

Design IV

E232 Spring 07

Class 1

Bruce McNair
bmcnair@stevens.edu

Course Introduction

- Logistics:
 - Instructor: Bruce McNair
 - Office: Burchard 206
 - Phone: 201-216-5549
 - email: bmcnair@stevens.edu
 - Web site: koala.ece.stevens-tech.edu/~bmcnair
 - Office hours: Monday – Thursday, 9:30 – 4, subject to class and other meetings

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 - **To ensure proper credit for the homework, the attachment file name must be in this format: student's Stevens email address-assignment-course number, e.g.,**
bmcnair-HW3-E232.doc

Course Introduction

- Logistics, continued
 - Homework problems will be assigned each week. Solutions are due 1 week after it is assigned. My goal is to have them graded by the following week.
 - **Problem solutions will be posted on WebCT sometime after the due date – LATE SUBMISSIONS ARE NOT PENALIZED, BUT NO SUBMISSIONS WILL BE ACCEPTED AFTER THE SOLUTION IS POSTED**
 - **No assignment will require massive printout. Limit your results to a few pages**

Course Introduction

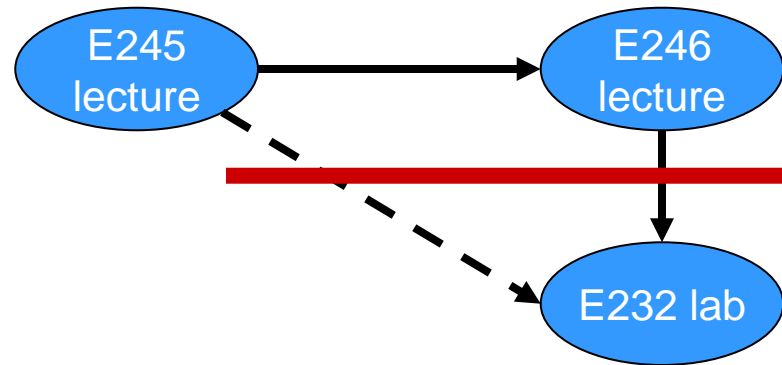
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 - **No assignment will require massive printout. Limit your results to a few pages**
- Grading – all submissions are to be an individual effort. Honor Code violations are taken very seriously.
 - Homework: 25%
 - Three quizzes: 25% each
- Submission status and grades will be posted on WebCT
- Three course credits will be evenly divided between Lecture section and Lab section (information on Registrar's site may be out of date)

Reference Materials

- Textbook:
 - Anthony Wheeler & Ahmad Ganji, “Introduction to Engineering Experimentation, 2nd ed.”, Pearson-PrenticeHall, 2004, ISBN 0-13-065844-8.

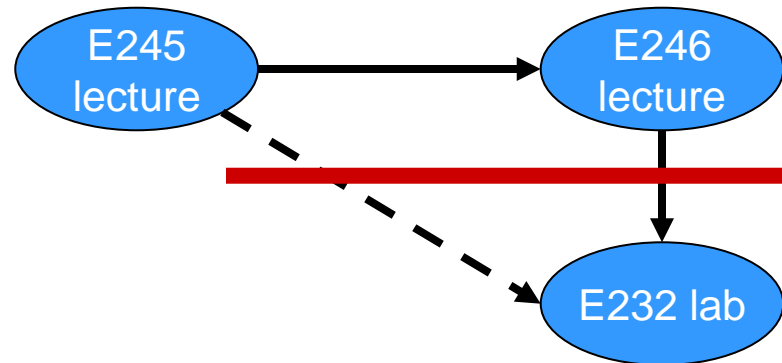
Course Philosophy

- Previously:

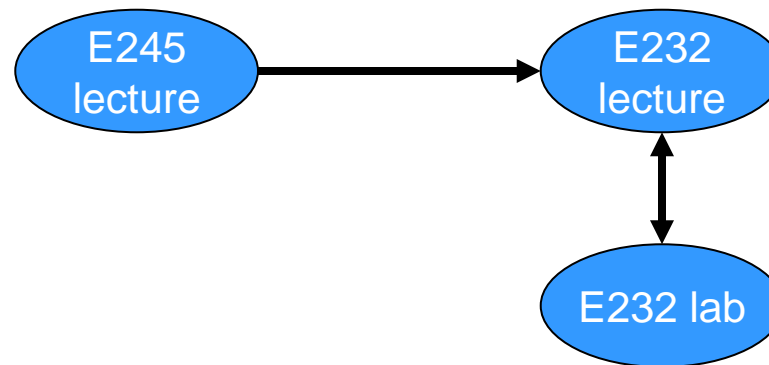


Course Philosophy

- Previously:



- Current curriculum



Syllabus

1. Introduction
 - course logistics

2. General Aspects of Measurement Systems
 - components
 - instrumentation
 - error – systematic & random, accuracy, precision, sensitivity
 - calibration, traceability of standards
 - dynamic measurement systems – response, damping, etc

3. Electrical Output Measurement Systems
 - sensors, amplification (review op amps from E245 and extend to op amp circuits), attenuation, filtering
 - measurement instruments
 - signal transmission
 - sensor principles and characteristics

4. Computer-based Data Acquisition Systems
 - system components – principles of A/D & D/A conversion

Syllabus

5. Sampling and Related Aspects of Measurement Systems
 - Characteristics of time-varying signals
 - Sample rate considerations
 - Filtering

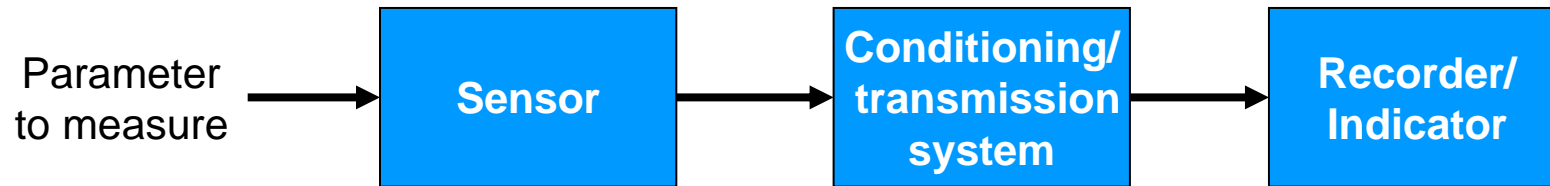
6. Statistical Aspects
 - noise
 - experimental considerations

7. Sensor Systems for Engineering Applications
 - measurement of various parameters of interest to engineers, e.g. temp, pressure, flow, vibration, stress, liquid level, gas

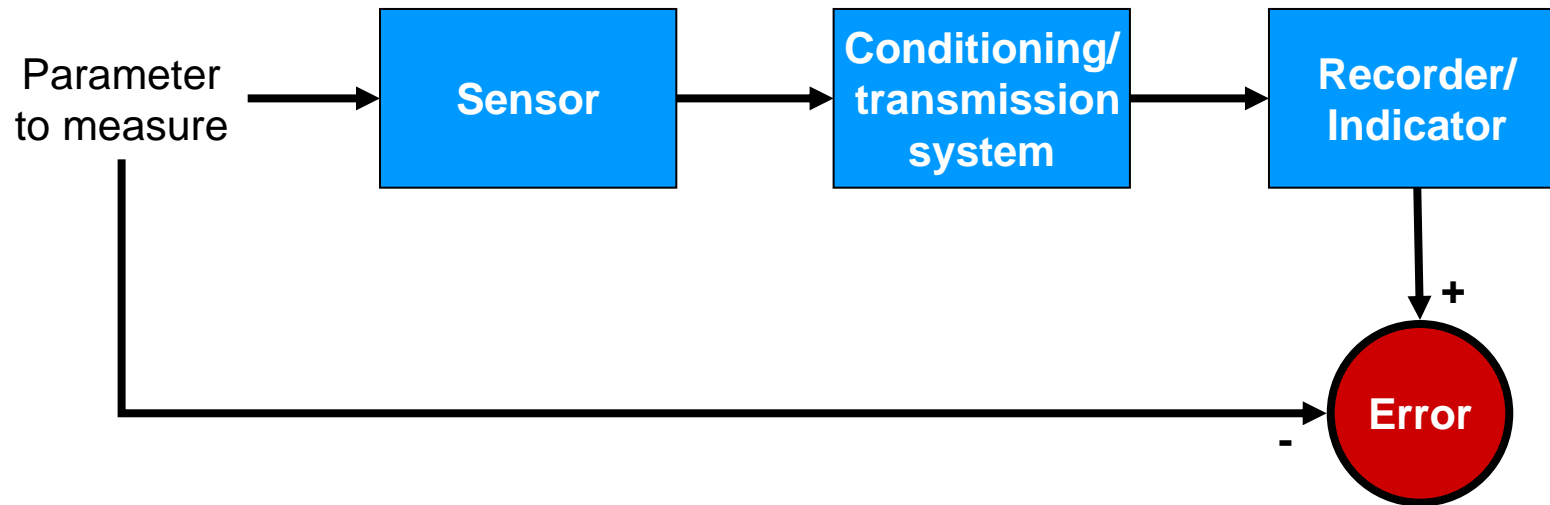
8. Dynamic Systems
 - dynamic measurement issues applied to practical engineering applications

9. Aspects of the Control of Systems
 - basic concepts of control
 - proportional, integral, derivative
 - applied to practical engineering applications

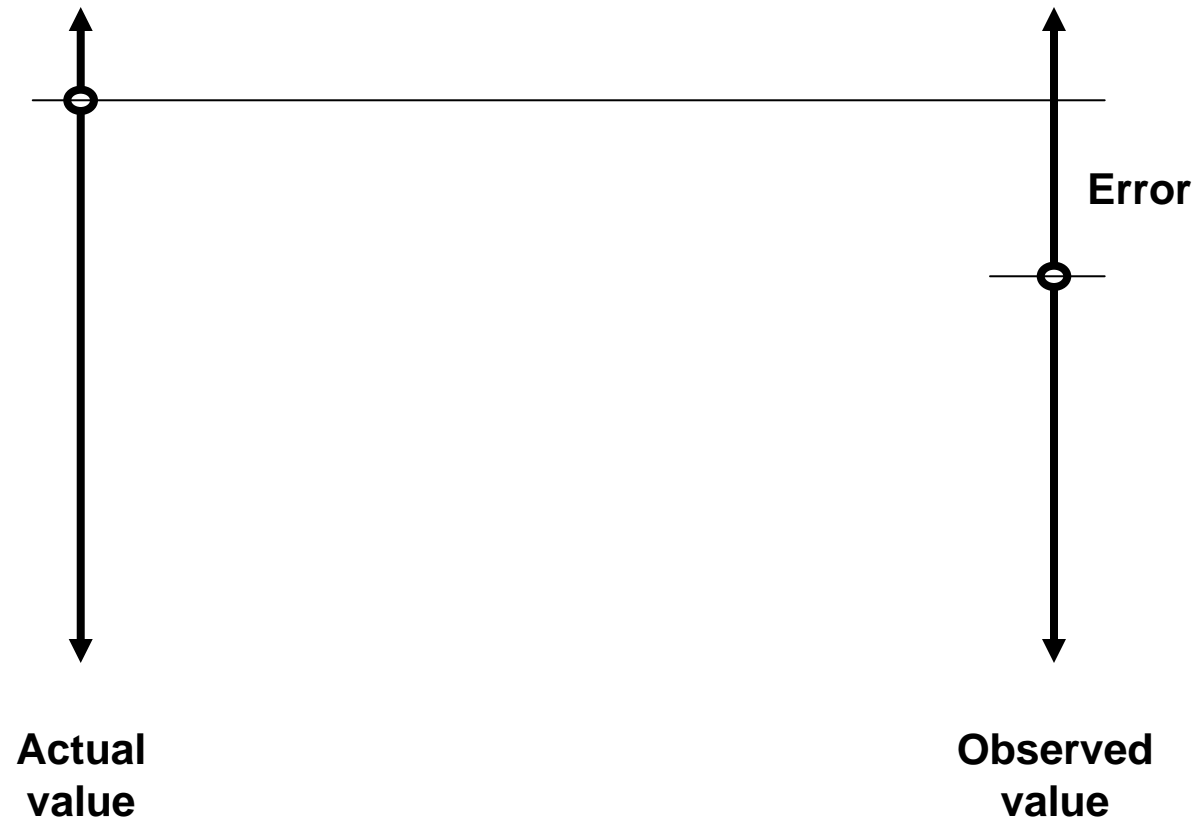
Measurement Systems



Measurement Systems

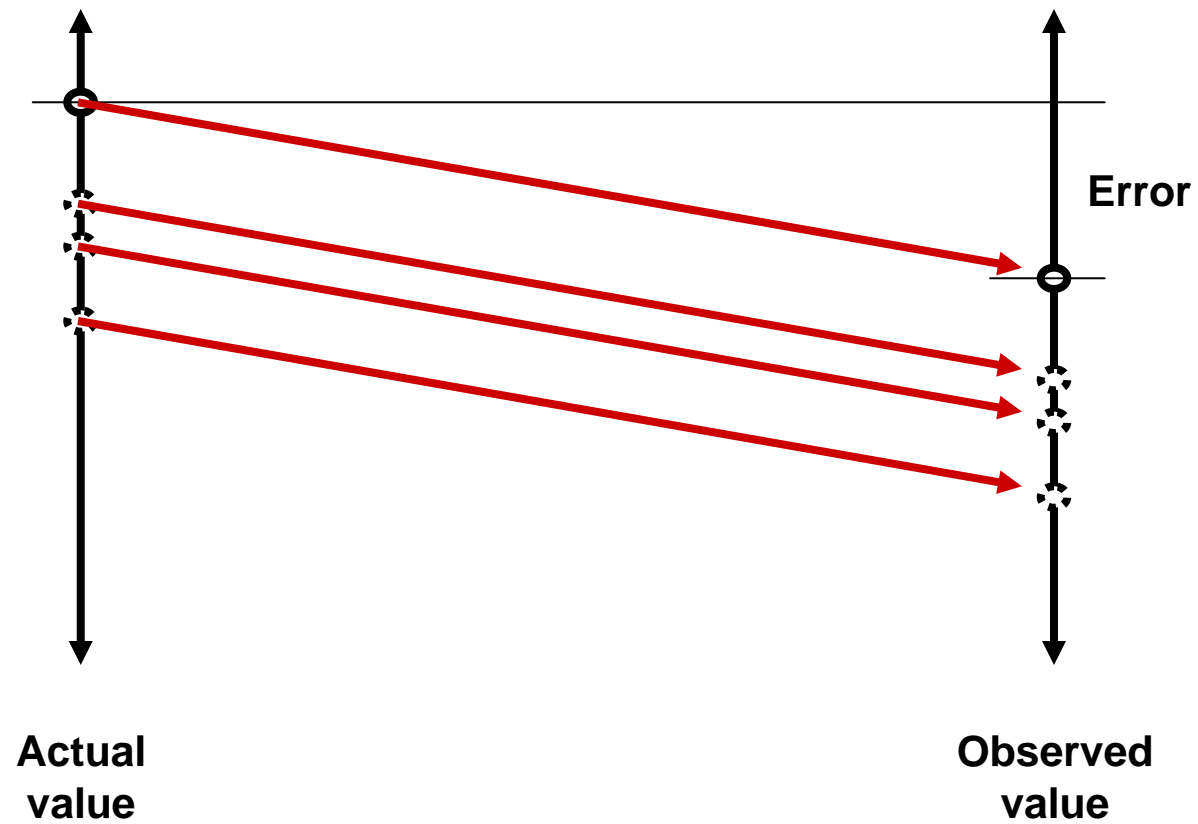


Types of Error



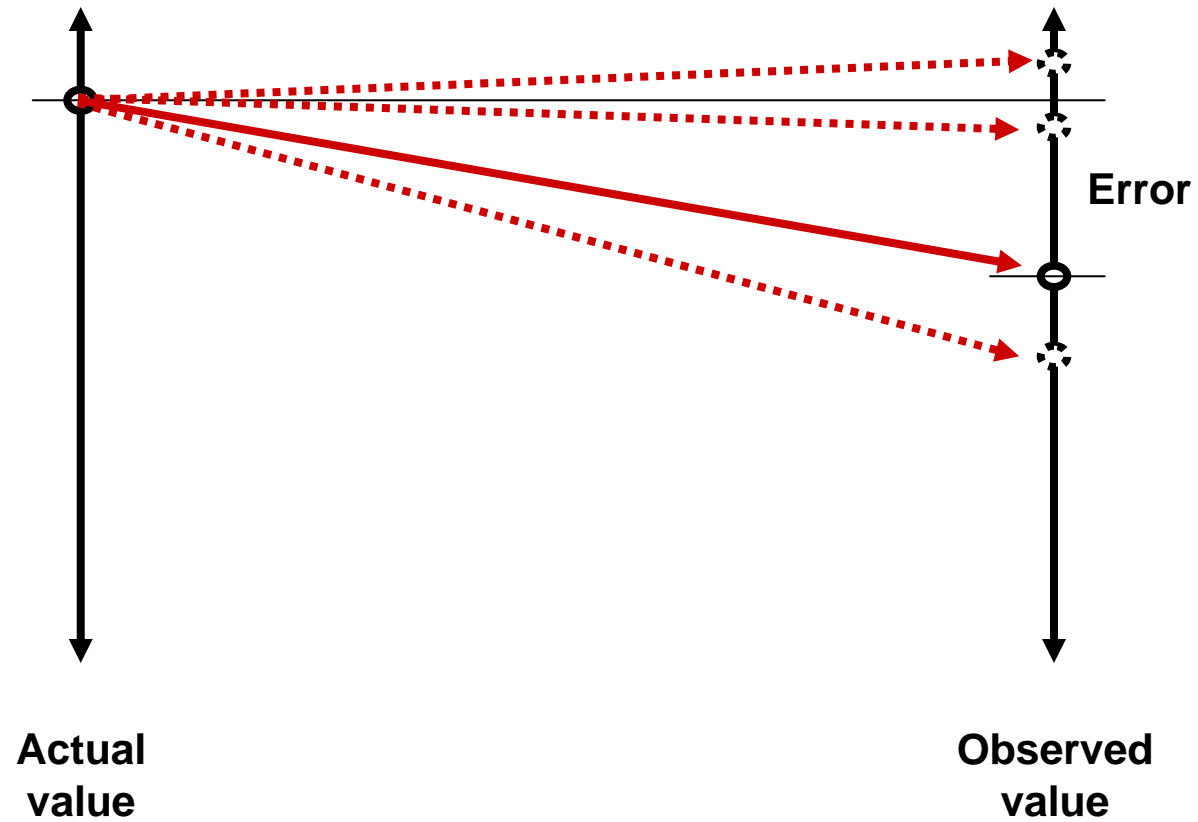
Types of Error

- Systematic error



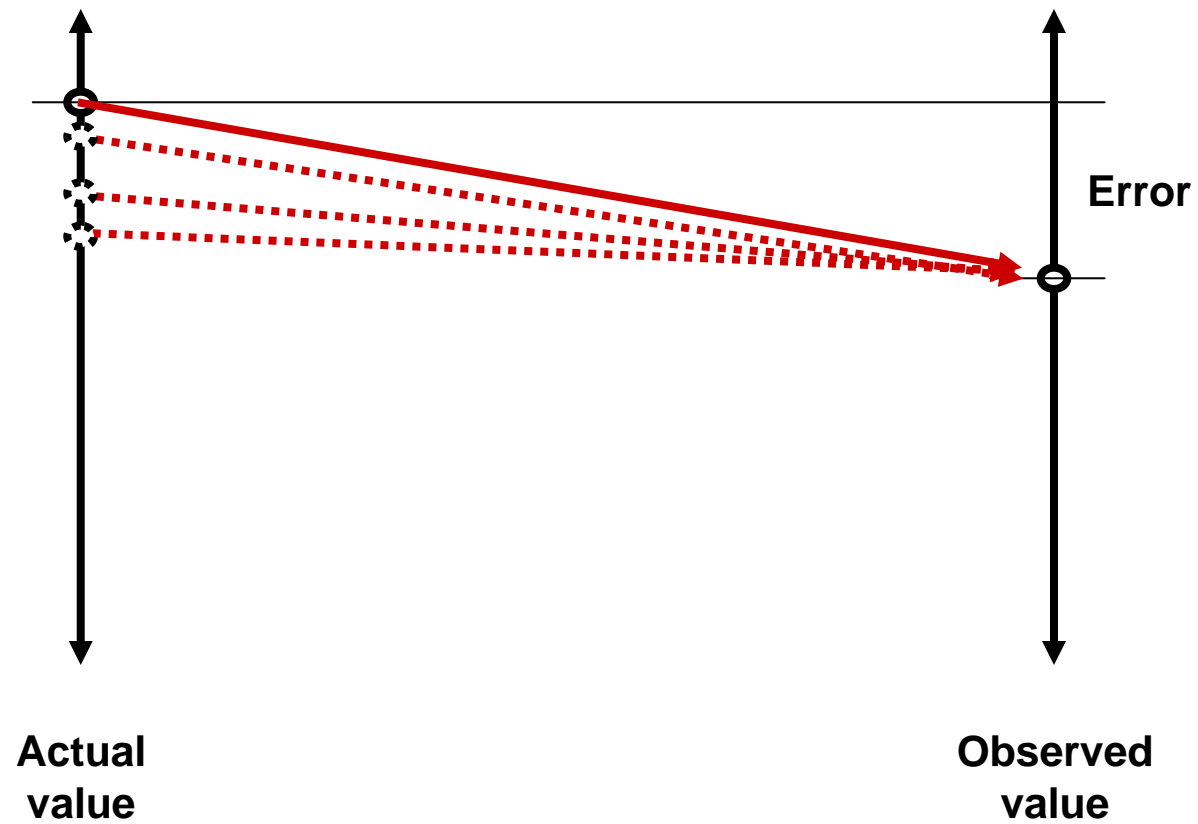
Types of Error

- Random error



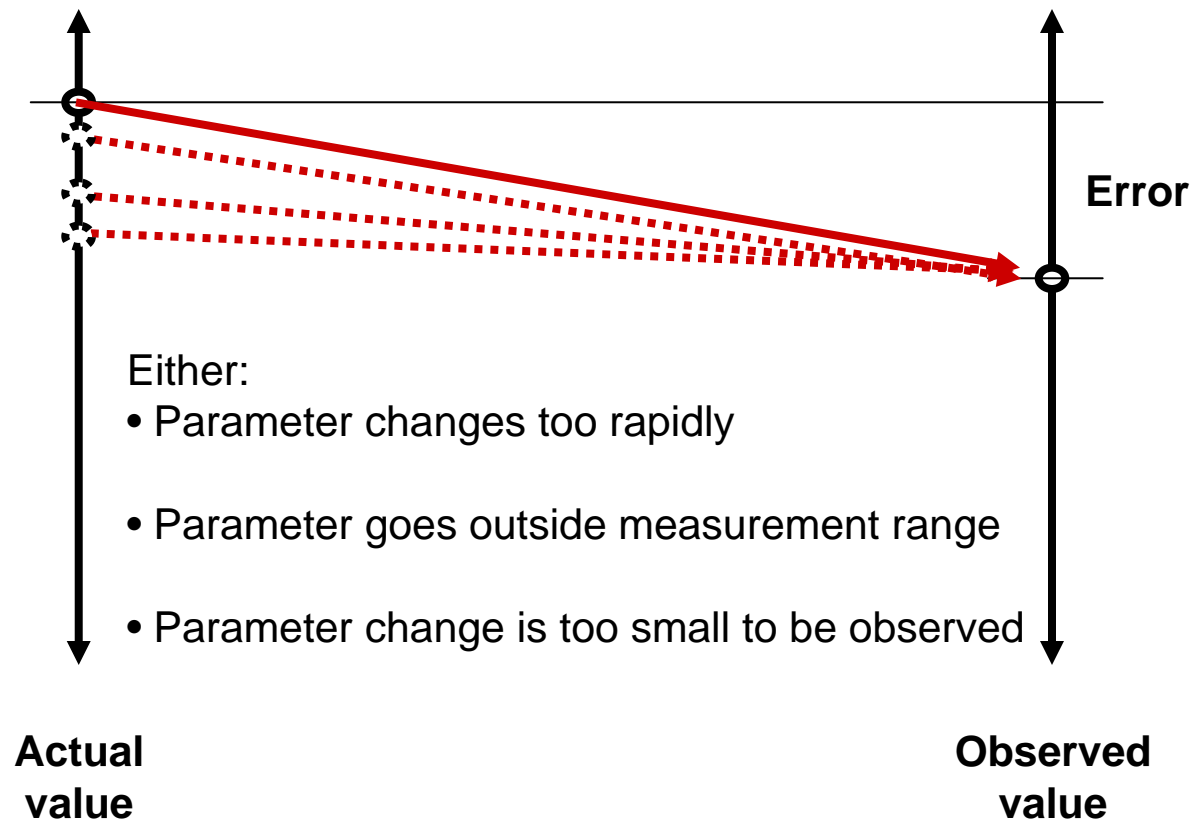
Types of Error

- Parameter tracking error

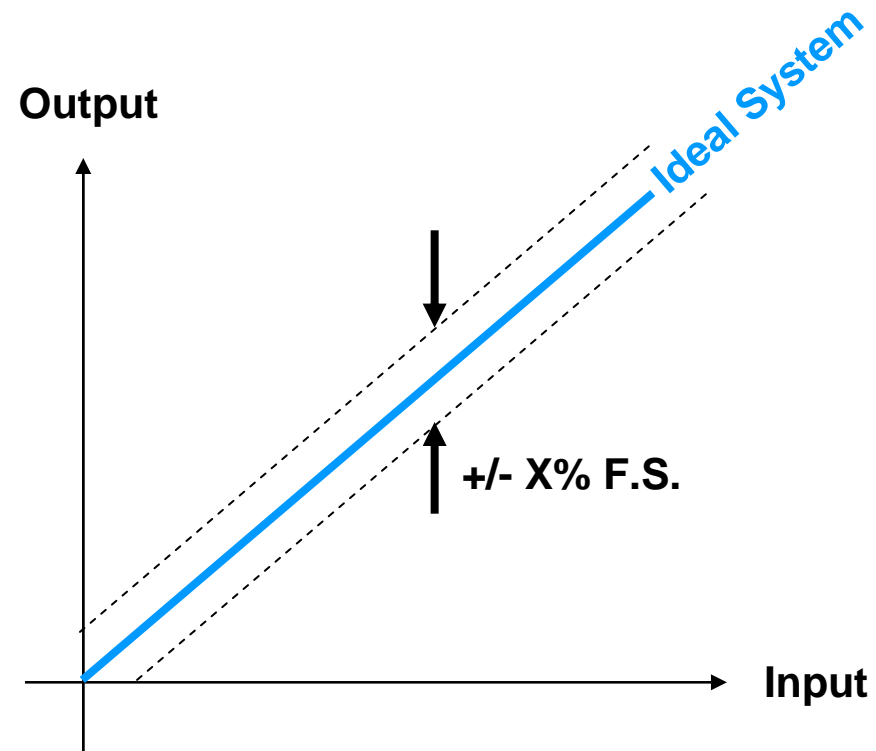


Types of Error

- Parameter tracking error

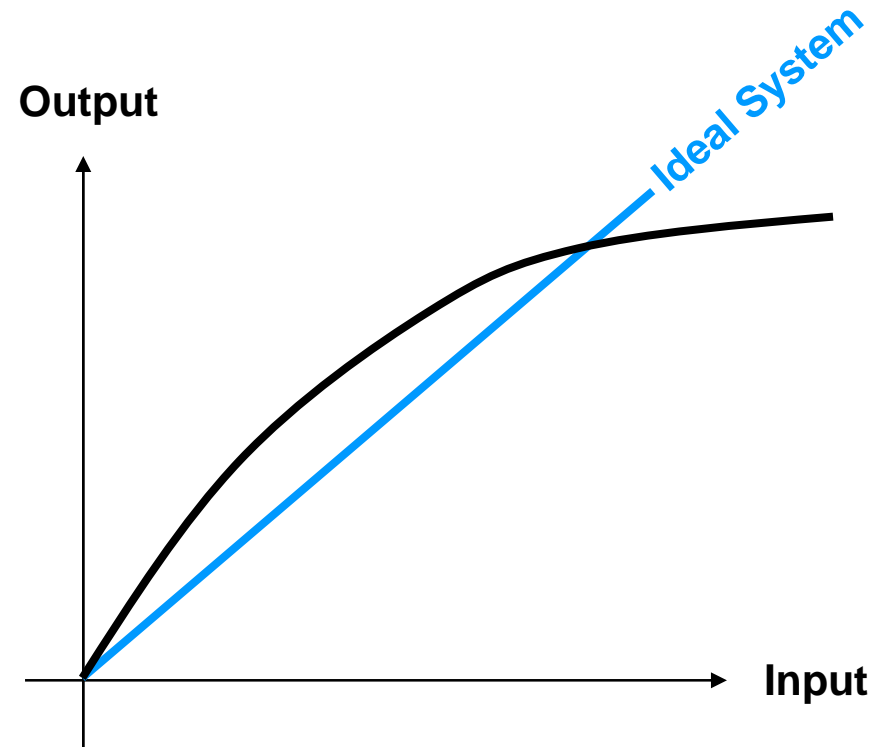


Measurement Error Characteristics



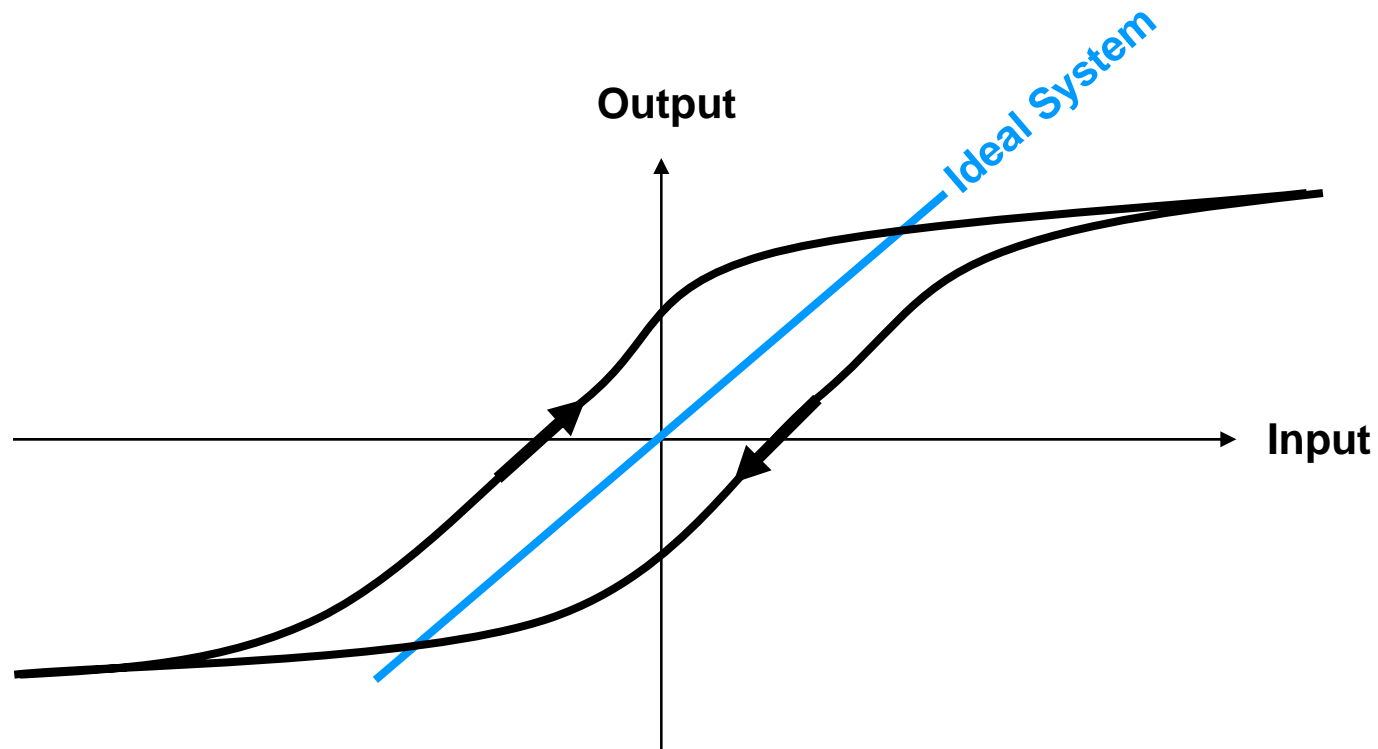
Measurement Error Characteristics

- Non-linearity



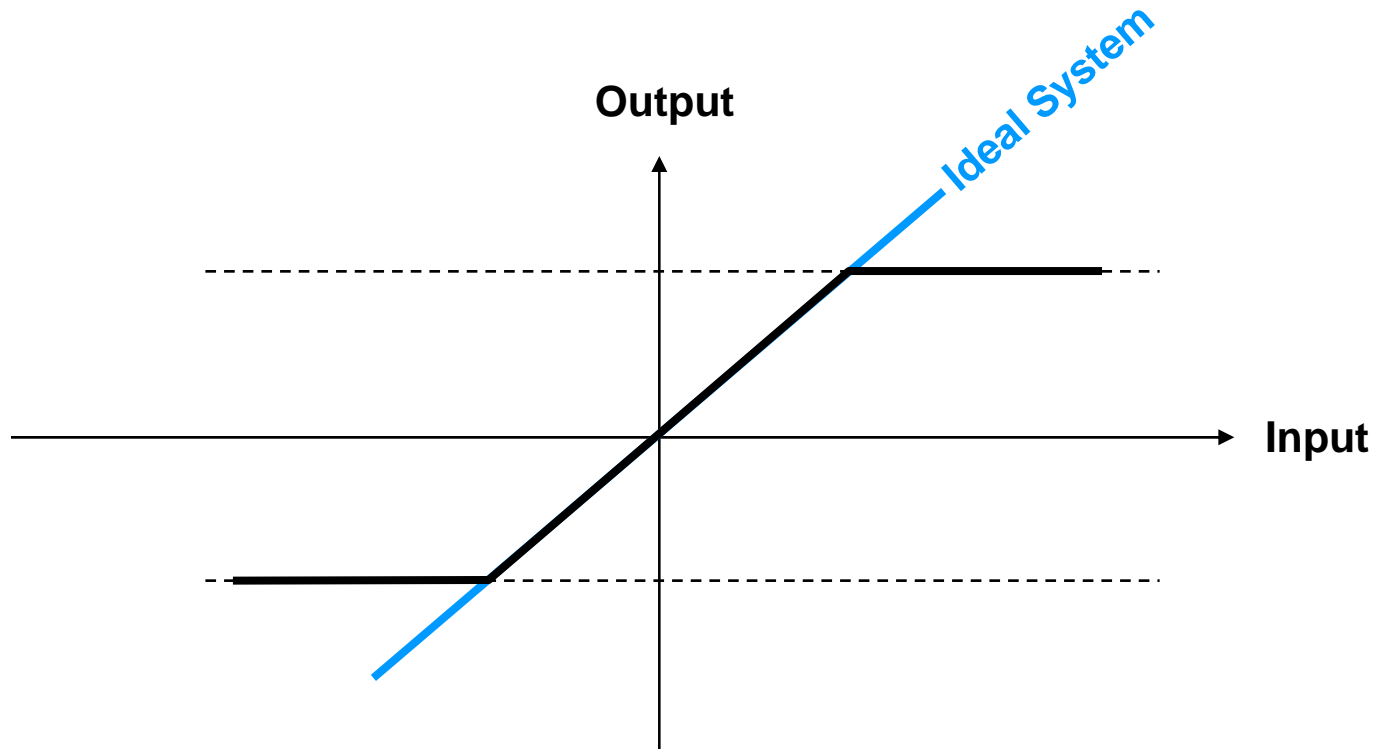
Measurement Error Characteristics

- Hysteresis

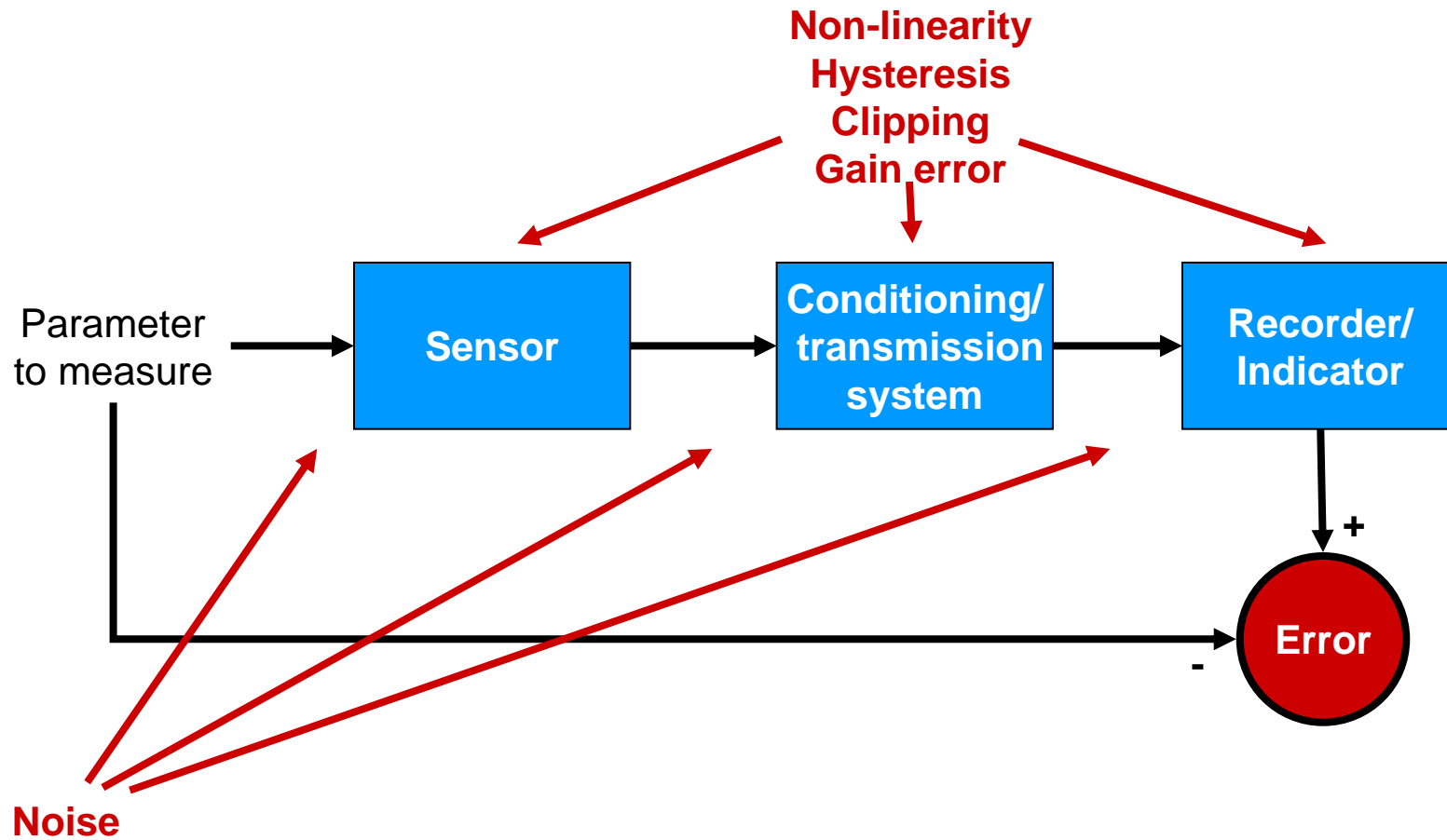


Measurement Error Characteristics

- Range-limitation (clipping)



Measurement Systems



Precision versus Accuracy

- Precision: related to the number of significant digits to which a value can be described
- Accuracy: How many of those digits are correct?
- $\frac{1}{4}$ " vs. .25" vs. .250000"

Next Topics

- Measurement and calibration standards
- Measuring equipment
- Dynamic systems, frequency response

Assignment

- Read Chapters 1 & 2
- Skim Chapter 3