Design IV

E232 Fall 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 (notes will be posted here)
    - Office hours: Monday – Thursday, 9:30 – 4, subject to class and other meetings

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    - **Make sure your name appears inside the attachment. Don't assume that the email wrapper will accompany the attachment to the printer.**
    - **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 (Don't use my email address for your work!!!)

    - **If you submit multiple files, label each file as indicated above or, preferably, put them all into a single zip file**

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 EXCEPTIONS**
  - **I may or may not give warning that the solution is about to be posted**
  - **No assignment will require massive printout. Limit your results to a few pages**

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  – 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. If you do not see your submission status change within a day of your submission, check to see if I received it.**

    - Three course credits will be divided between Lecture section (2/3rd) and Lab section (1/3rd) (information on Registrar's site may be out of date)
    - You must achieve passing grades in **both** the lab **as well as** the lecture section to pass E232.

Stevens Honor Code Matters

- This is the lecture section of E232. Unlike the lab section,

  ALL WORK SUBMITTED IS TO BE YOUR OWN WORK ONLY

- All quizzes will be open book/open notes. Cite any other sources you use, but another person (e.g., student in this class or otherwise) is never a valid source for this course.

- Per the Honor Code, work that is not pledged will not be graded.

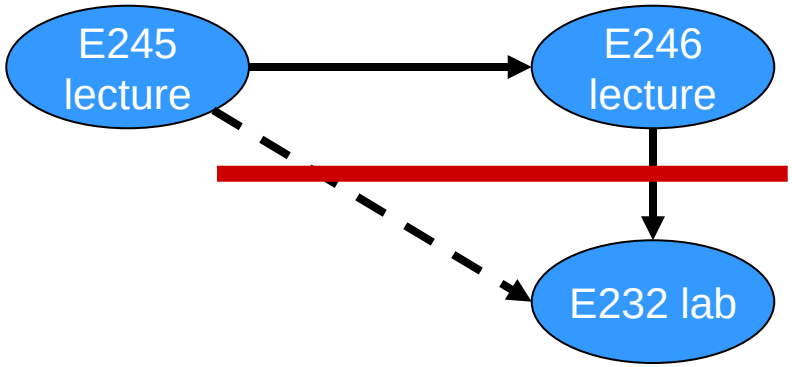
- A WebCT shell will accompany this course. All quiz and homework solutions will be posted there. A discussion group also exists in the course. I will use this to make announcements and provide general feedback (e.g., clarification of homework/quiz question). You may ask general questions about material in the class in the discussion groups but: **DO NOT USE THE DISCUSSION TOOL TO SOLICIT HELP ON HOMEWORK/QUIZ QUESTIONS**.

Reference Materials

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

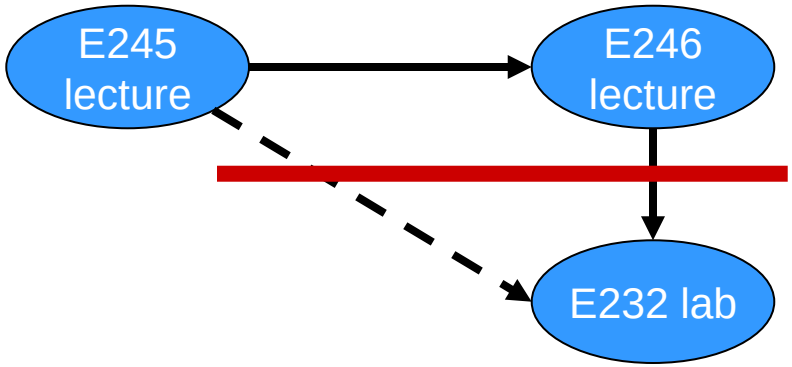
Course Philosophy

- Previously:

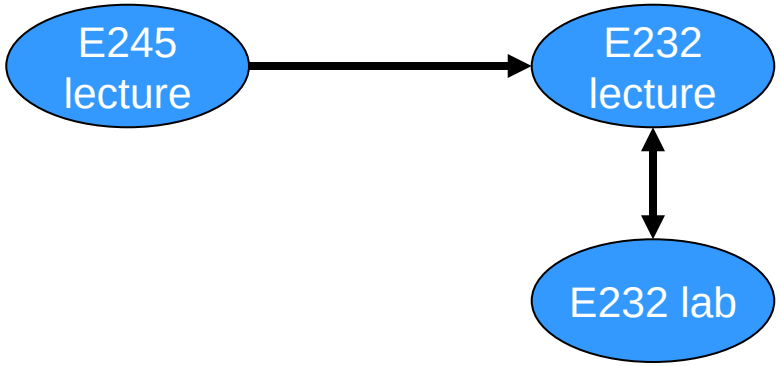


Course Philosophy

- 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

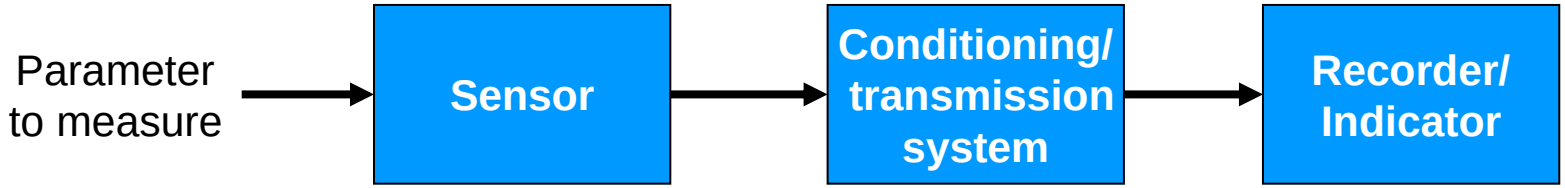
6. Statistical Aspects
   - noise
   - experimental considerations

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

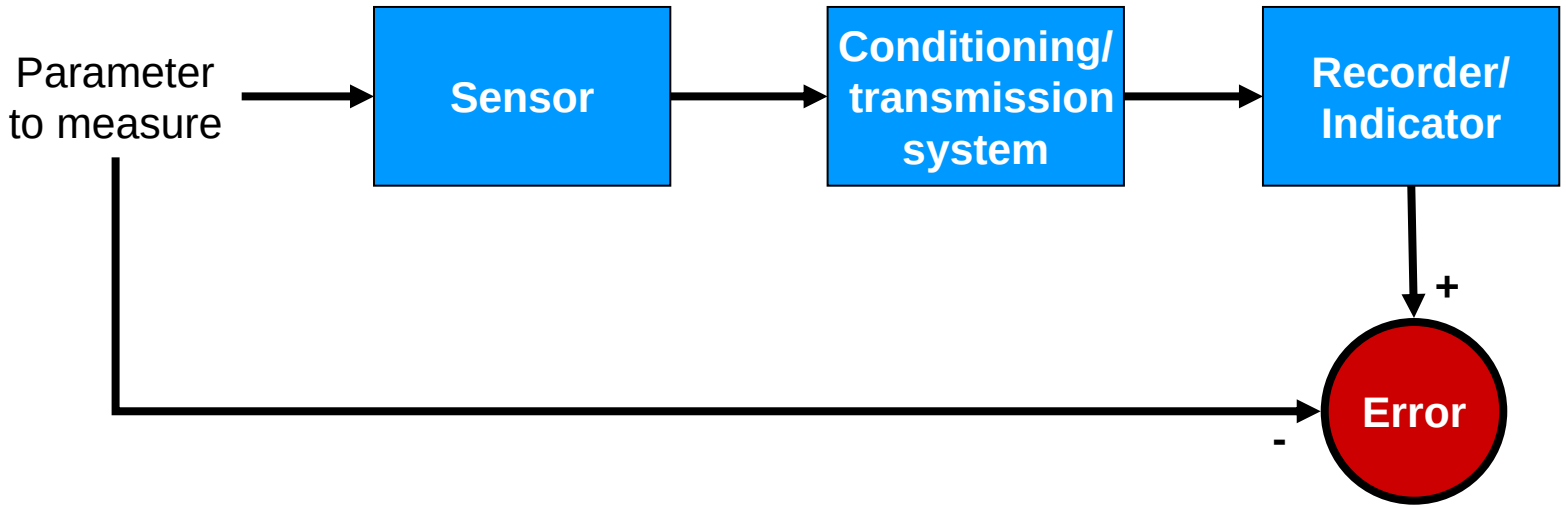
8. Dynamic Systems
   - dynamic measurement issues applied to practical engineering applications

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

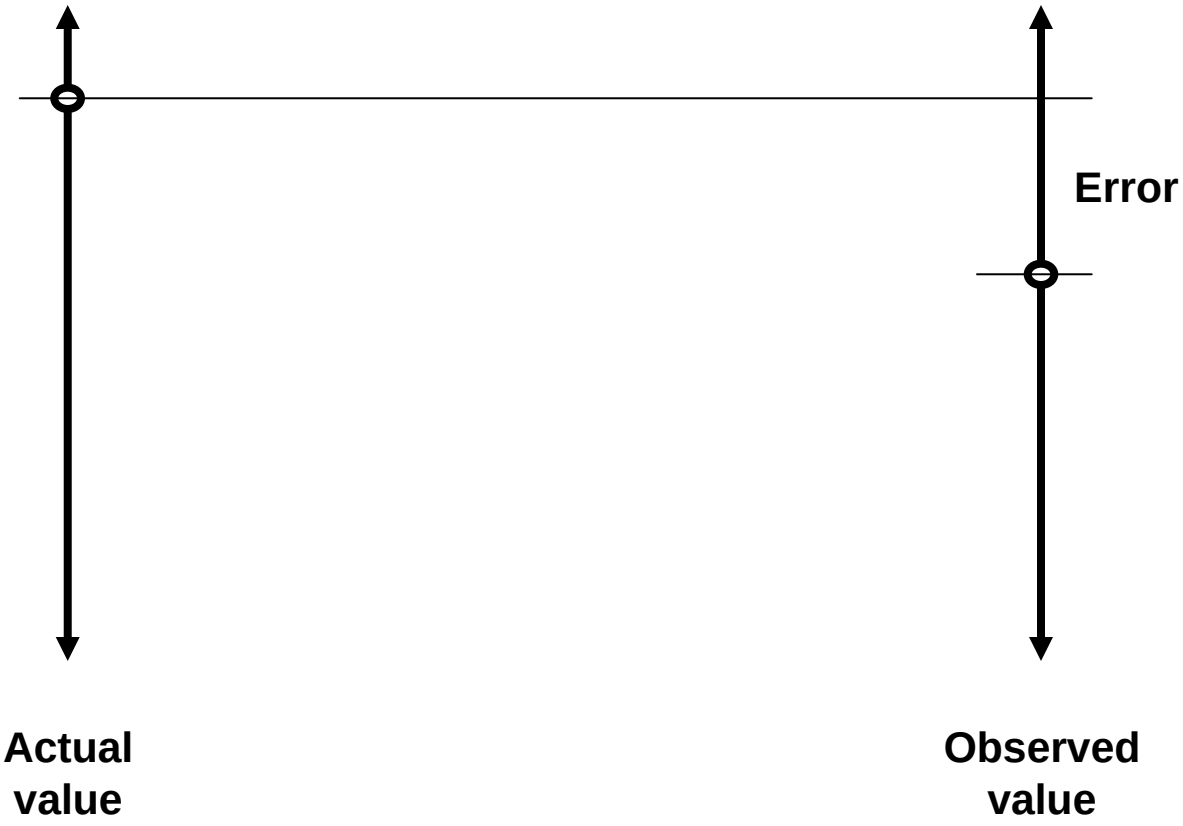
Measurement Systems



Measurement Systems

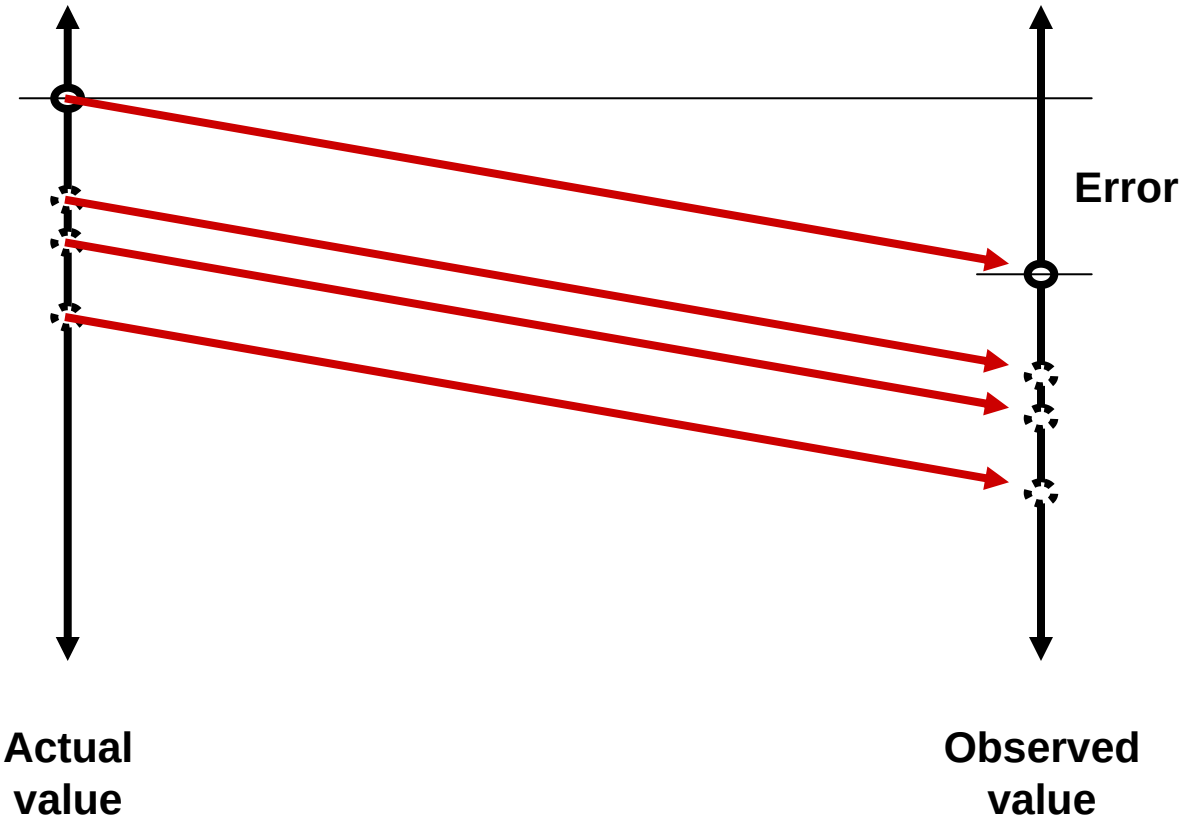


Types of Error



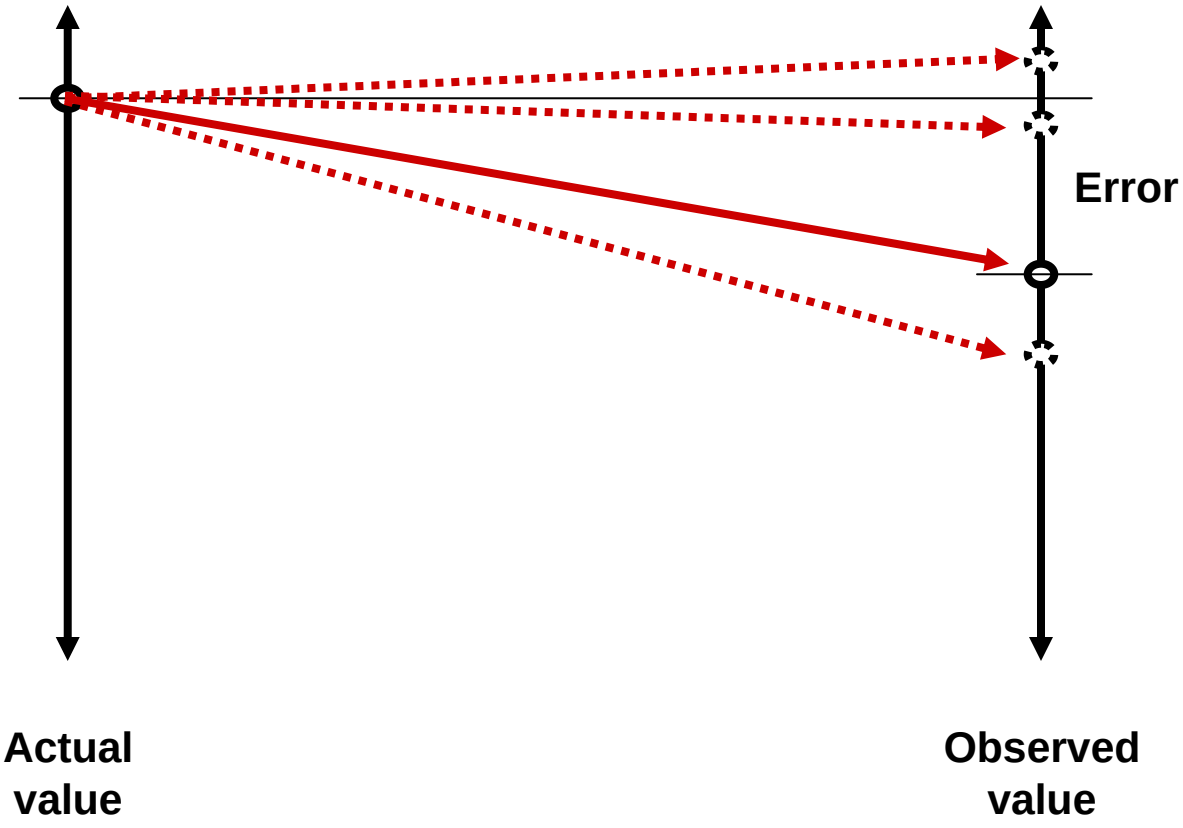
Types of Error

- Systematic error



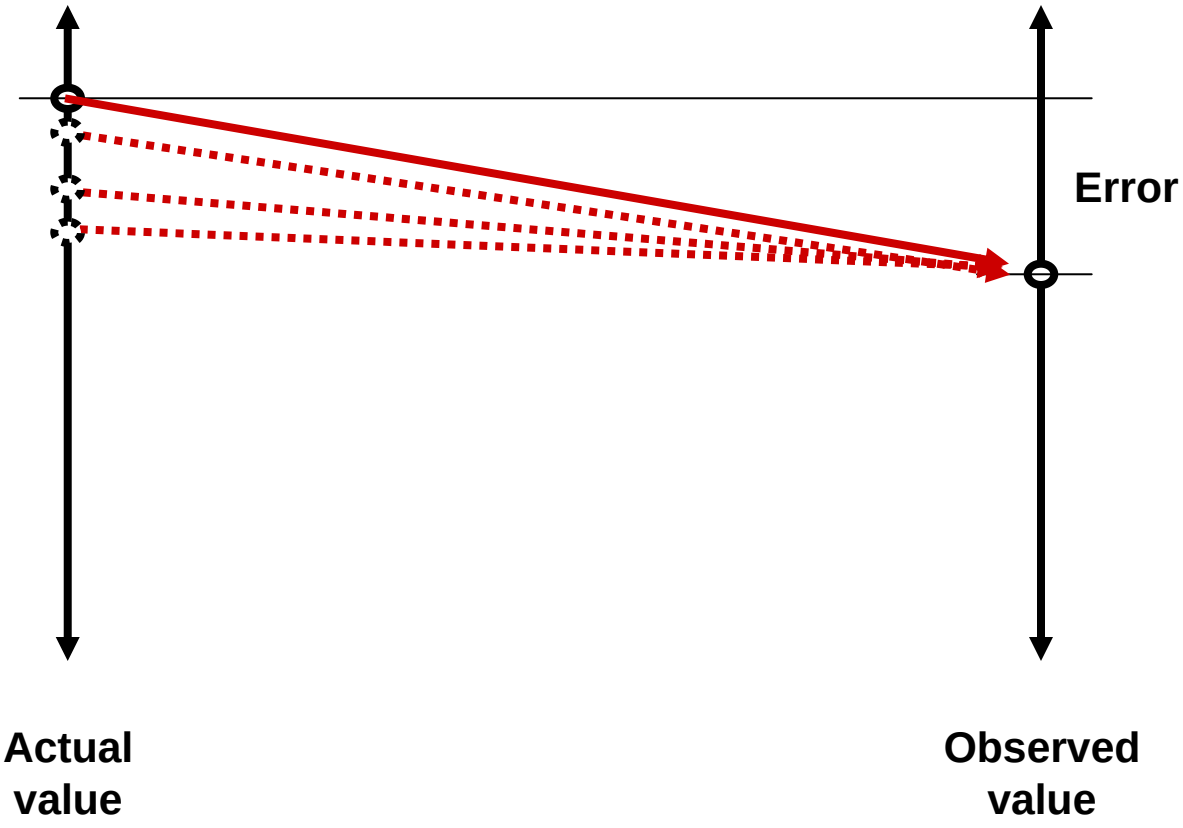
Types of Error

- Random error



Types of Error

- Parameter tracking error



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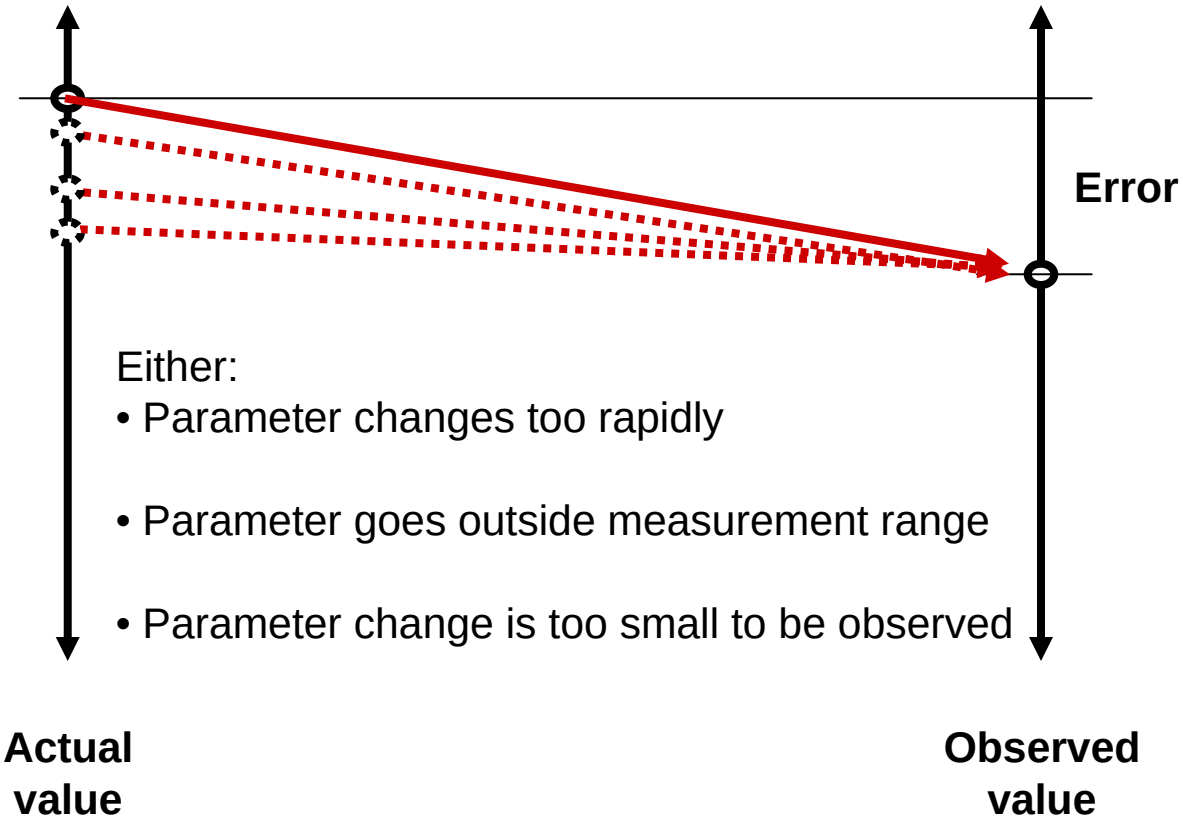
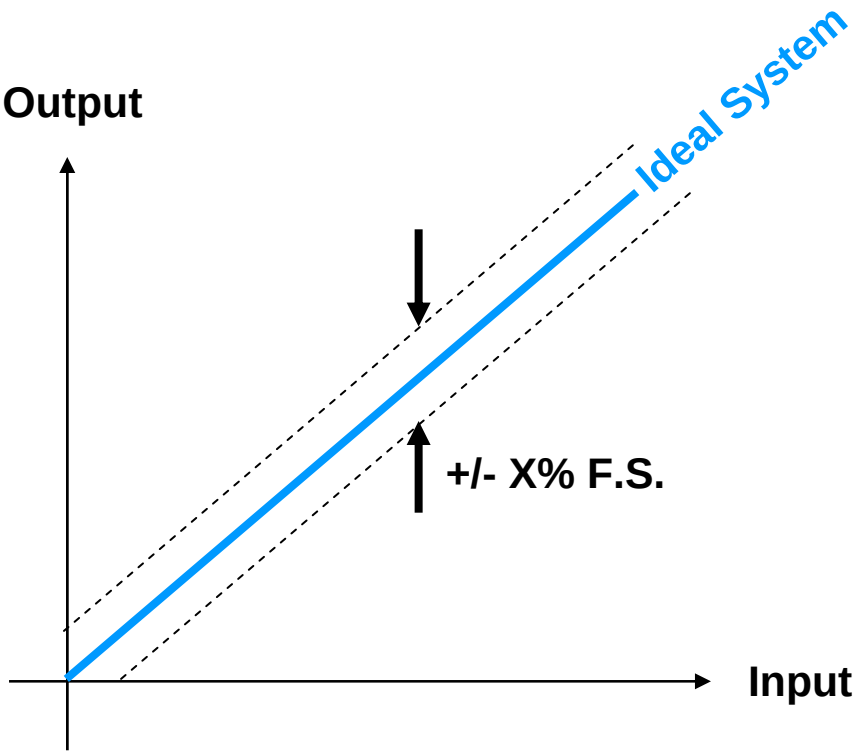
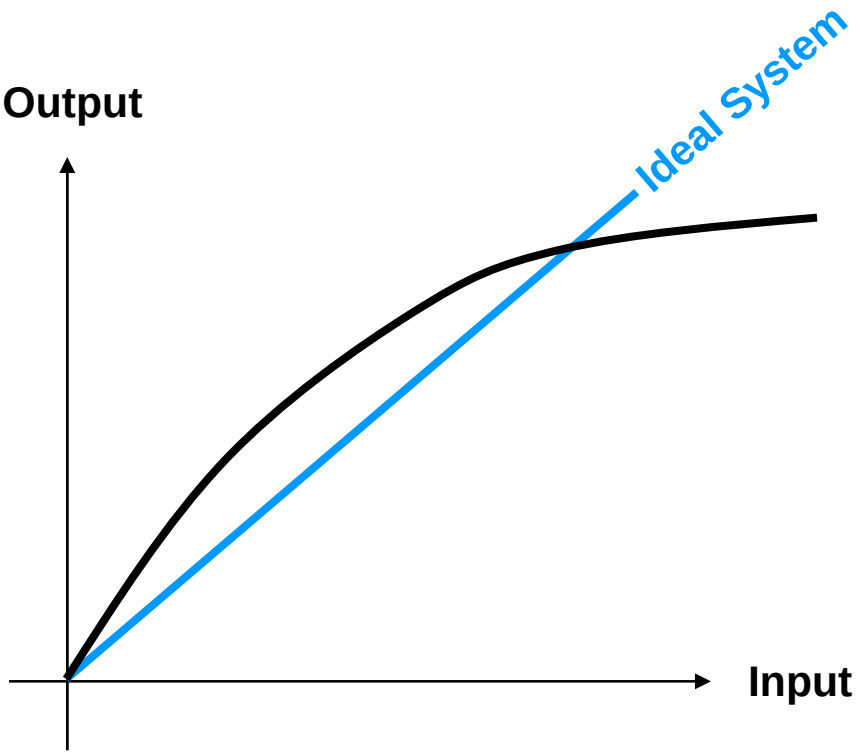


Measurement Error Characteristics



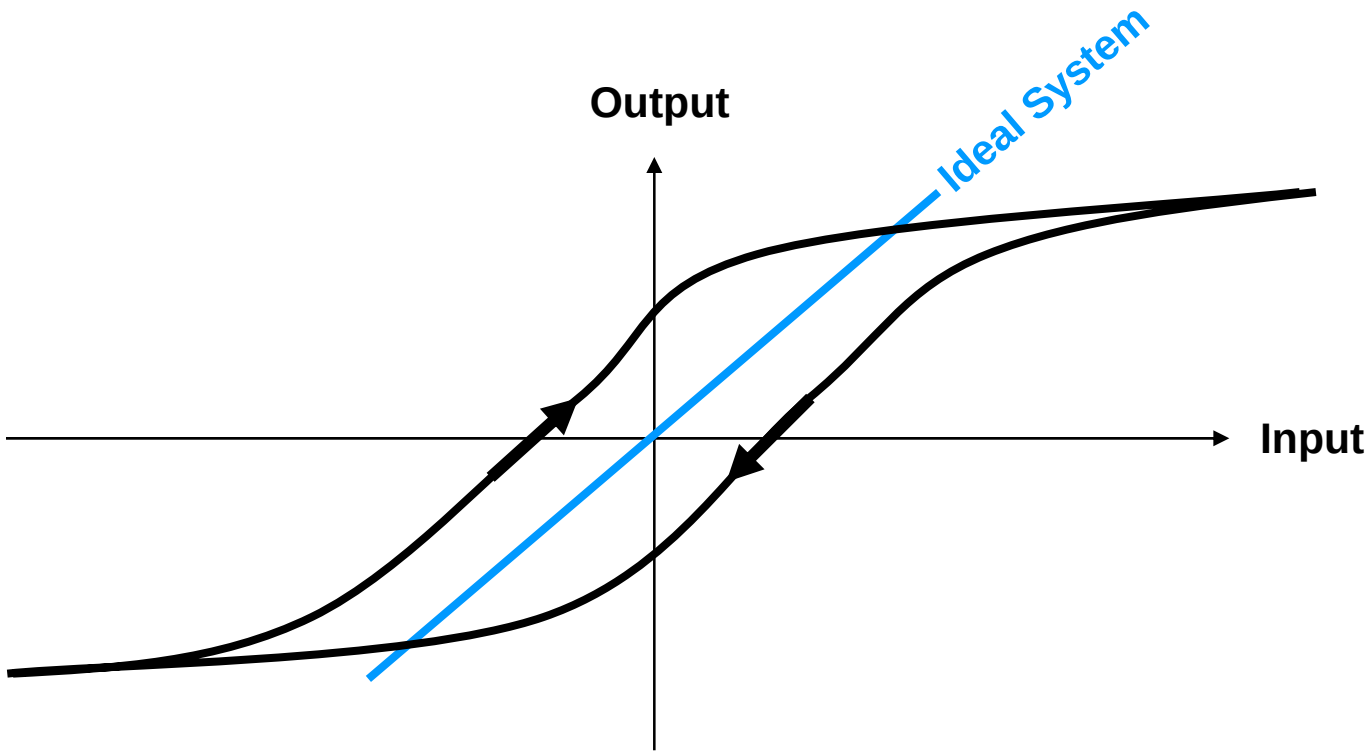
Measurement Error Characteristics

- Non-linearity



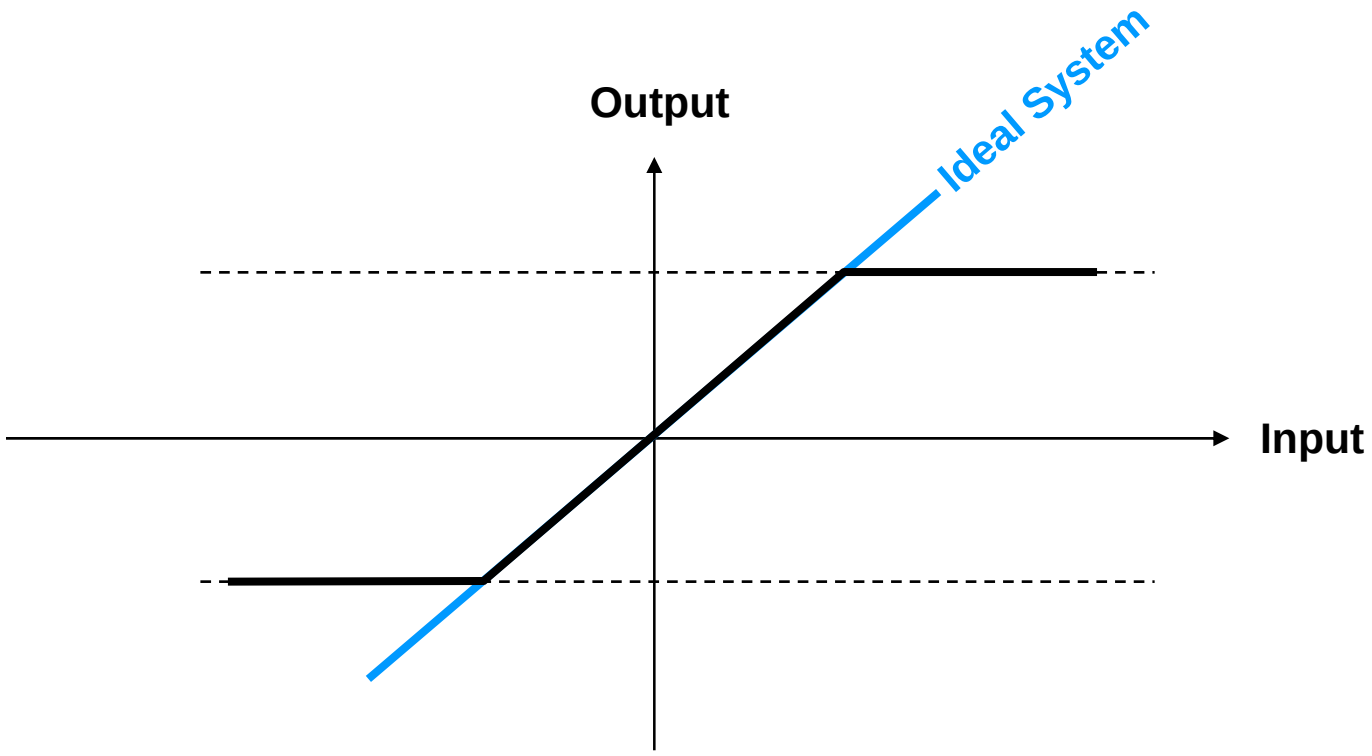
Measurement Error Characteristics

- Hysteresis

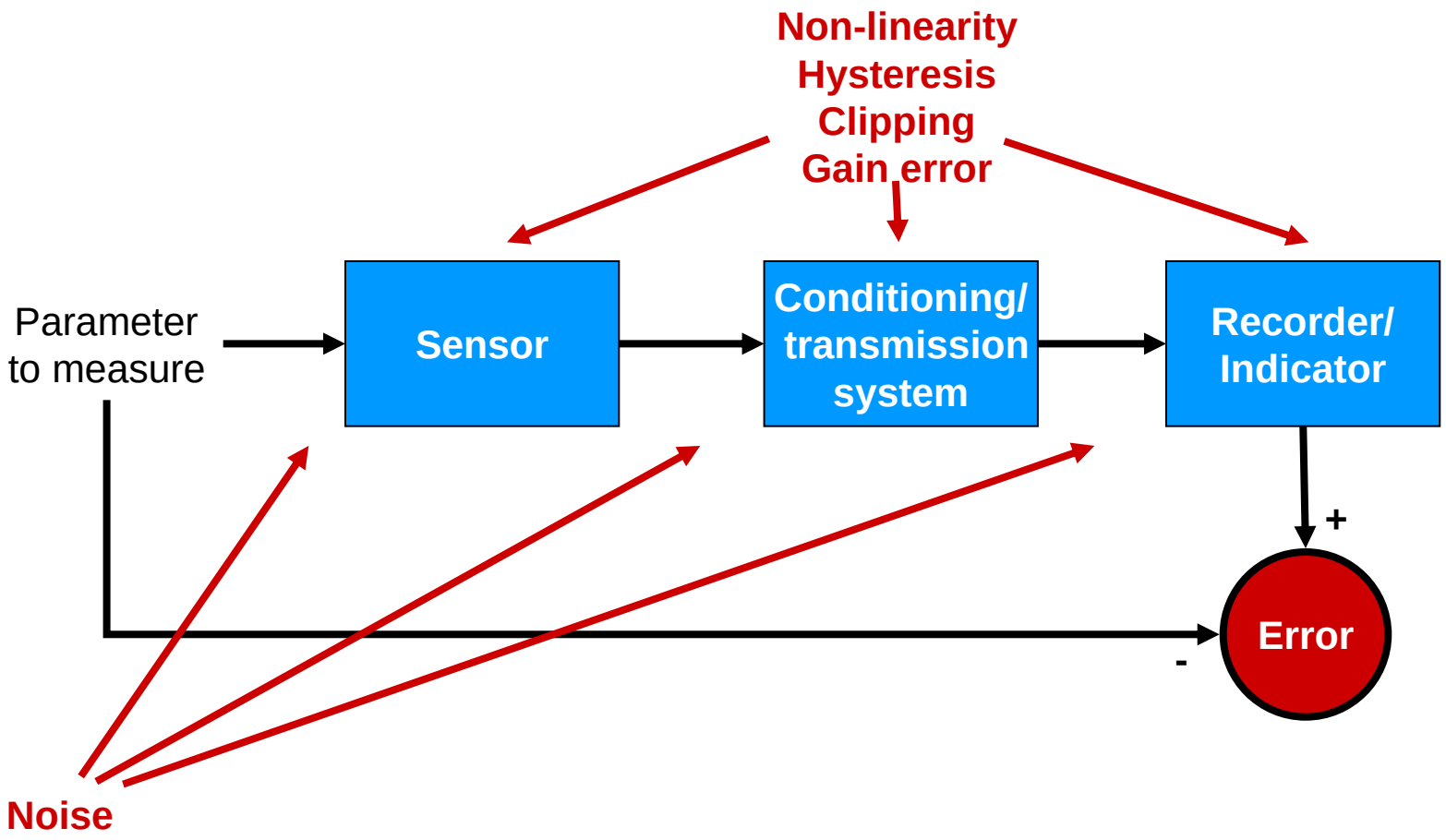


Measurement Error Characteristics

- 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?
- ¼” vs. .25” vs. .250000”

Next Topics

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

Assignment

- Read Chapters 1 & 2
- Skim Chapter 3