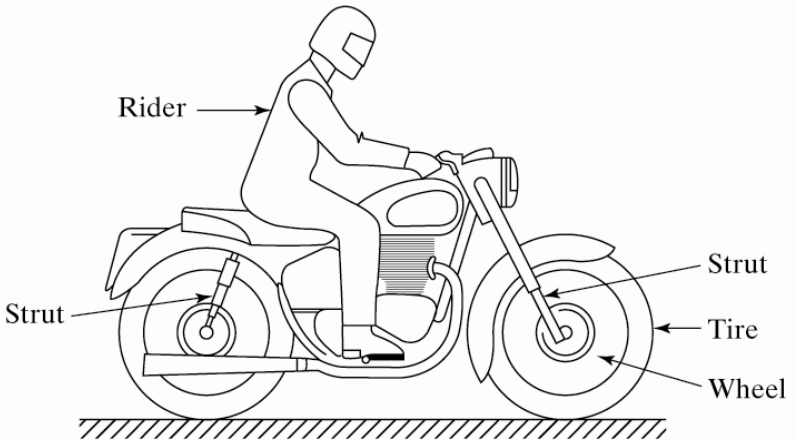
Degrees of Freedom



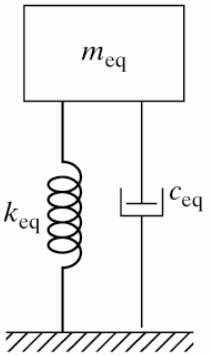
Modelling of Mechanical Systems



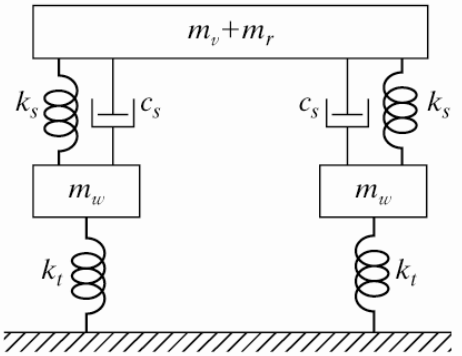
Modelling of Mechanical Systems



(a)



(b)



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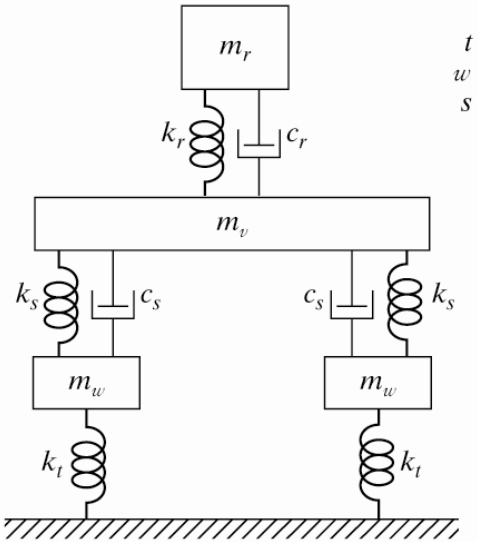
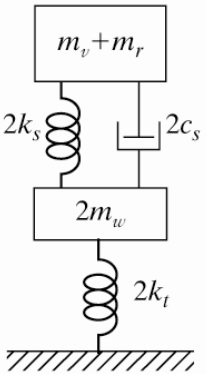


(d)

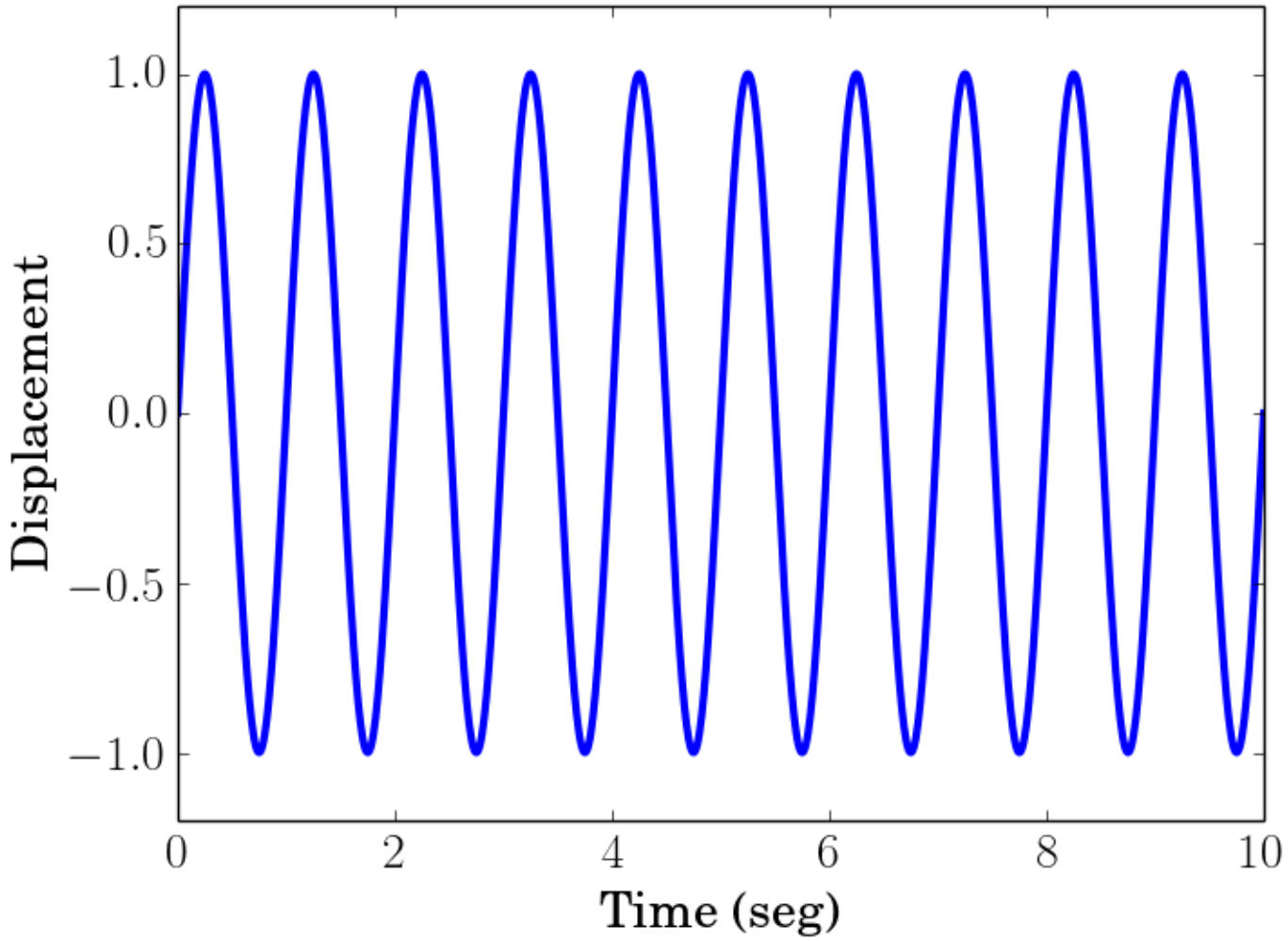
Subscripts
t : tire v : vehicle
w : wheel r : rider
s : strut eq : equivalent



(e)

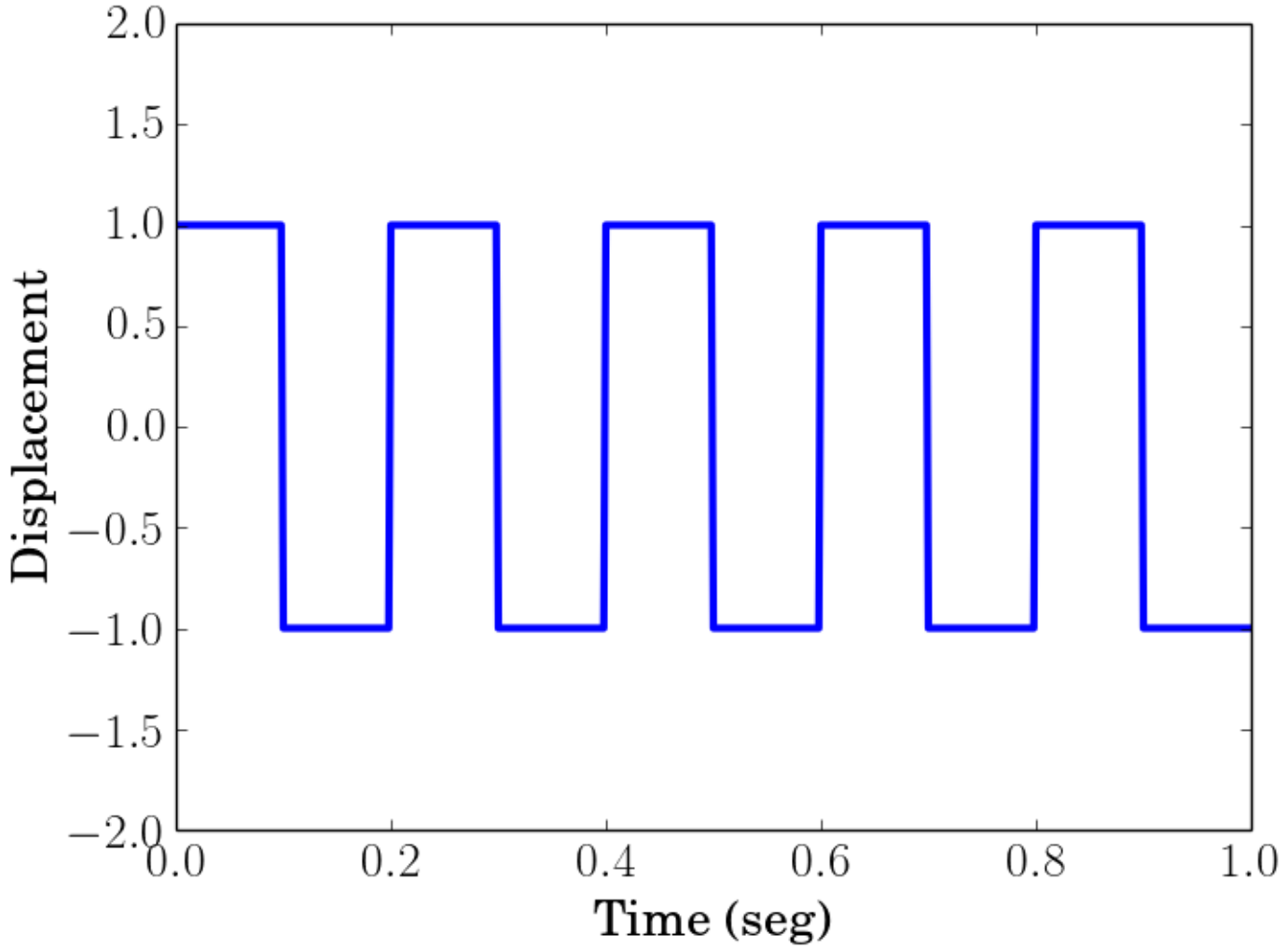
Types of Vibration Responses

Periodic Vibration



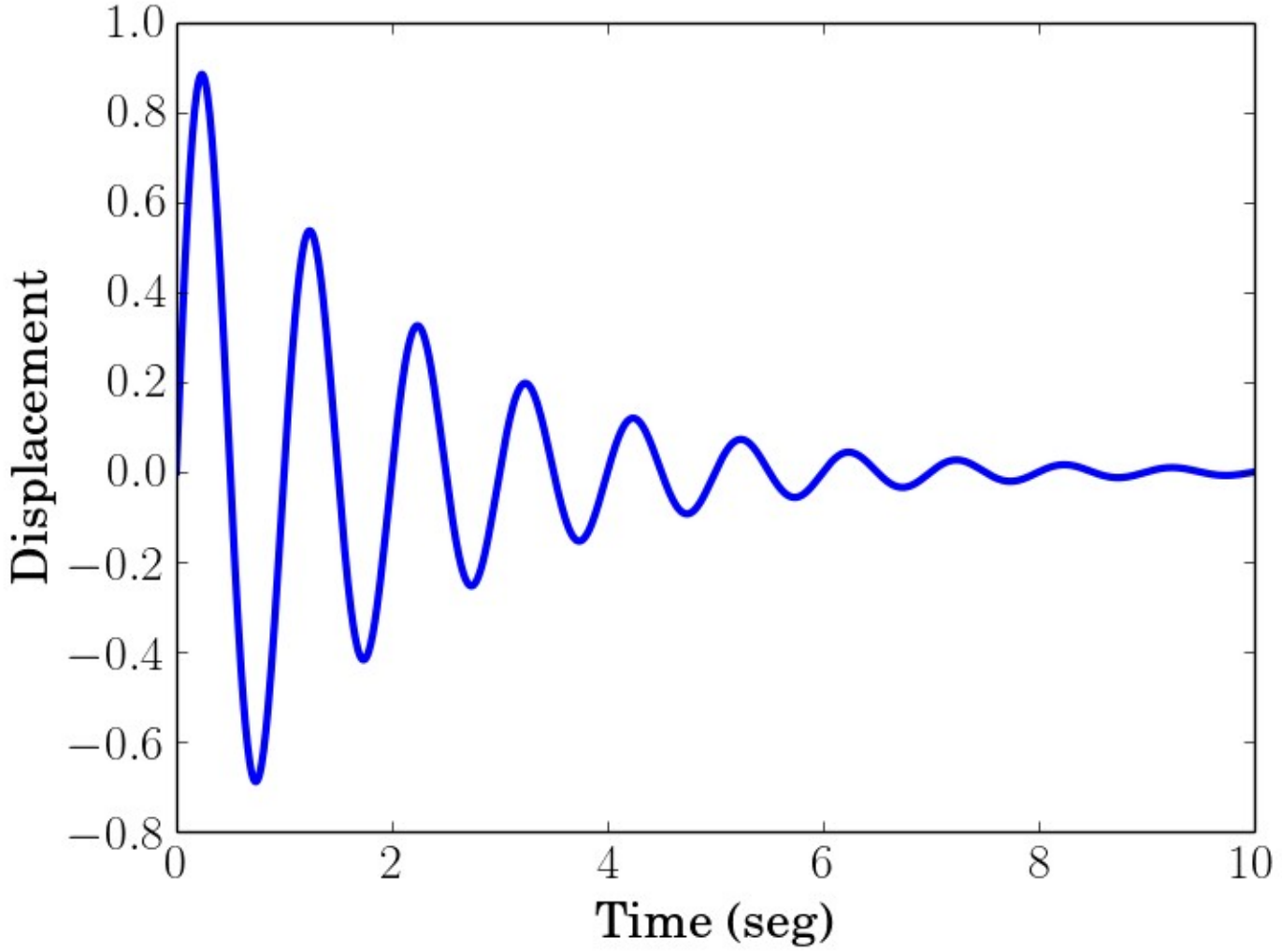
Types of Vibration Responses

Periodic Vibration



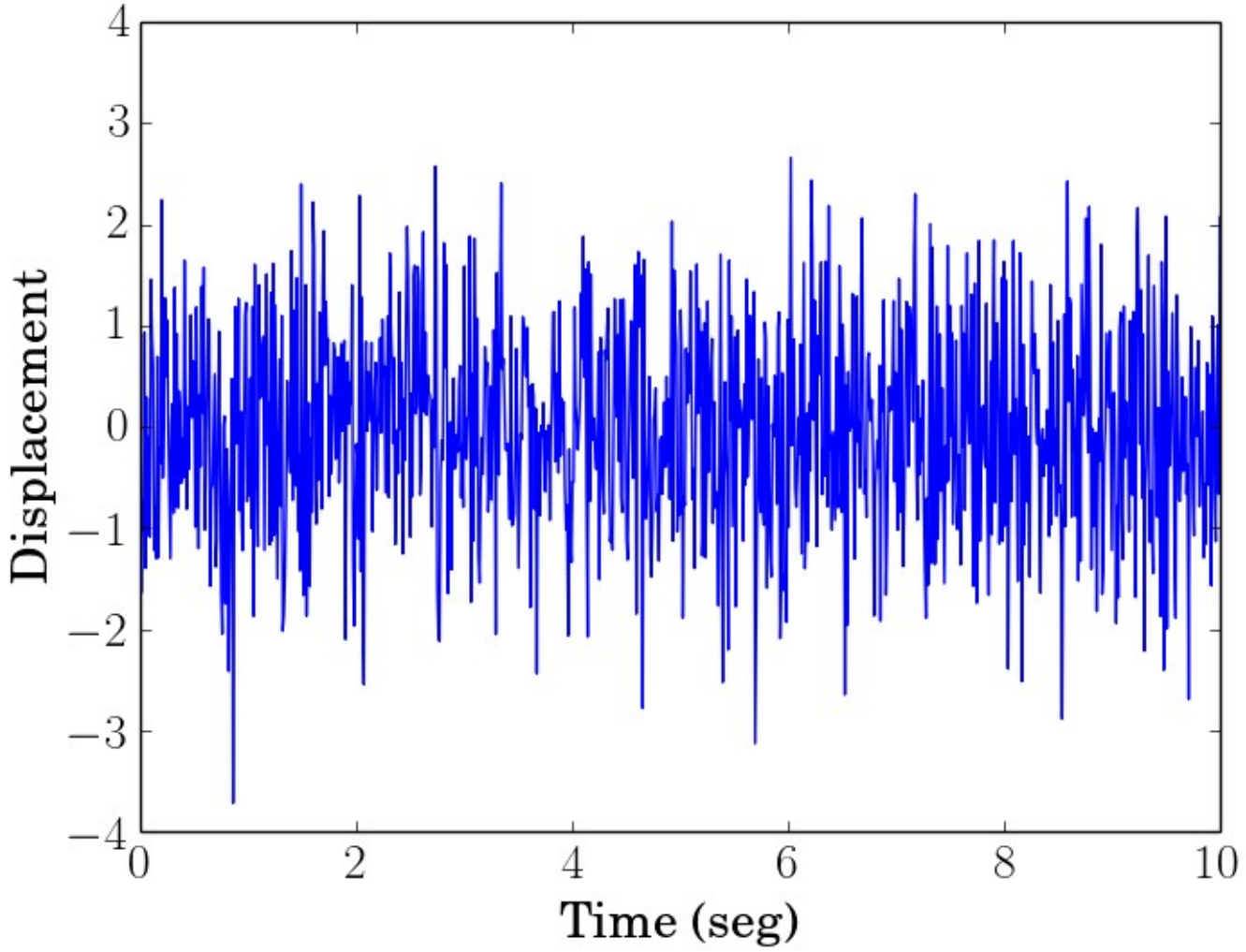
Types of Vibration Responses

Transient Vibration



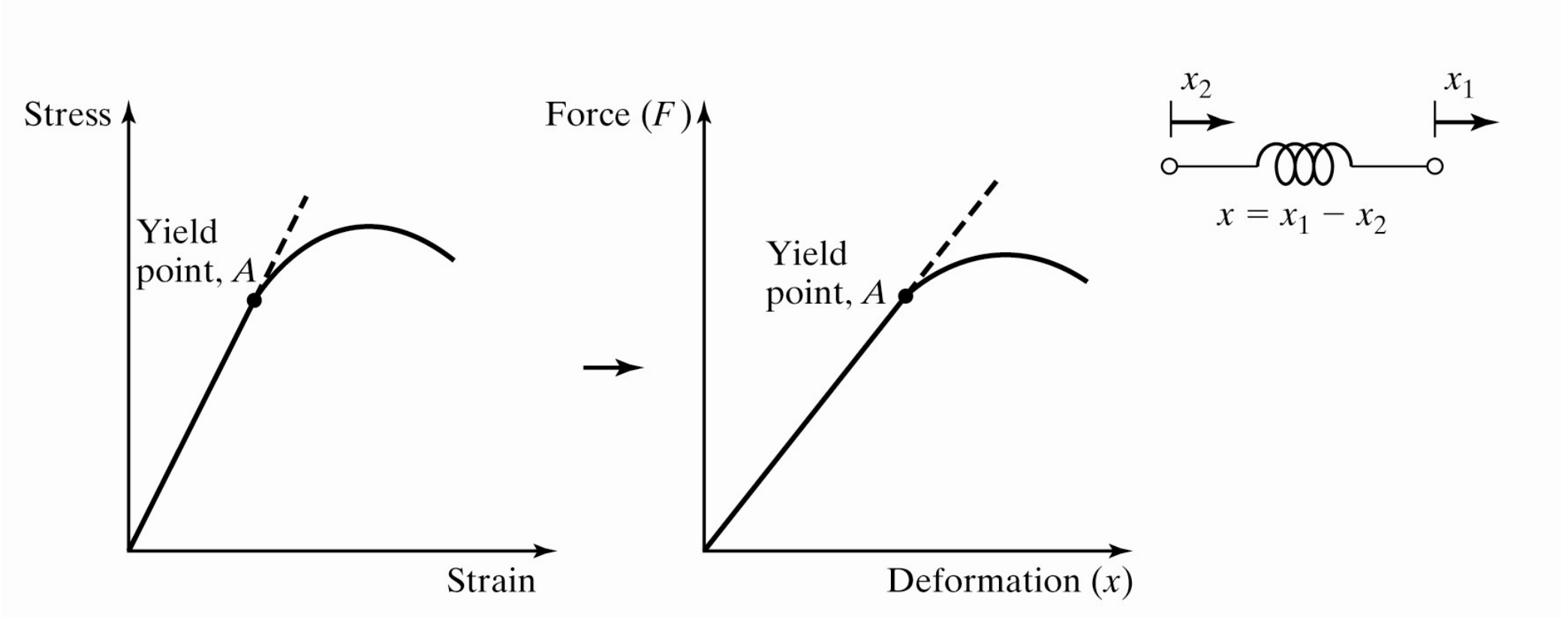
Types of Vibration Responses

Random Vibration



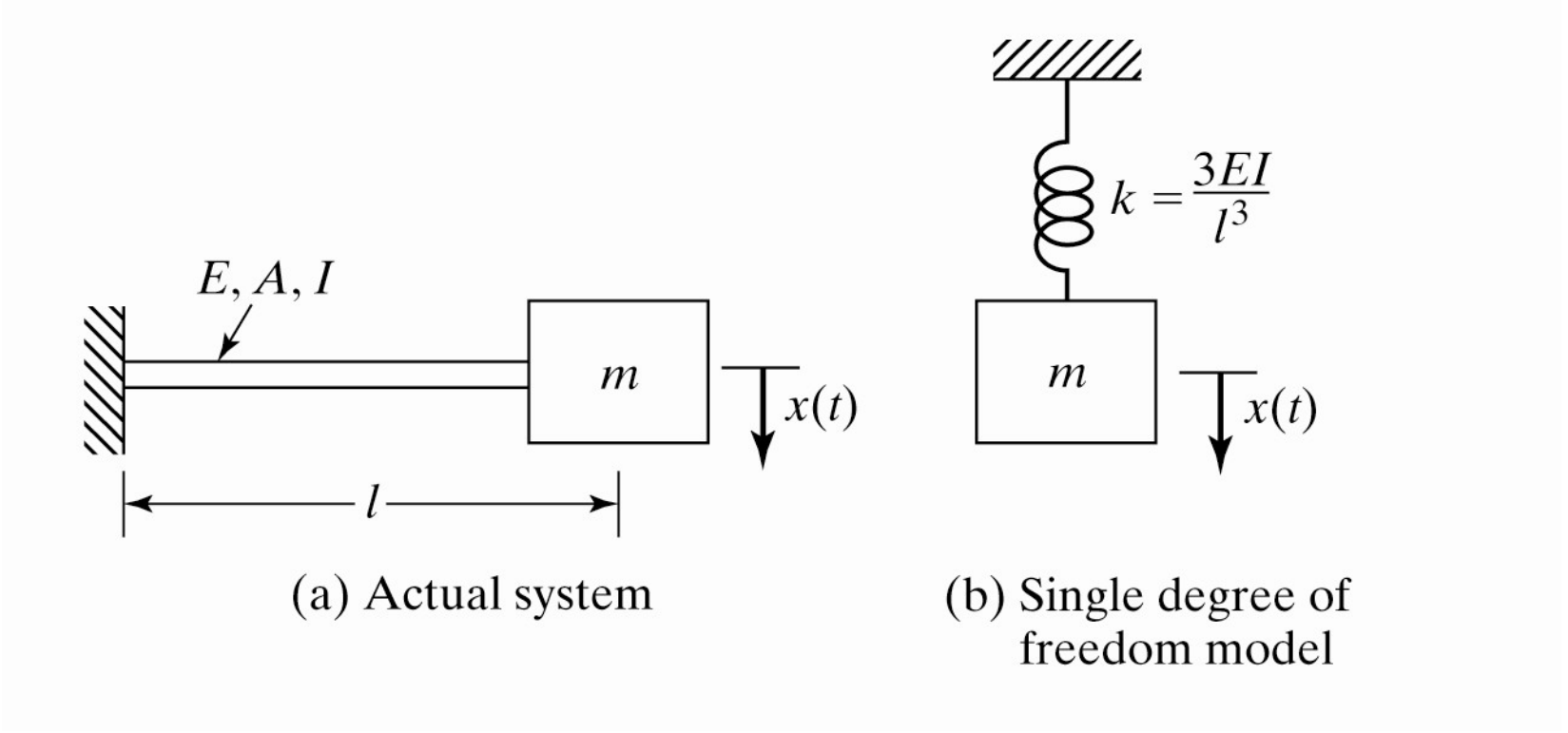
Basic Concepts

Stiffness



Basic Concepts

Stiffness

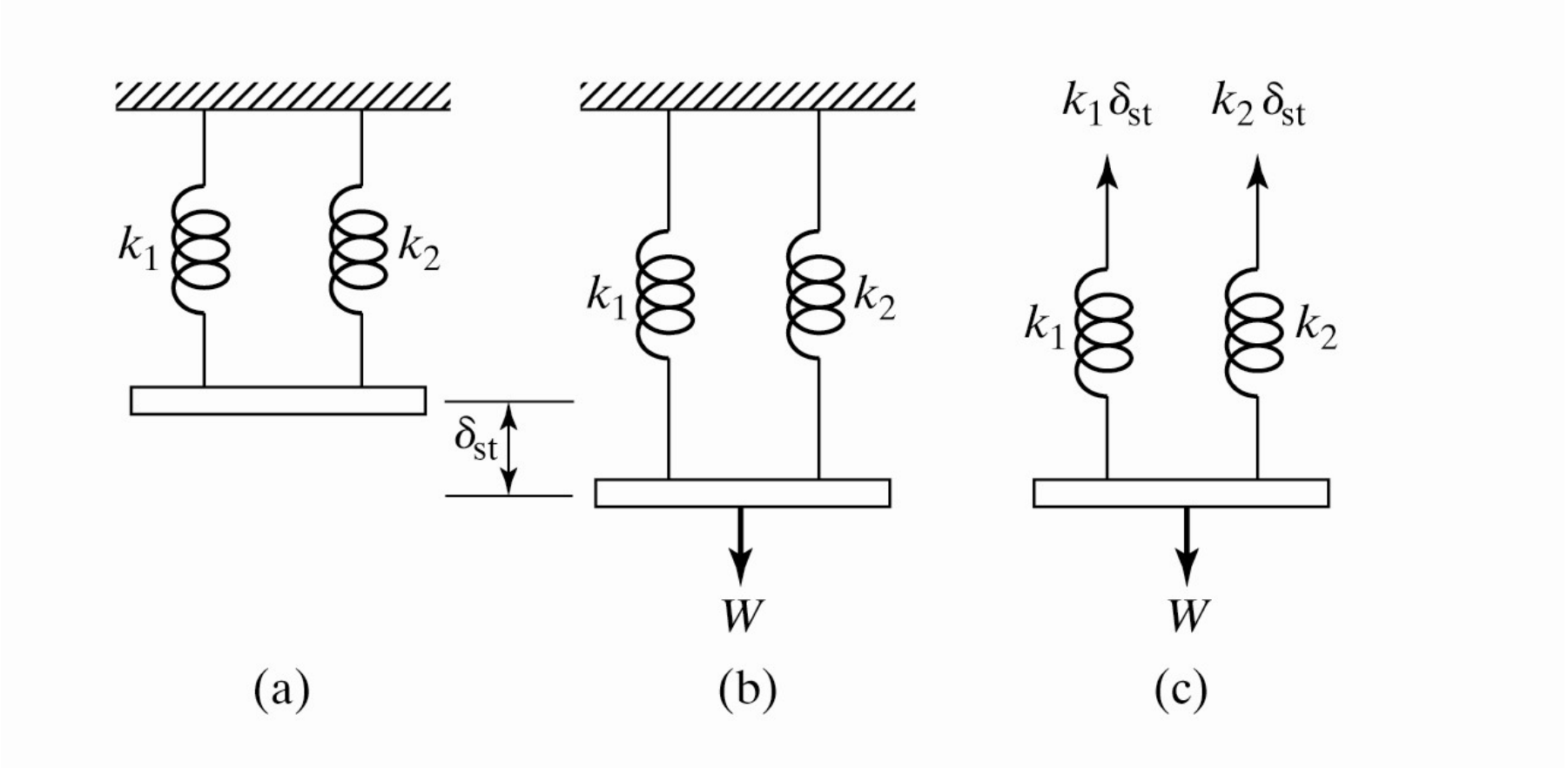


(a) Actual system

(b) Single degree of freedom model

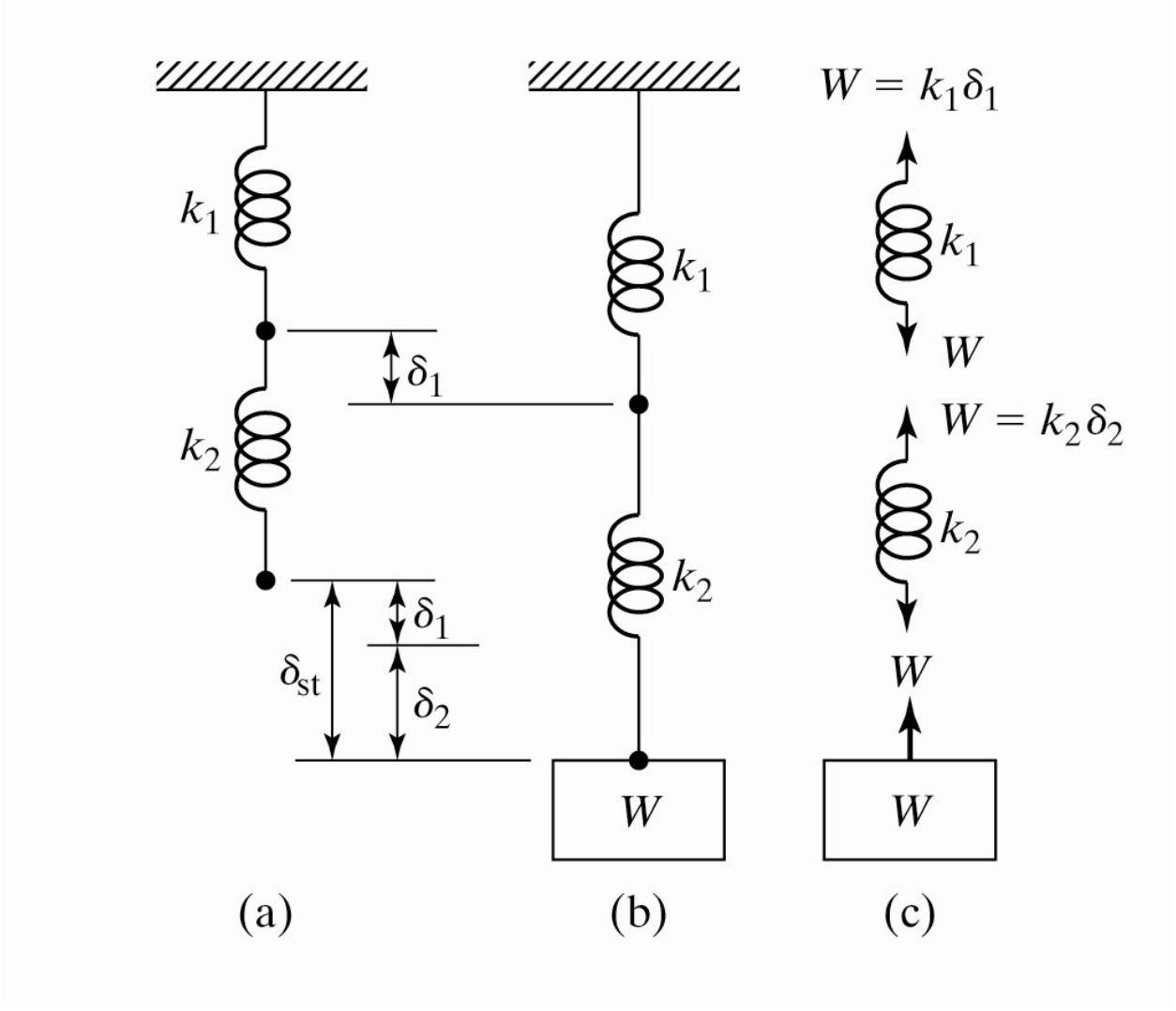
Basic Concepts

Stiffness – Parallel arrangement

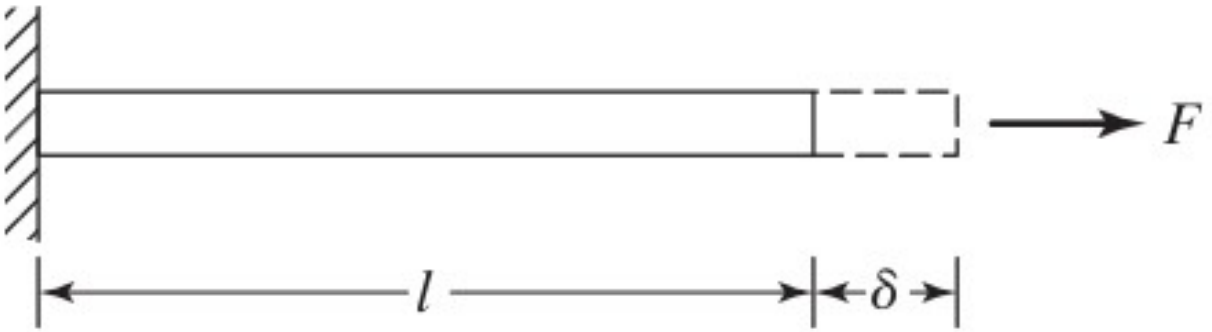


Basic Concepts

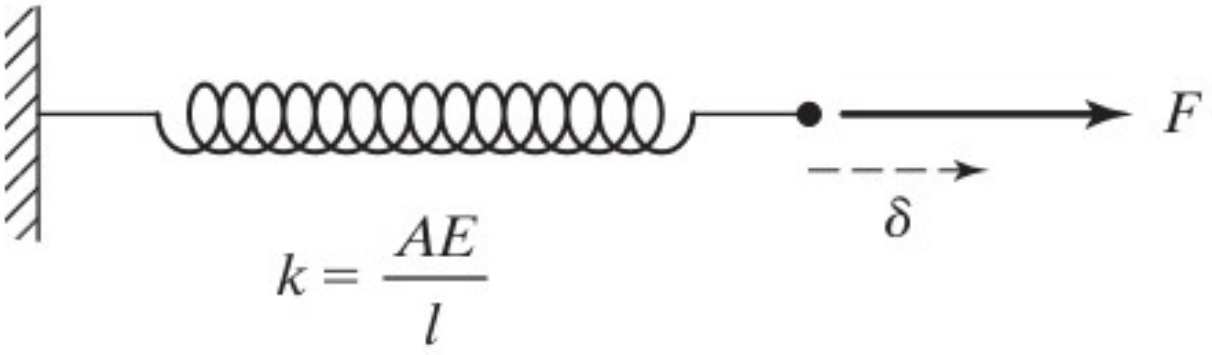
Stiffness – Series arrangement



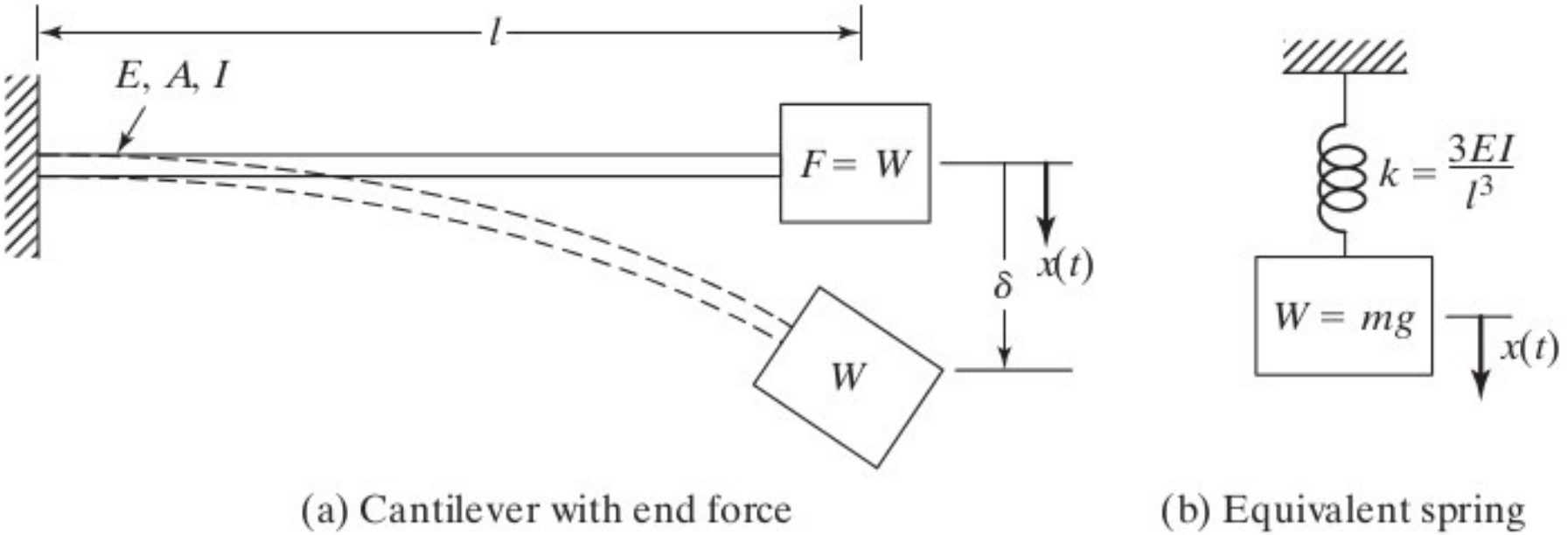
Equivalent Stiffness



(a)



Equivalent Stiffness



(a) Cantilever with end force

(b) Equivalent spring

Equivalent Stiffness