ELG4157 Basing on
Control Systems Engineering
Sixth Edition

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Chapter 1
Introduction

Figure 1.1

Elevator Response

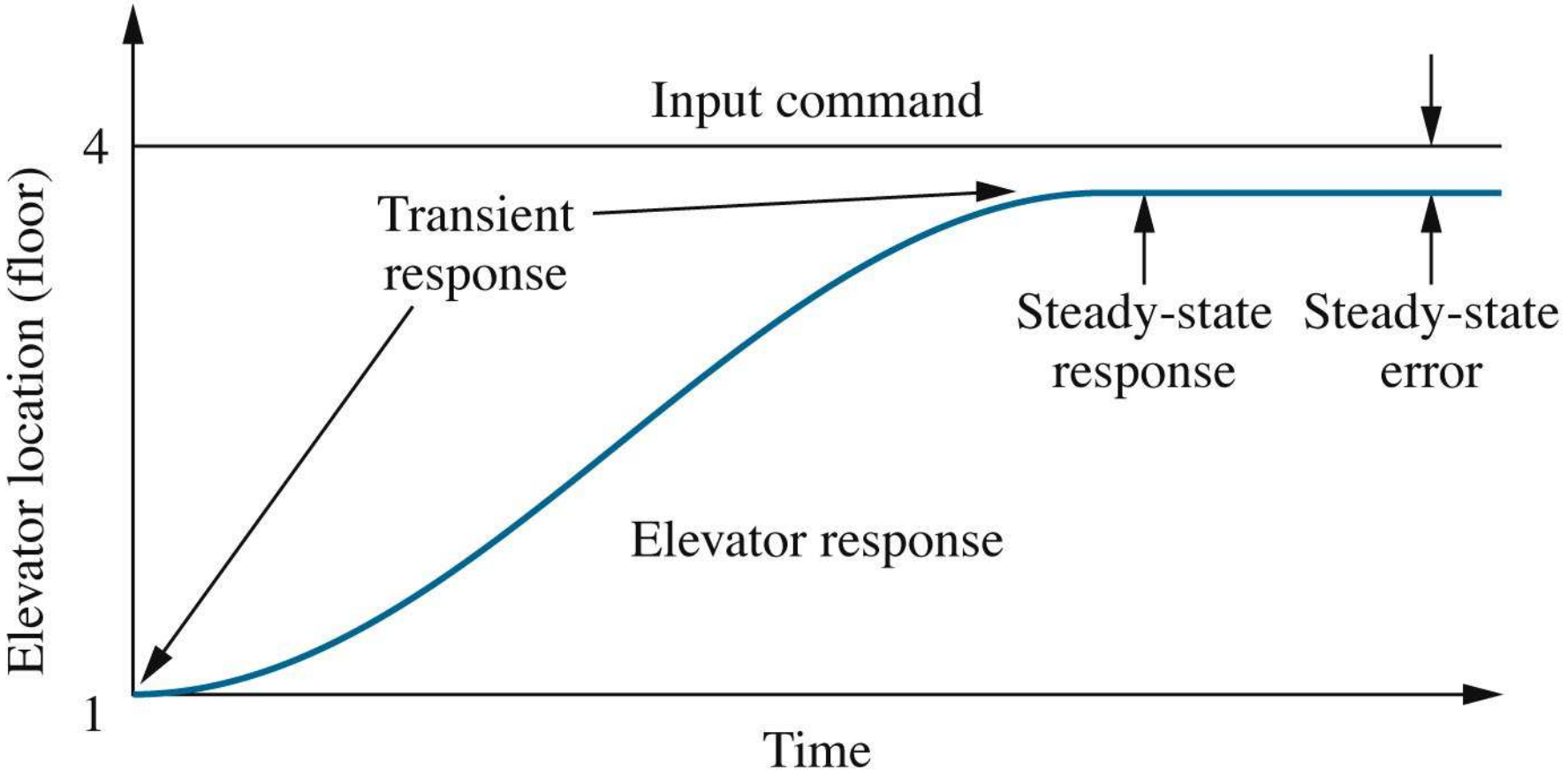


Figure 1.2

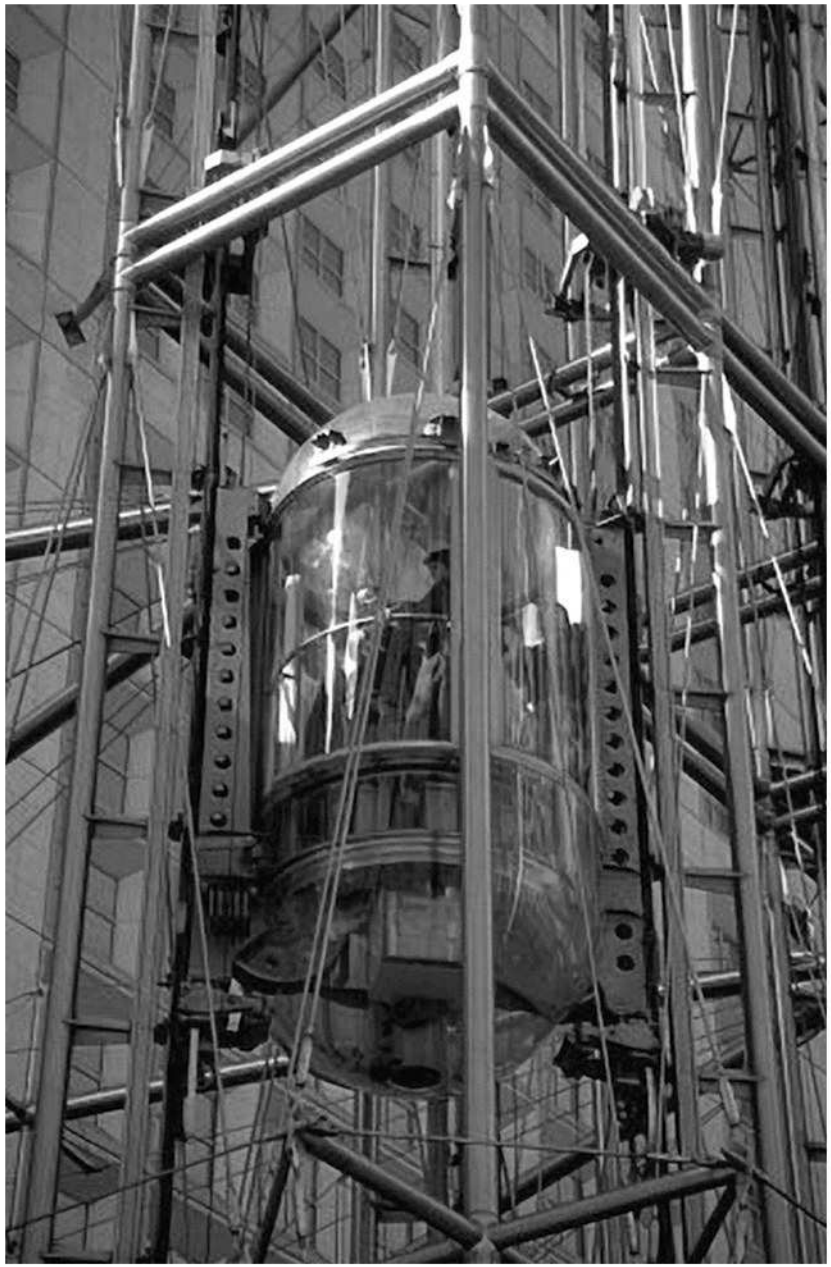
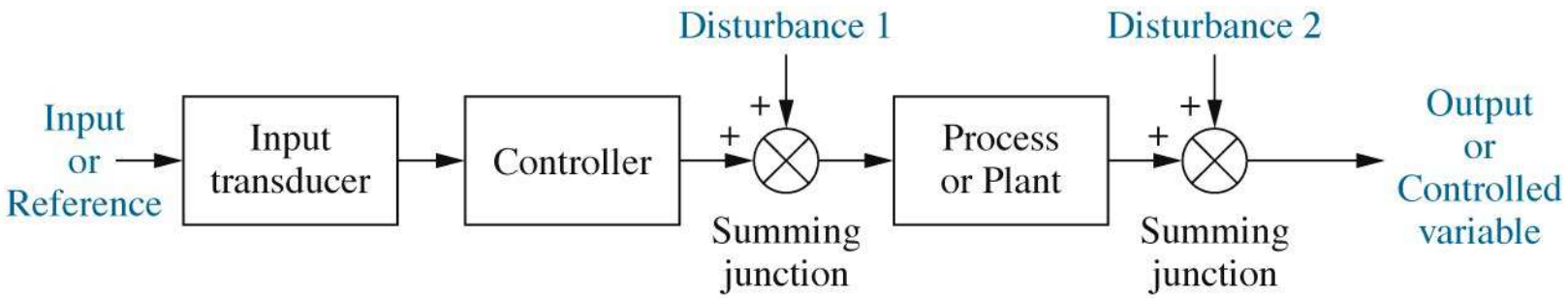
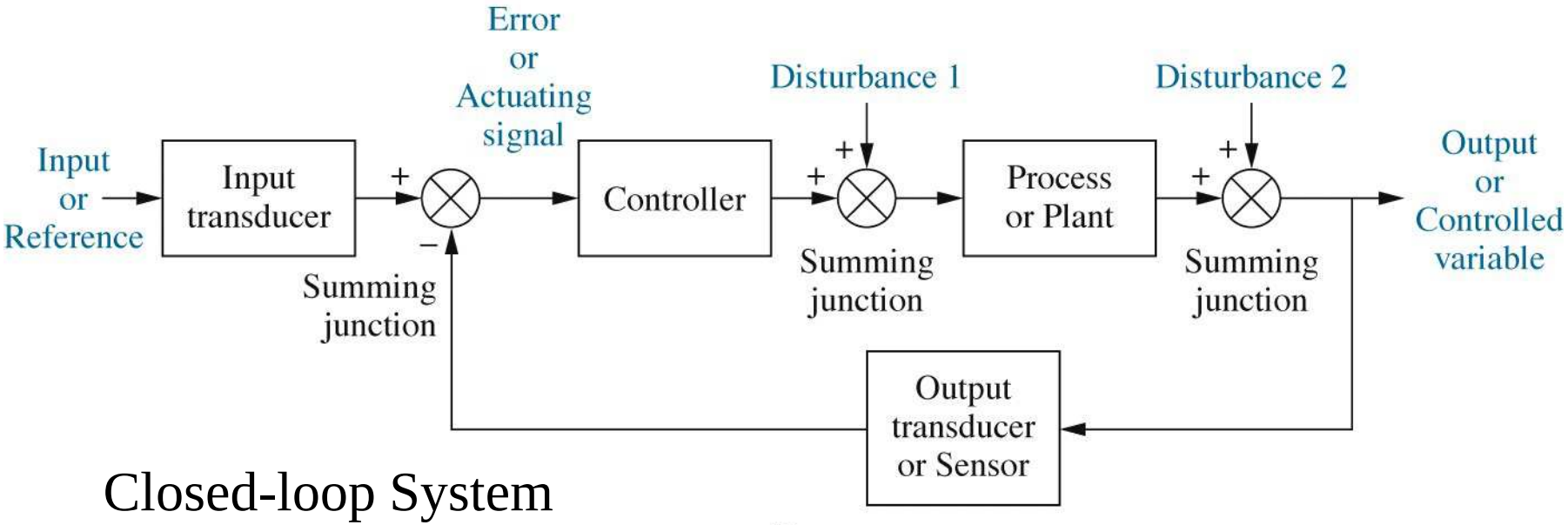


Figure 1.3b



Open-loop System

(*a*)



Closed-loop System

(*b*)

Figure 1.6

Figure 1.7

Analysis and Design Objectives

- Transient Response
- Steady-state Response
- Stability
- Other considerations
  - Finances
  - Robust Design

Case Study
Antenna Azimuth
Position Control System

Figure 1.8

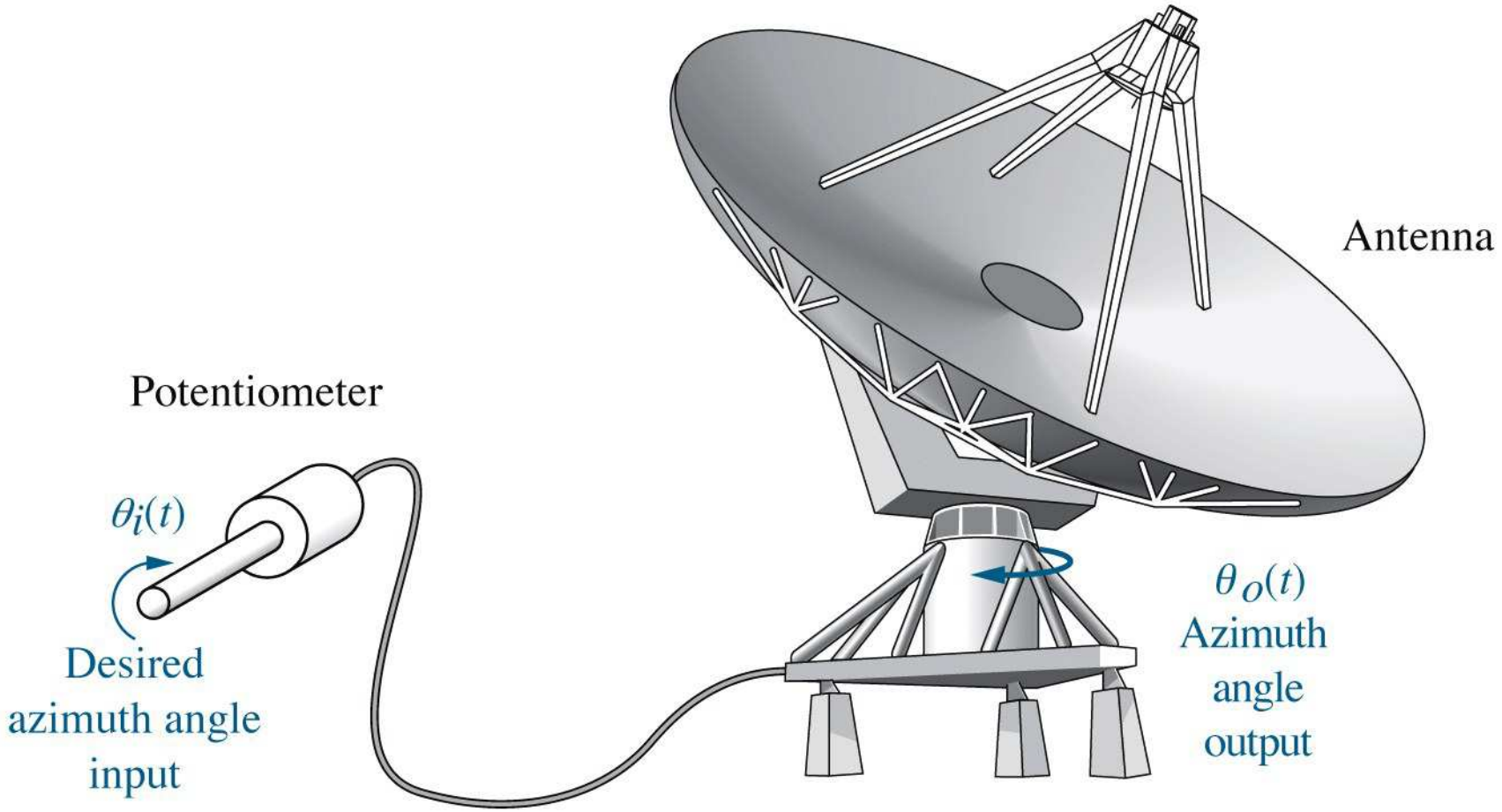


Figure 1.9a

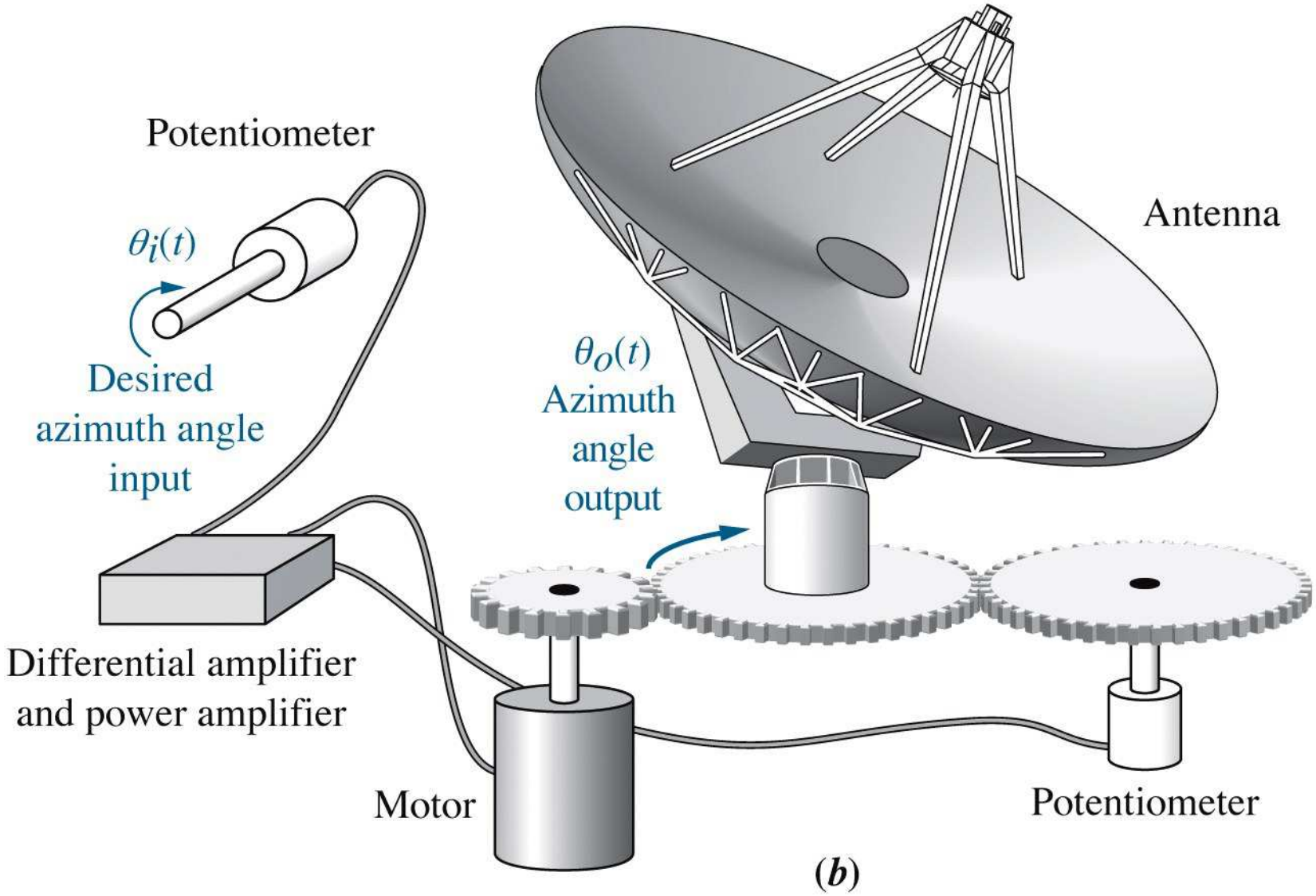


Figure 1.9b

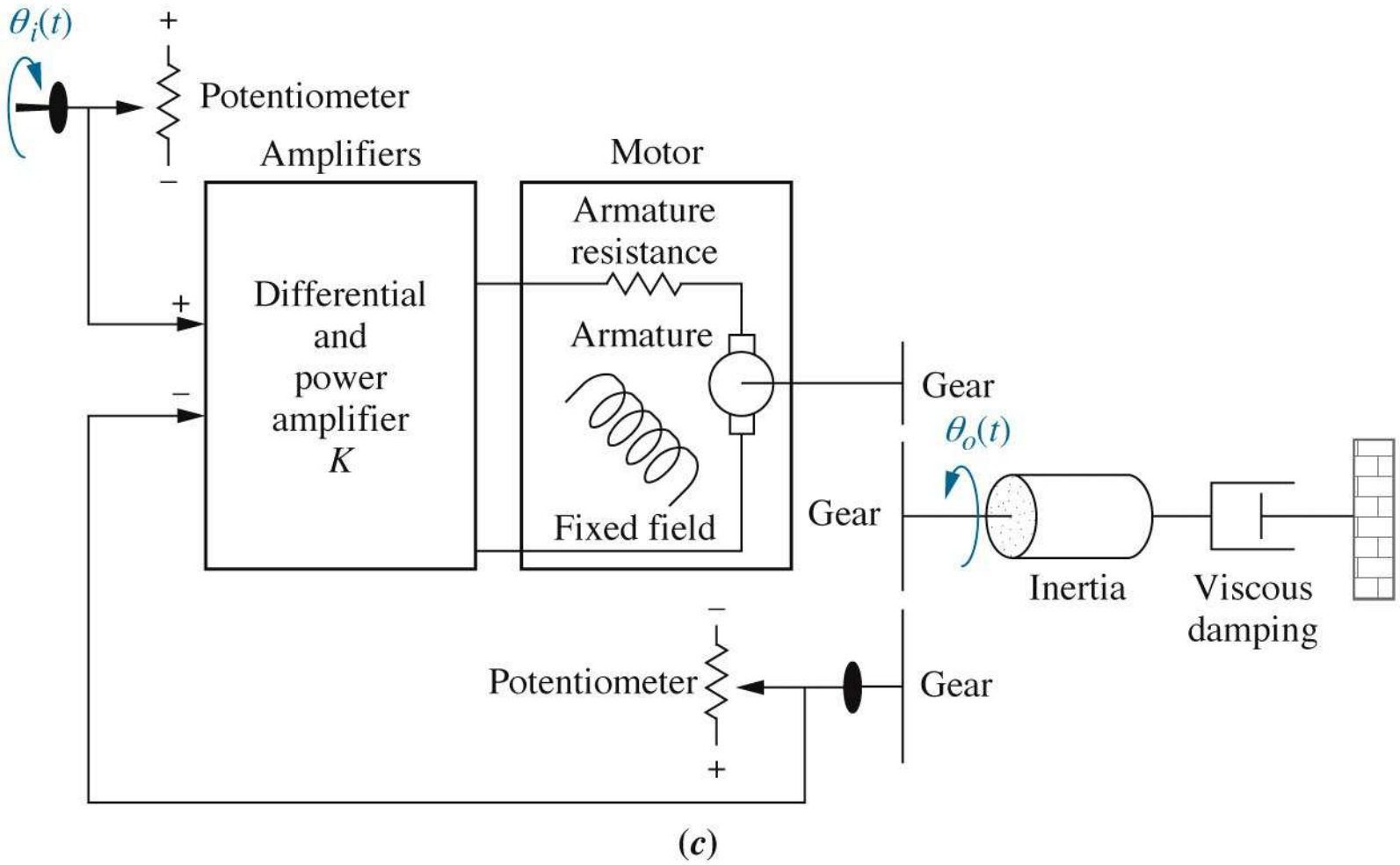
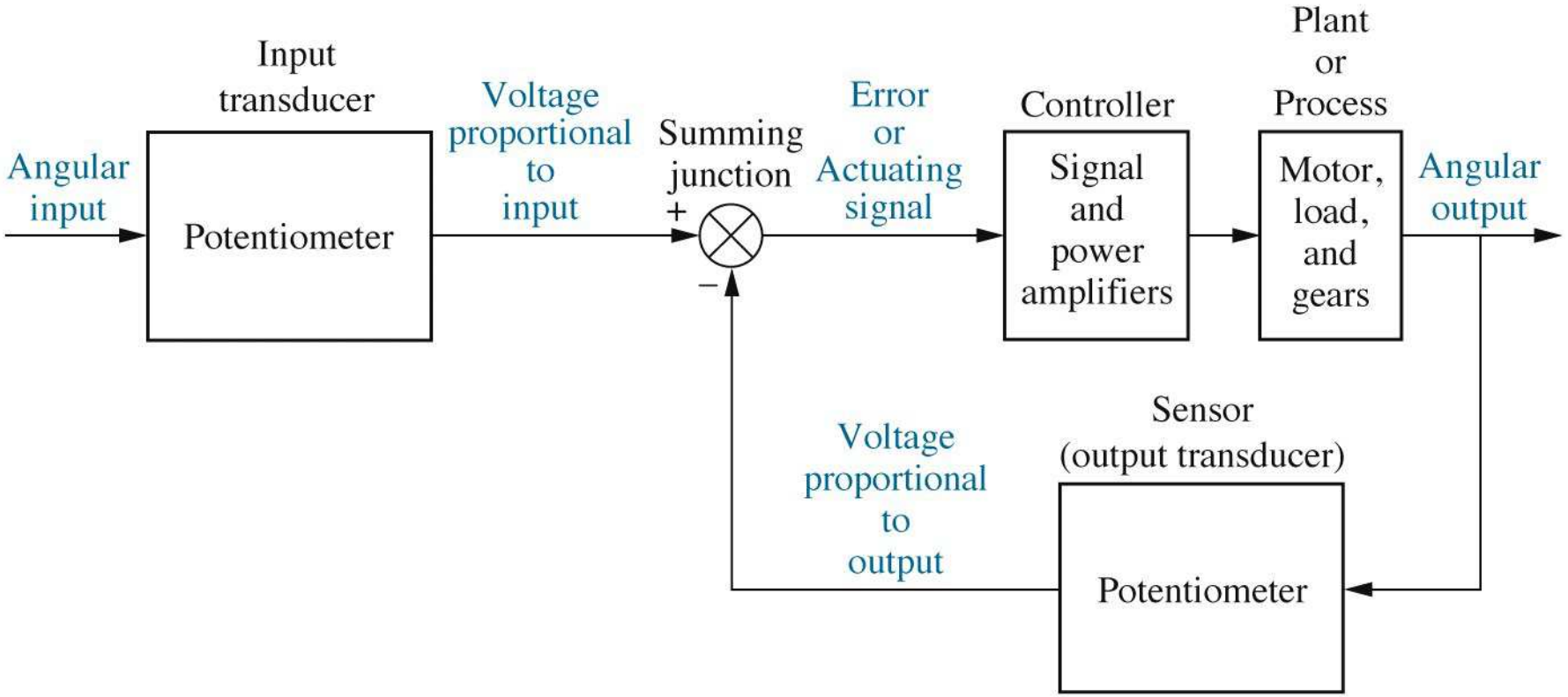


Figure 1.9c

Functional Block Diagram



(*d*)

Figure 1.9d

Response a Position Control System

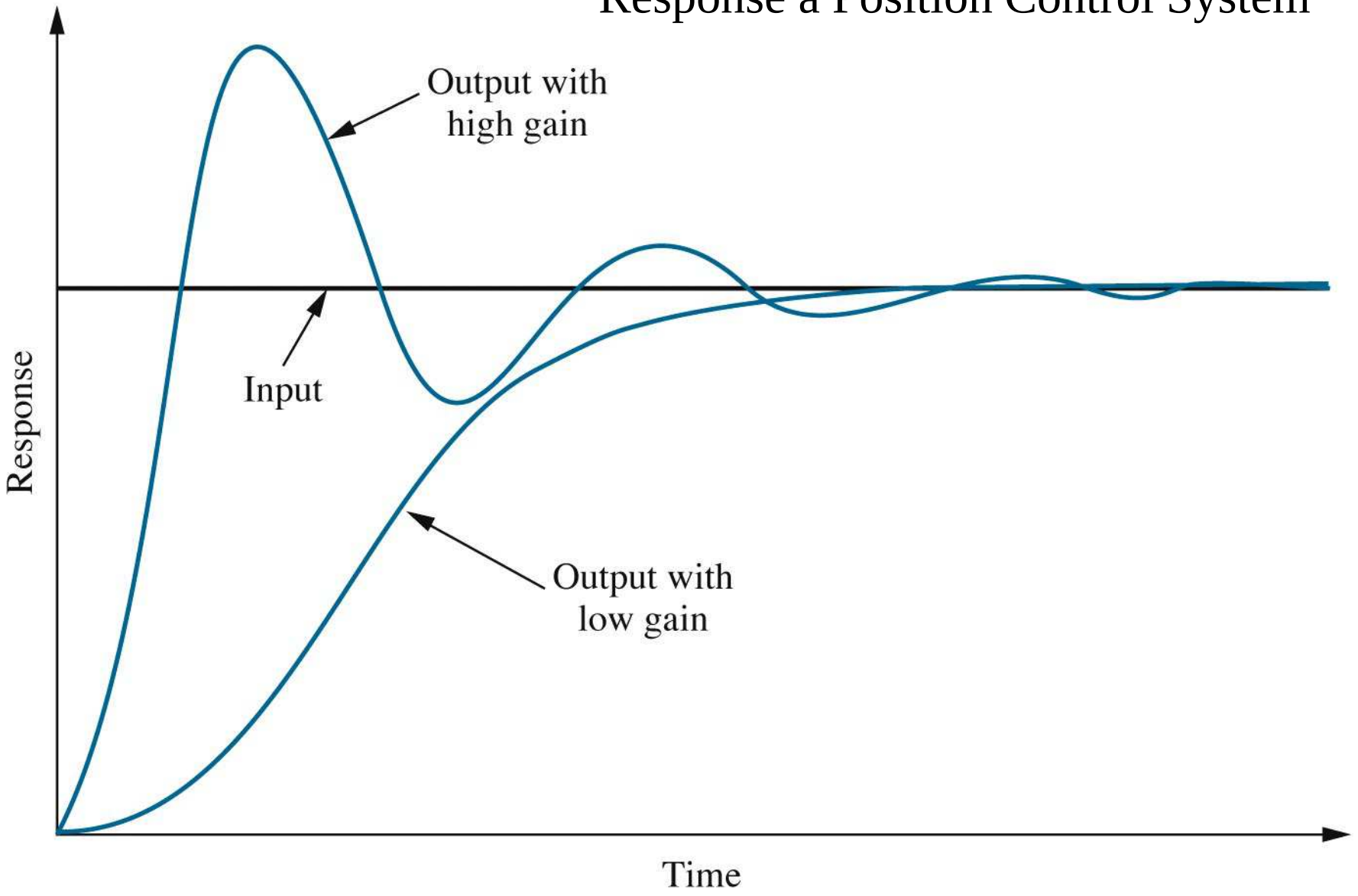


Figure 1.10

The Design Process!

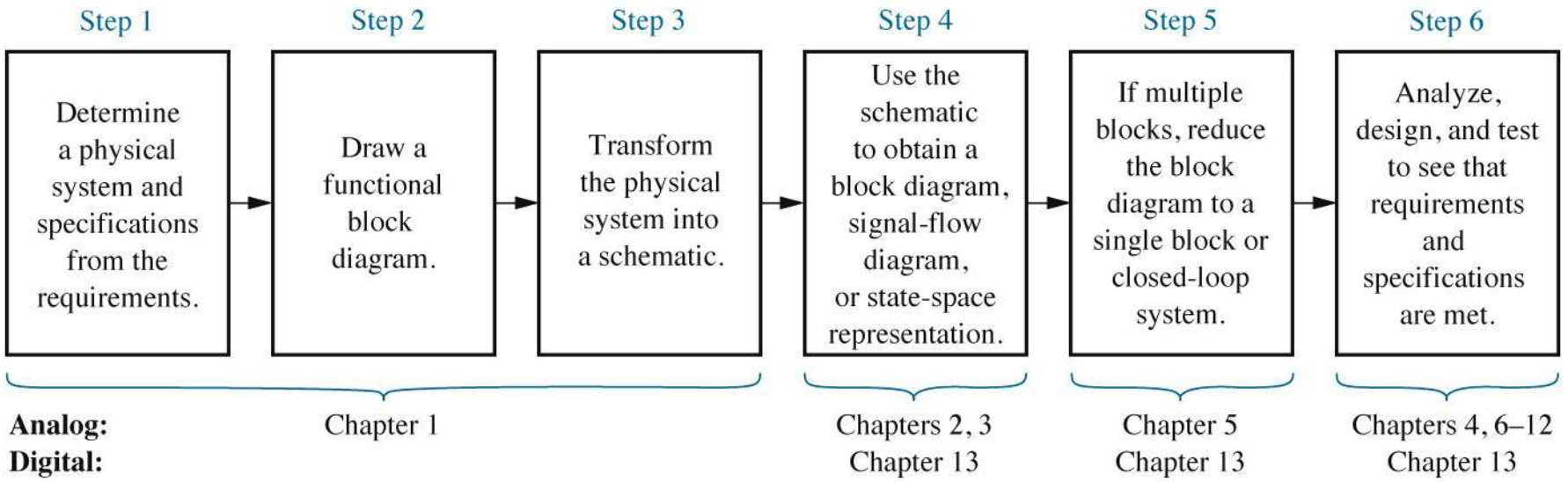


Figure 1.11
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Develop the Mathematical Model!

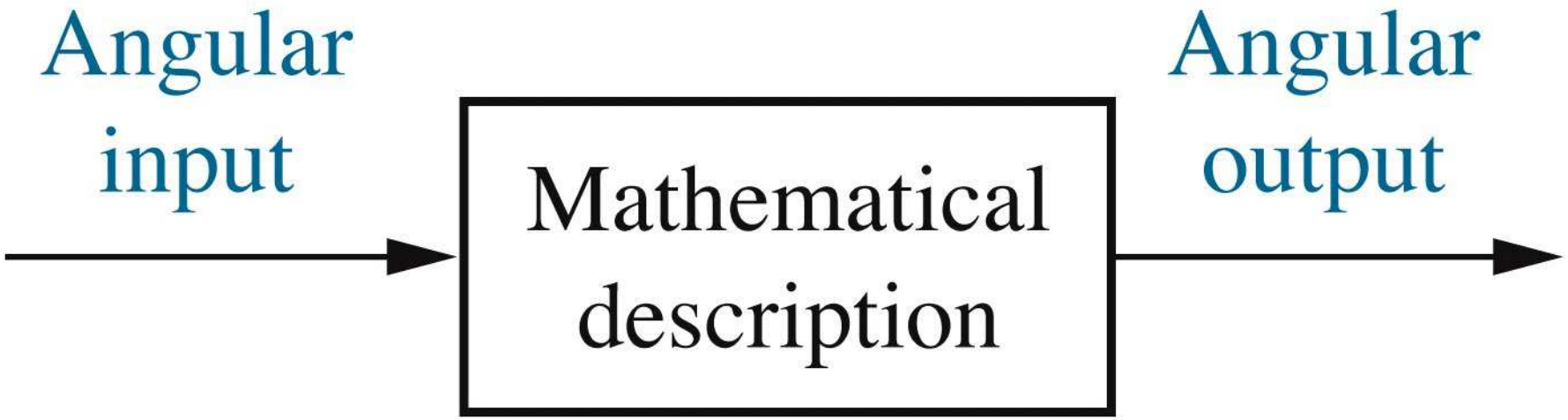


Figure 1.12

TABLE 1.1 Test waveforms used in control systems

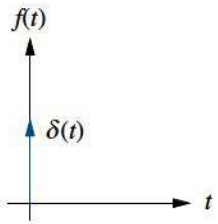
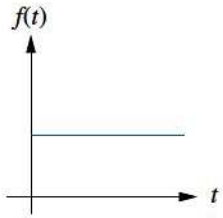
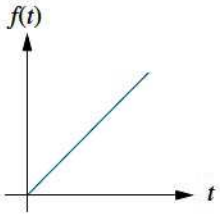
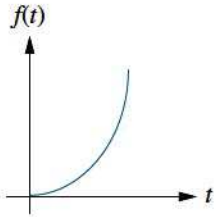
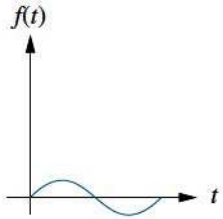
Input	Function	Description	Sketch	Use
Impulse	$\delta(t)$	$\delta(t) = \infty$ for $0- < t < 0+$ $= 0$ elsewhere $\int_{0-}^{0+} \delta(t)dt = 1$		Transient response Modeling
Step	$u(t)$	$u(t) = 1$ for $t > 0$ $= 0$ for $t < 0$		Transient response Steady-state error
Ramp	$tu(t)$	$tu(t) = t$ for $t \geq 0$ $= 0$ elsewhere		Steady-state error
Parabola	$\frac{1}{2}t^2u(t)$	$\frac{1}{2}t^2u(t) = \frac{1}{2}t^2$ for $t \geq 0$ $= 0$ elsewhere		Steady-state error
Sinusoid	$\sin \omega t$			Transient response Modeling Steady-state error

Table 1.1

Computer-Aided Design

- MATLAB and the control System Toolbox:
- Simulink (Graphical User Interface)
  - LTI Viewer (Measurements)
  - SISO Design Tool
  - Math Tool Box.
- LabVIEW: Virtual lab on your computer reproducing hardware instruments