Fundamentals of Signals and Systems

- Signal: a function of one or more variables (e.g., time, distance) that convey information on the nature of a physical phenomenon.

  Examples: heartbeat, blood pressure, temperature, vibration.
  One-dimensional signals: function depends on a singe variable, e.g., $x(t)$
  Multi-dimensional signals: function depends on two or more variables, e.g., video - time and two spatial dimensions

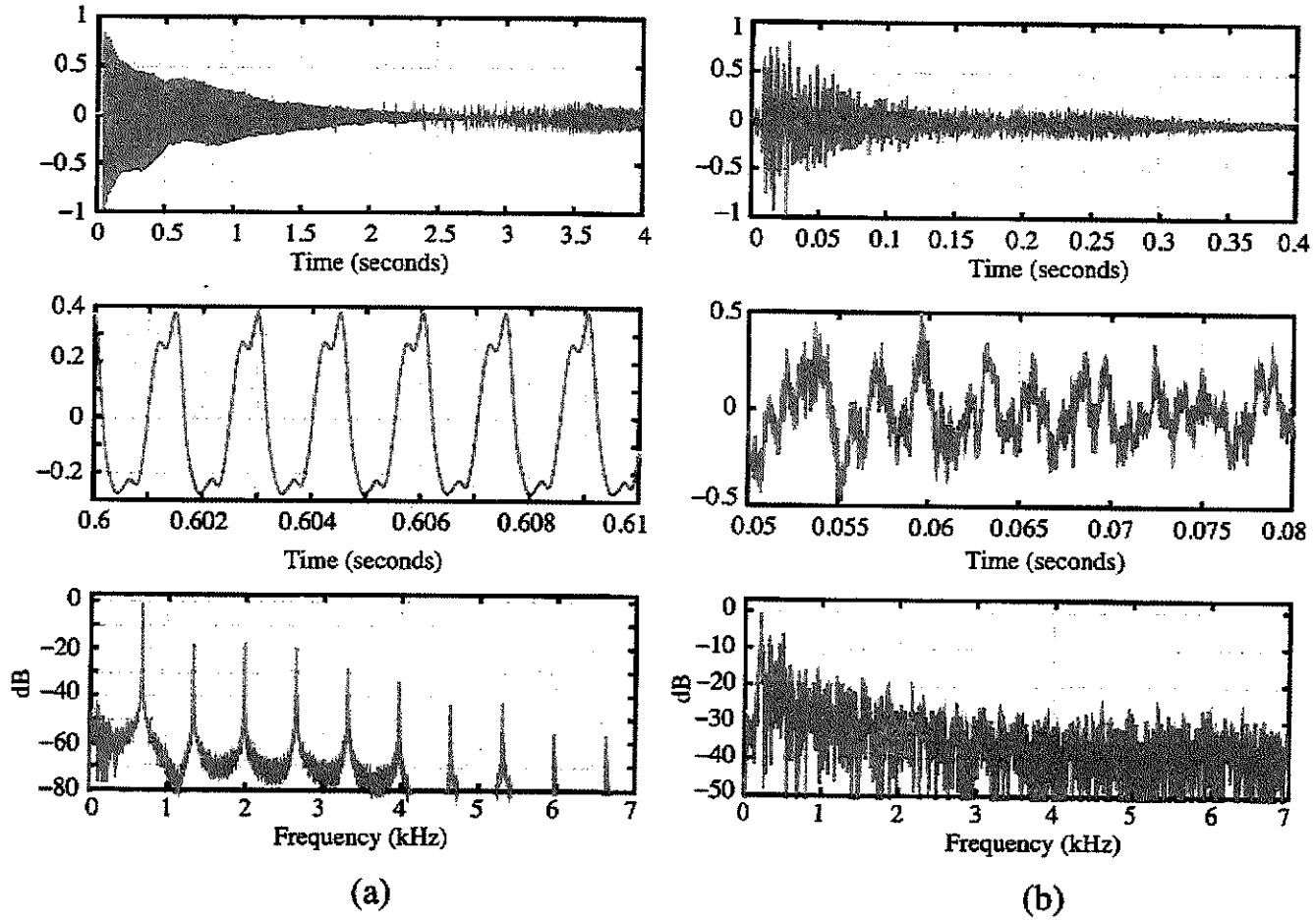

Figure 1.8 **Waveforms of (a) a guitar and (b) a bass drum. (Courtesy of Maximilian Schäfer, University of Erlangen-Nürnberg, Erlangen, Germany.)**

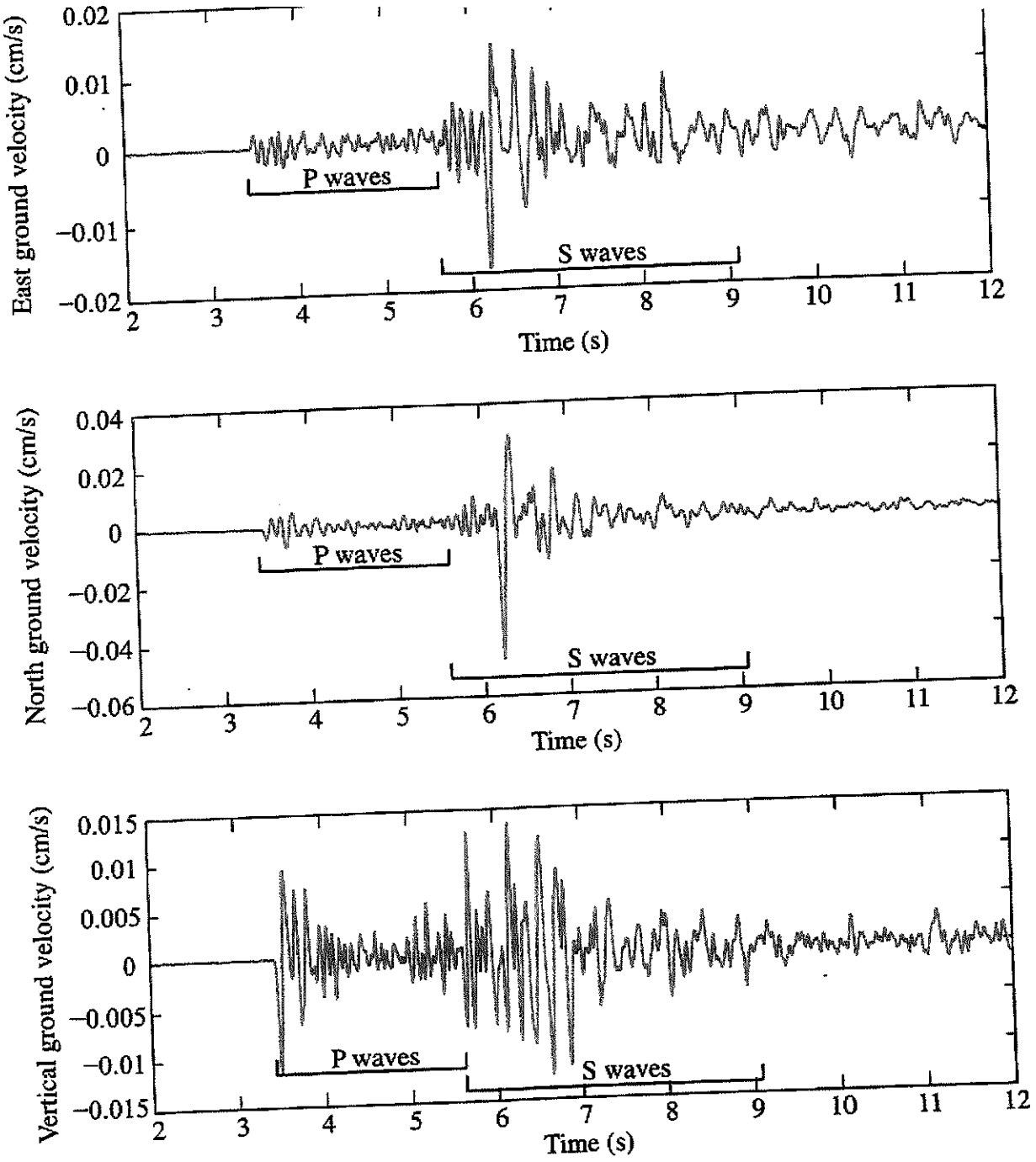

Figure 1.12 Tracings of the Chino Hills aftershock recorded at the Puddingstone Reservoir Station of the Southern California Seismic Network. Southern California Earthquake Data Center, 29 July 2008. Approximate durations of the P- and S-waves have been added to the original seismograph.

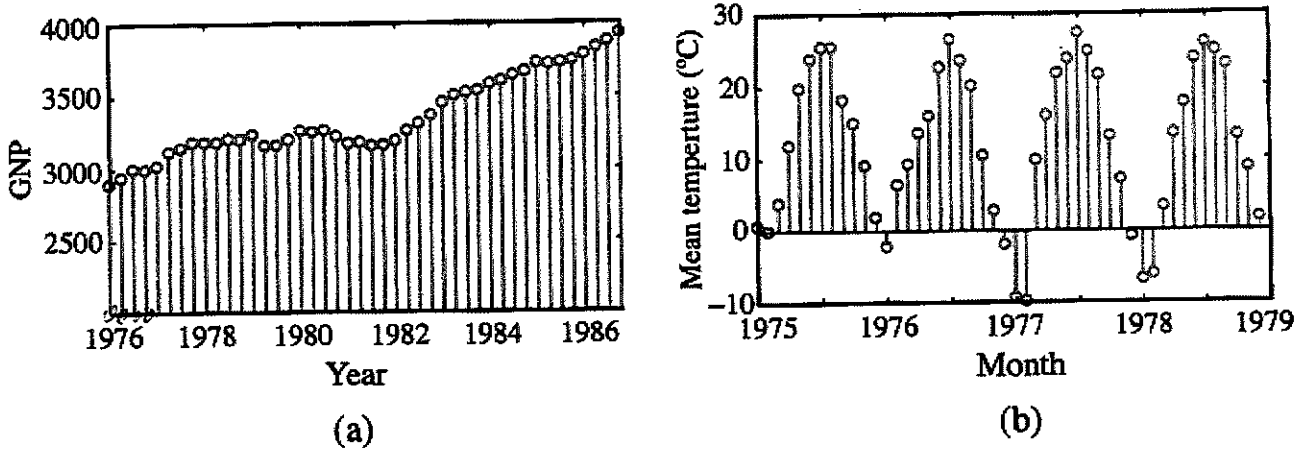

Figure 1.14 (a) Seasonally adjusted quarterly gross national product of the United States in 1982 dollars from 1976 to 1986. (Adapted from [Lüt91].) (b) Monthly mean temperature in degrees Celsius of St. Louis, Missouri, for the years 1975 to 1978. (Adapted from [Mar87].)

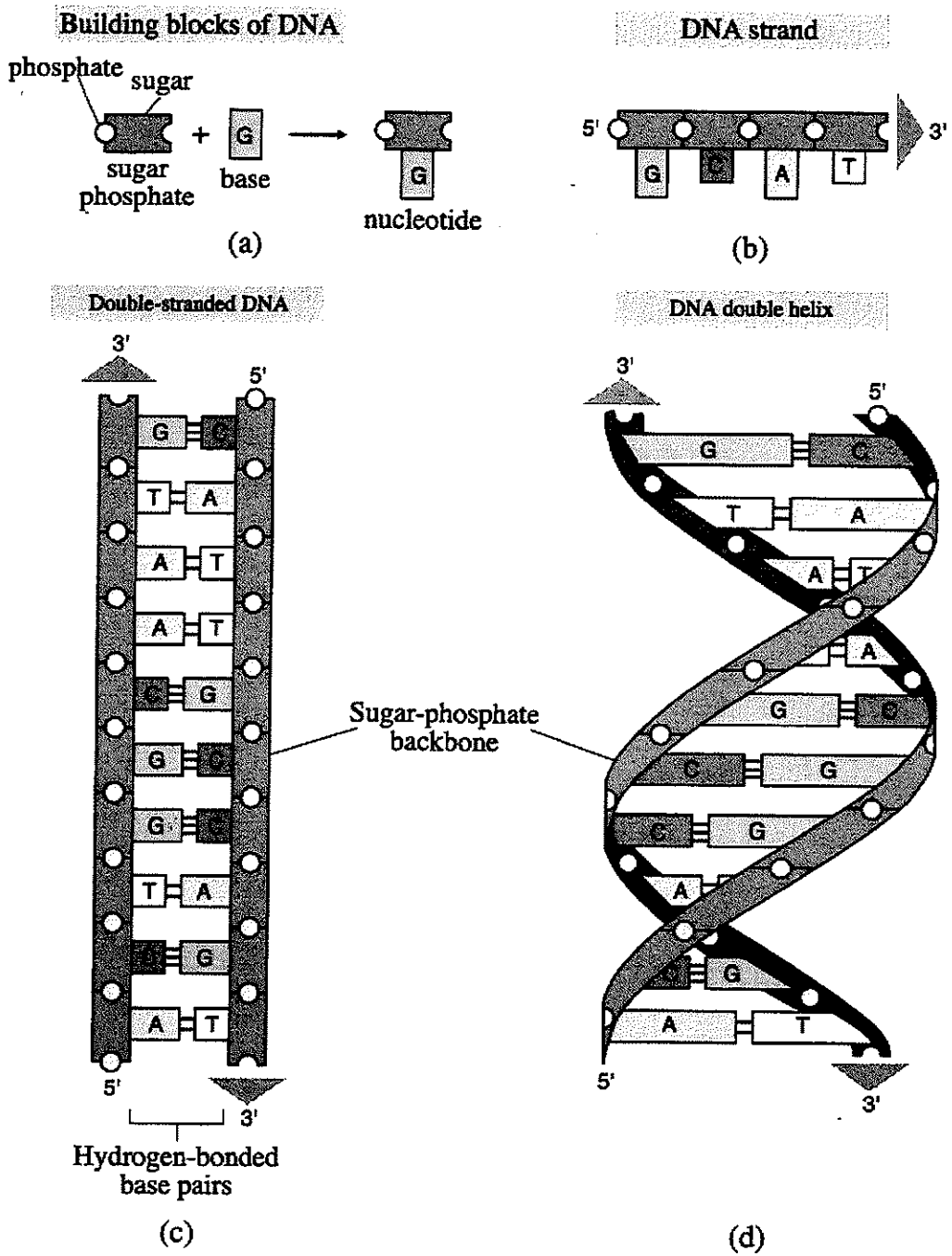

Figure 1.16 (a) Building block of DNA. (b) DNA strand. (c) Double-stranded DNA. (d) DNA double helix. (©1997 from "Essential Cell Biology," 1st edition, by Alberts et al. Reproduced by permission of Garland Science/Taylor & Francis Group, LLC.)

Fundamentals of Signals and Systems (cont.)

- System: an entity that manipulates one or more signals to accomplish a function, thereby yielding new signals.

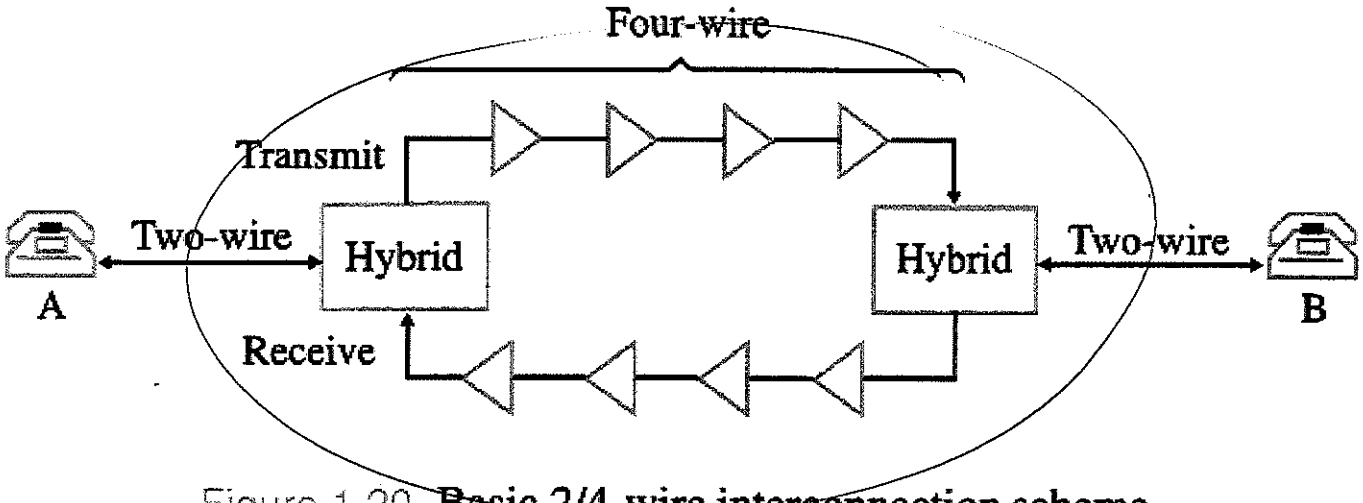

Figure 1.20 Basic 2/4-wire interconnection scheme.

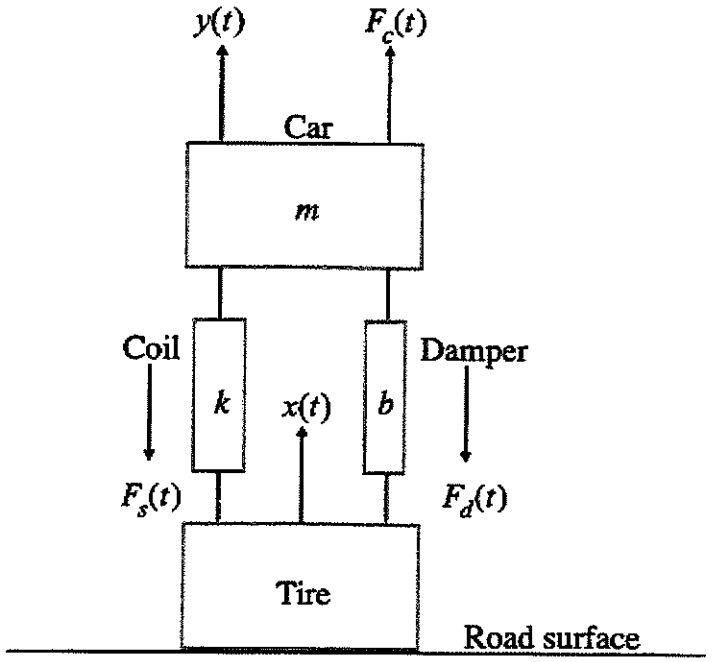

Figure 1.19 **A free-body diagram of an automobile shock absorber system.**

Fundamentals of Signals and Systems (cont.)

- Analog signal processing (ASP): use analog circuits such as resistors, capacitors, inductors, transistors, and diodes.

  Real time.

- Digital signal processing (DSP): adders, multiplers, memory.

  Flexible and repeatable.

- Notation:

  $x(t)$-Continuous time (CT) signals.
  $x[n]$-discrete time (DT) signals (n integers)

Classification of signals

- Based on features:

1. CT and DT signals: