

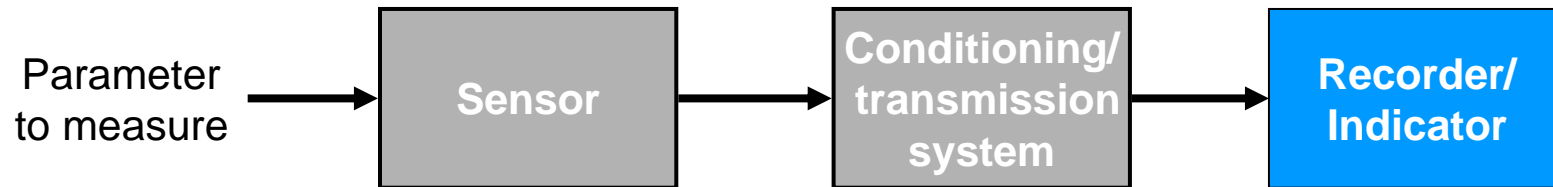
Design IV

E232 Spring 07

Class 6

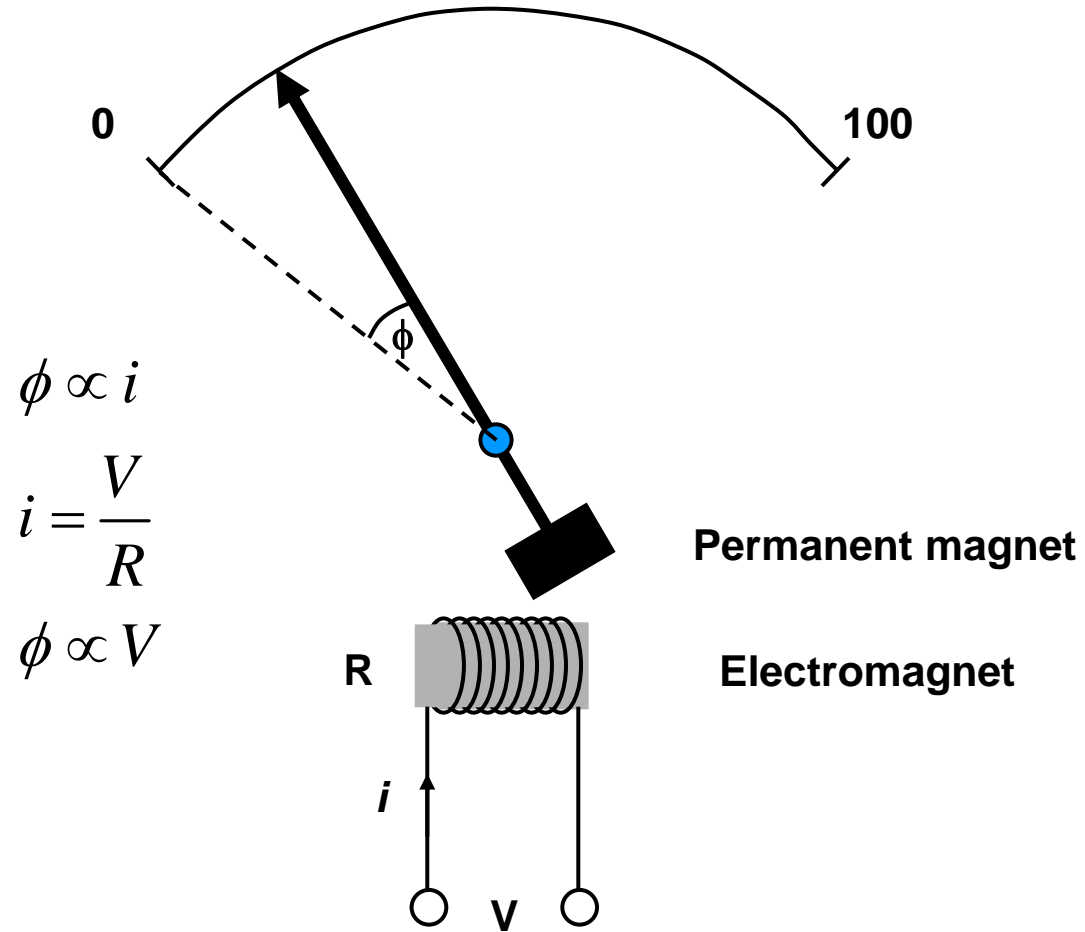
Bruce McNair
bmcnair@stevens.edu

Recorders/Indicators



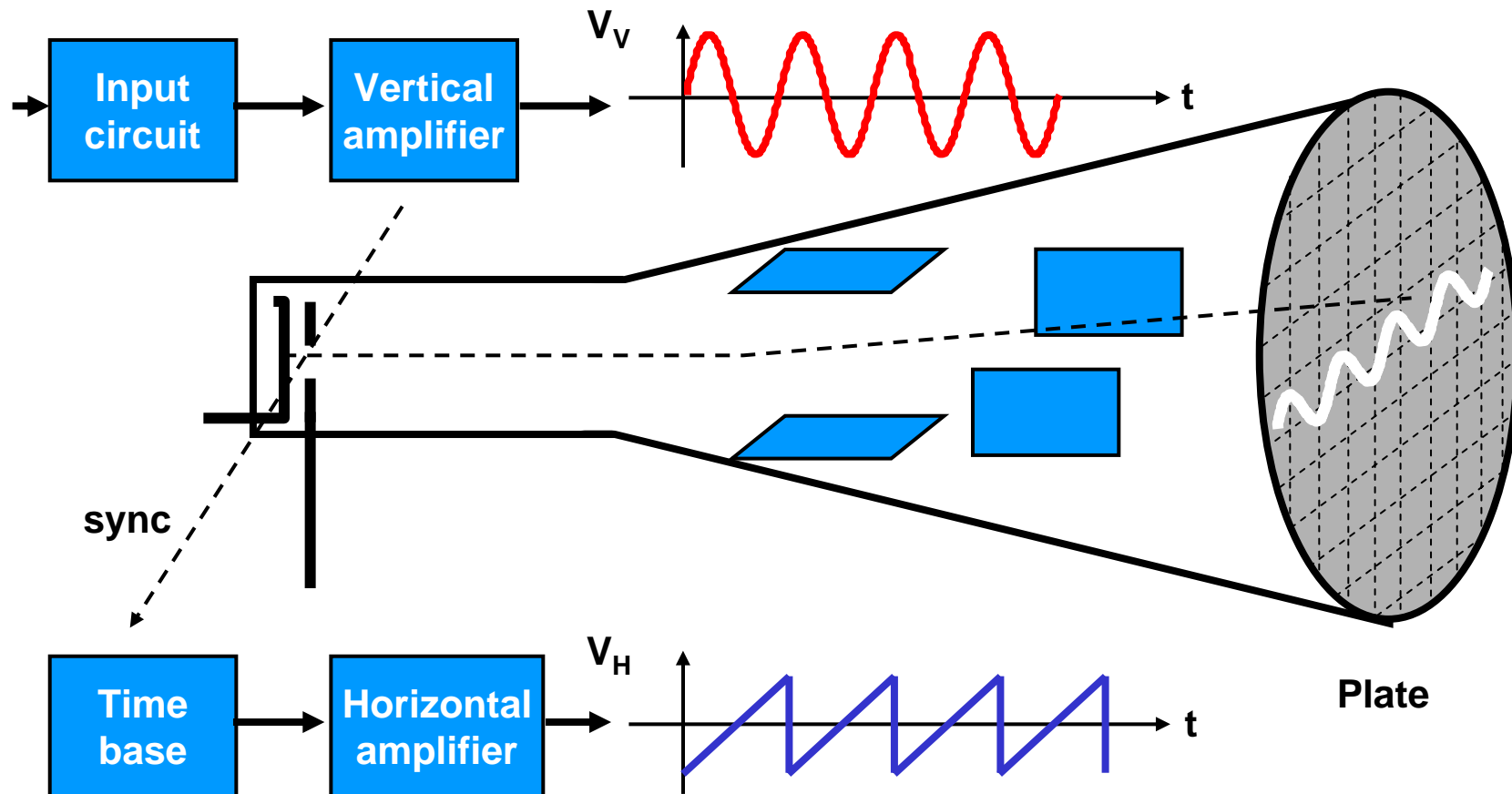
Recorders/Indicators

- Classical voltage (current) measurement



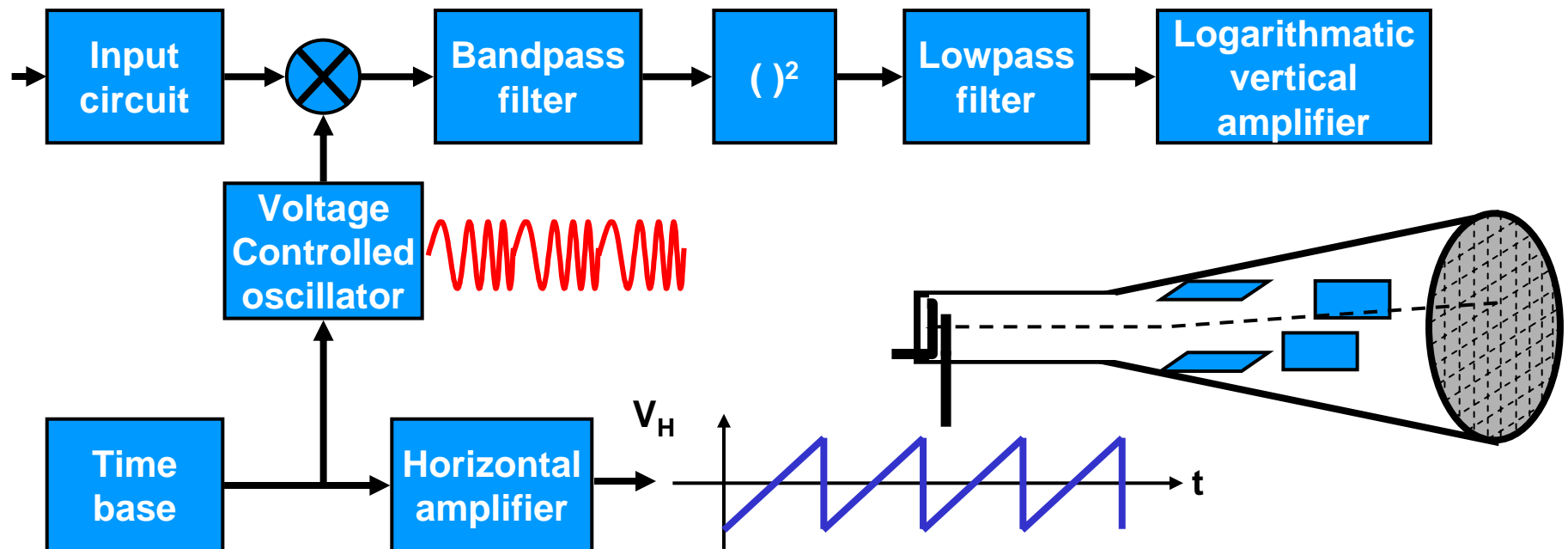
Recorders/Indicators

- Dynamic signal measurements – waveform displays: oscilloscope



Recorders/Indicators

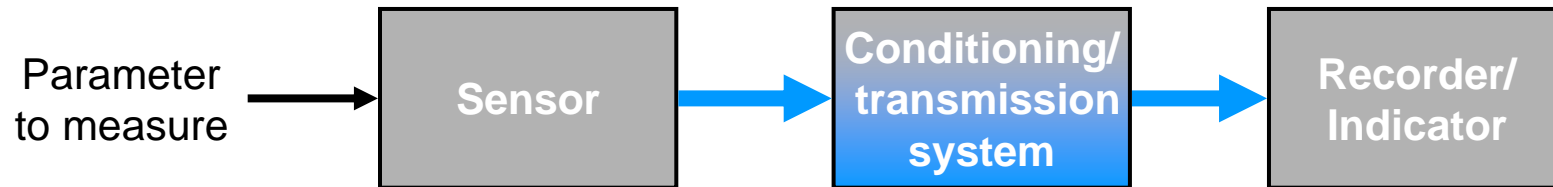
- Dynamic signal measurements – spectral displays: spectrum analyzer



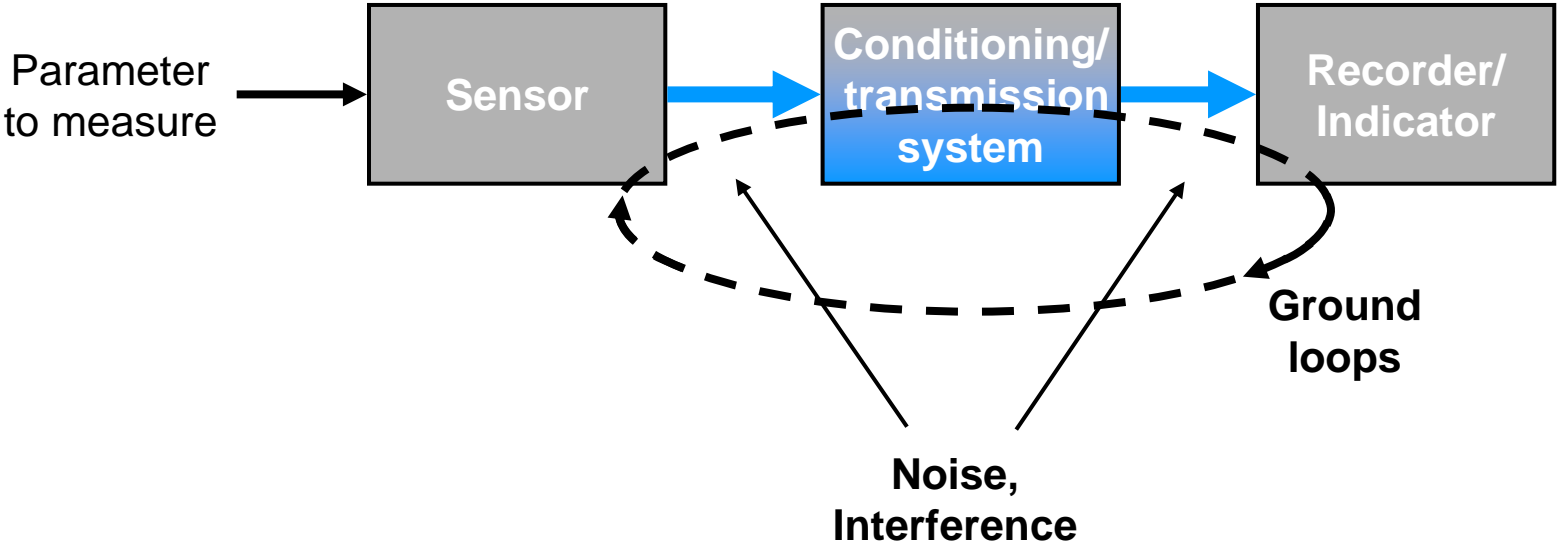
Today's topics

- Transmission
 - Signal level considerations
 - Interference sources
 - Ground loops
 - Rationale for digital signal transmission

Transmission System

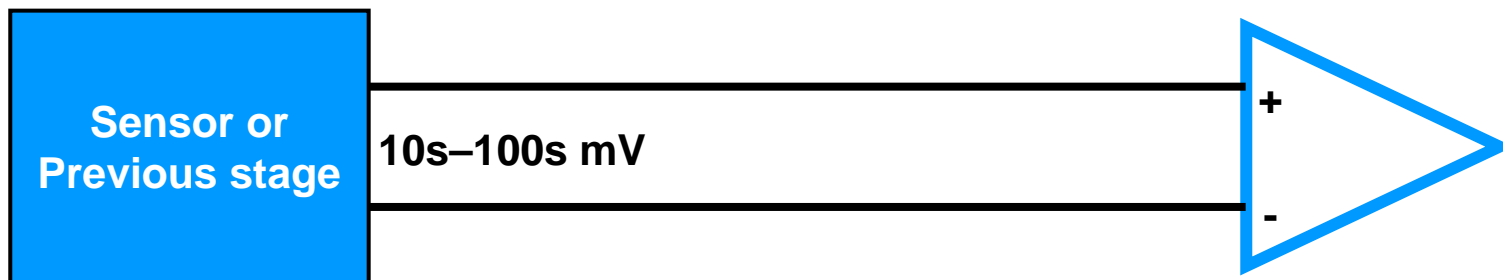


Transmission System



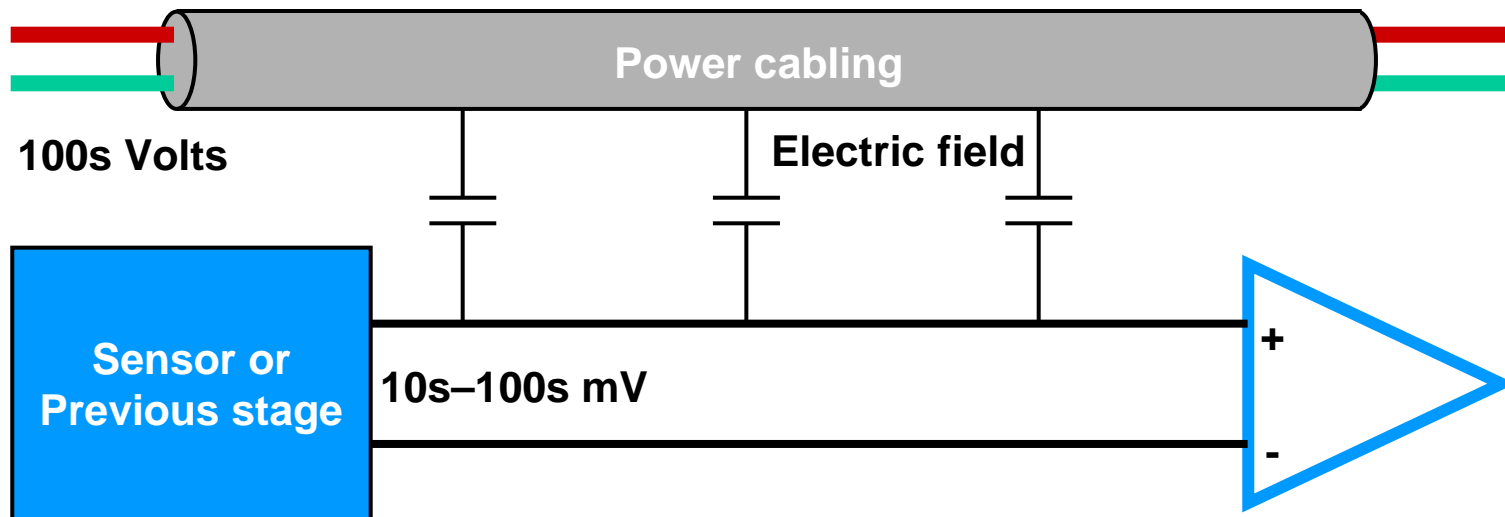
Transmission Systems

- Signal level considerations



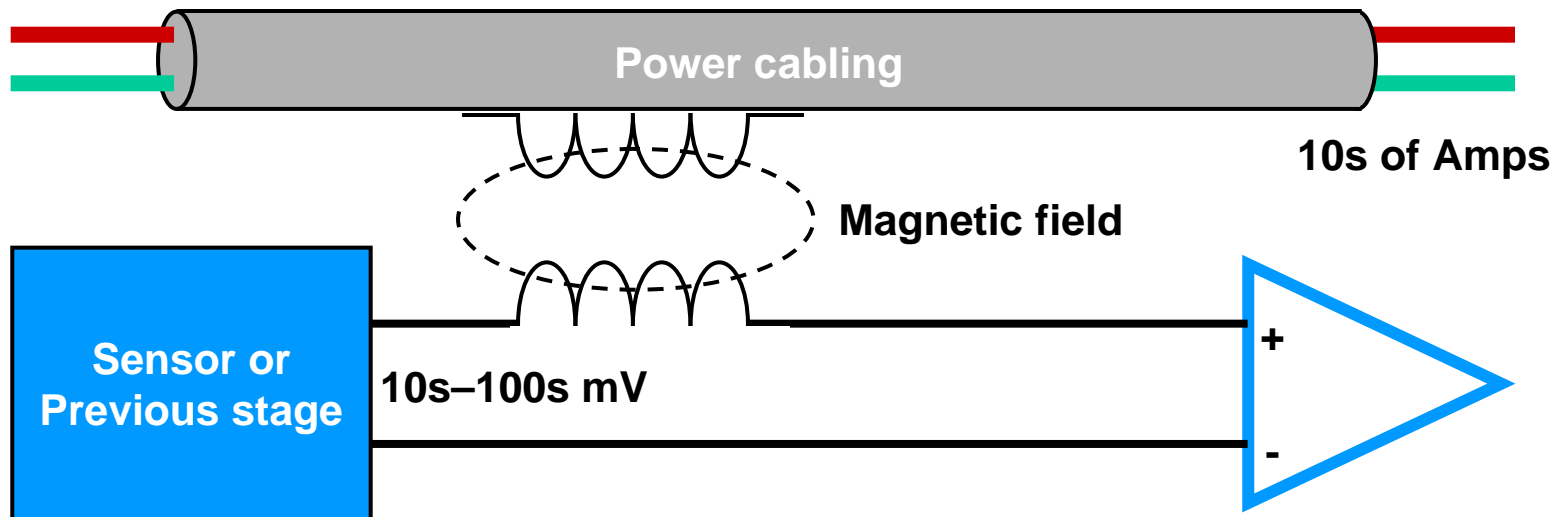
Transmission Systems

- Signal level considerations



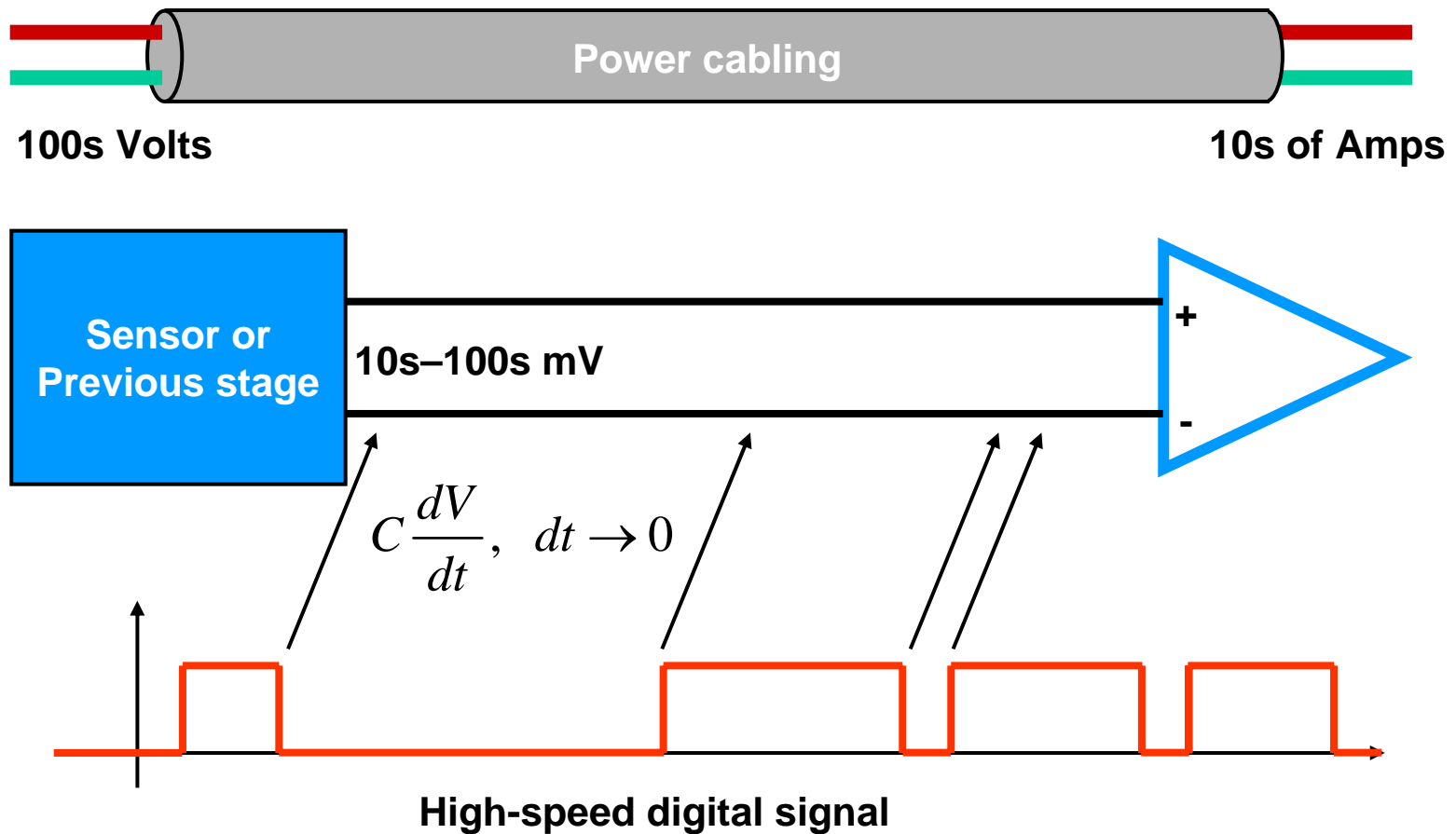
Transmission Systems

- Signal level considerations



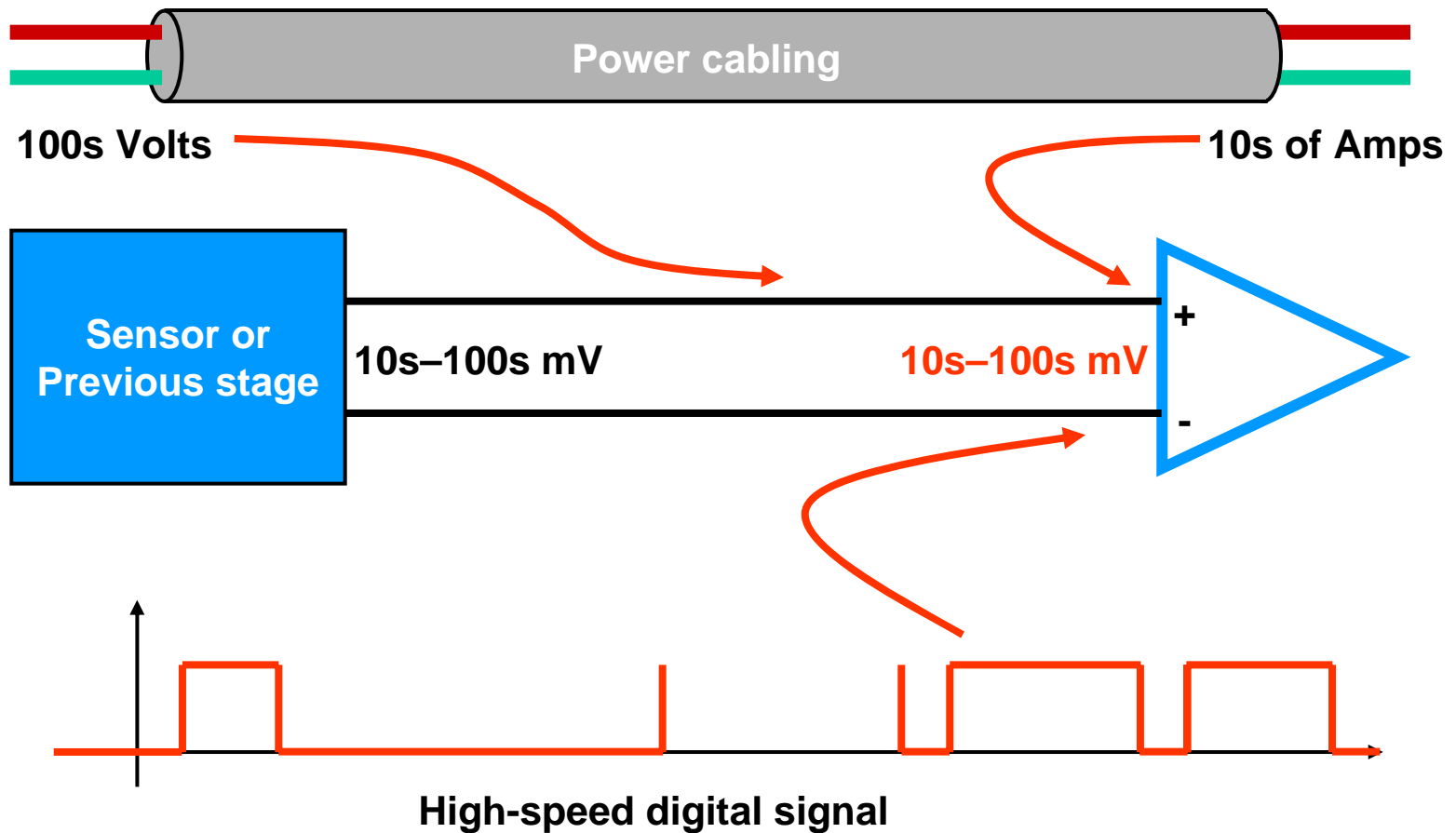
Transmission Systems

- Signal level considerations



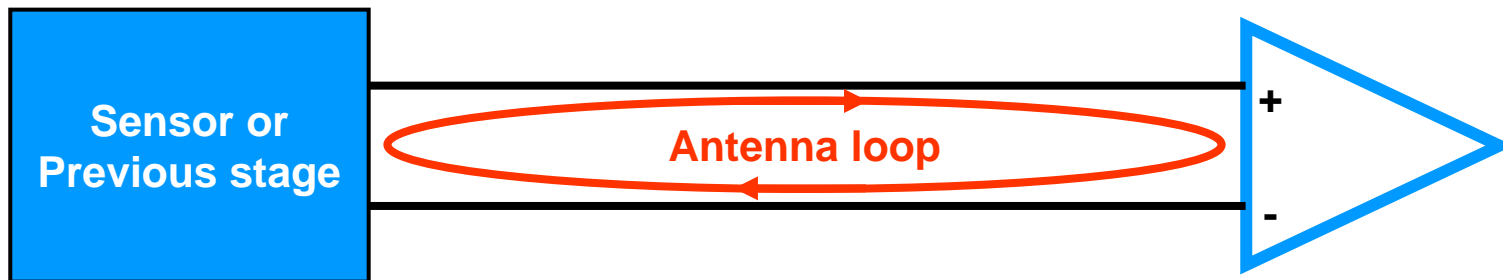
Transmission Systems

- Signal level considerations



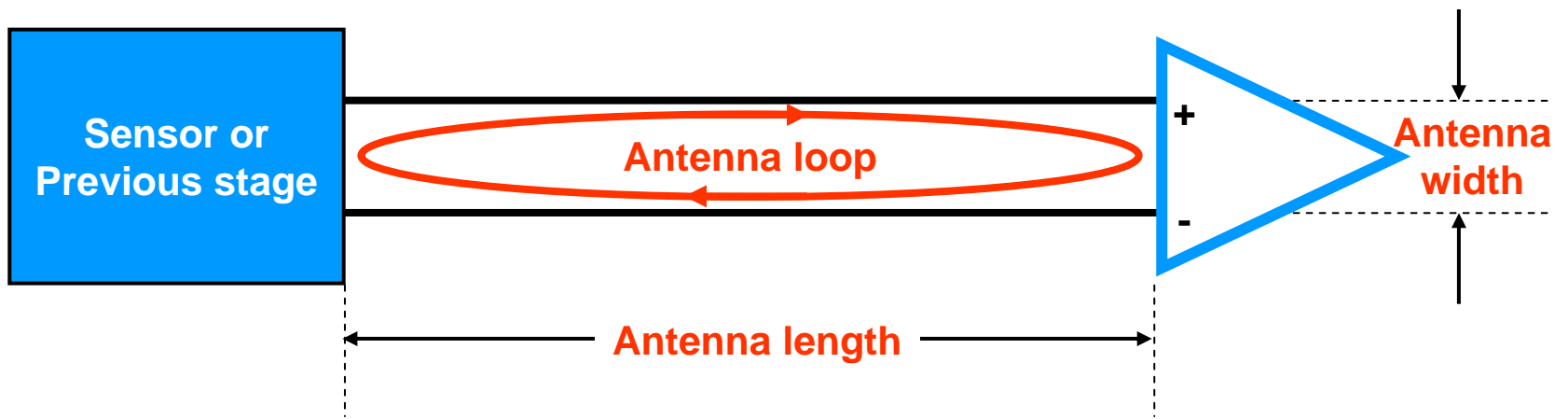
Transmission Systems

- Controlling interference



Transmission Systems

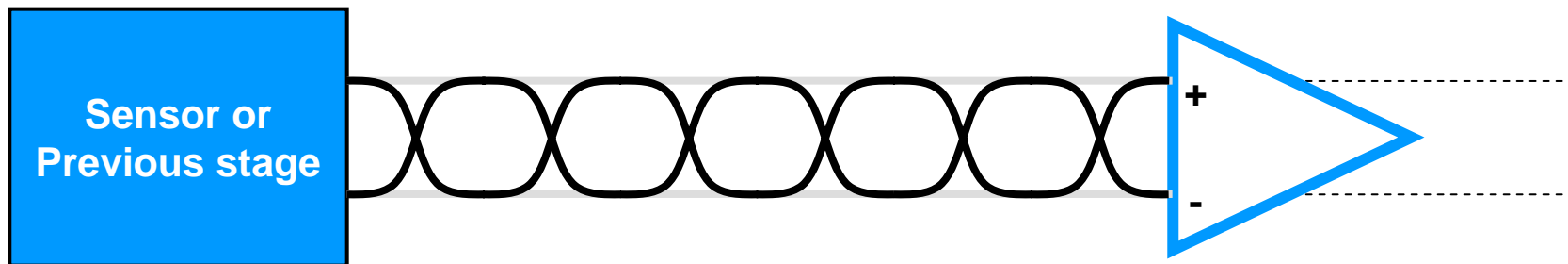
- Controlling interference



Interference pickup \propto antenna area

Transmission Systems

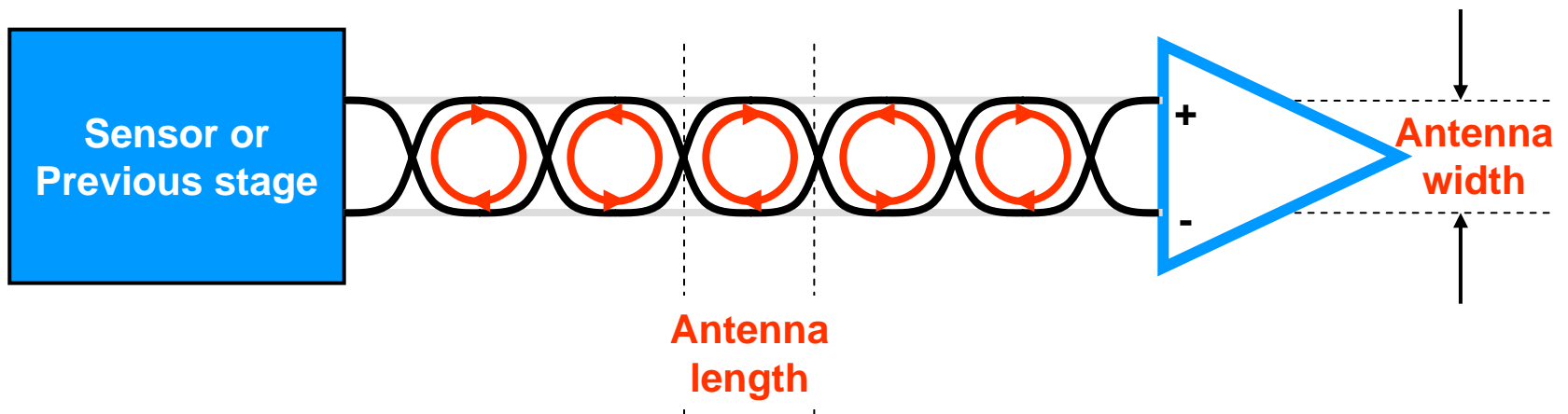
- Controlling interference with twisted pair cabling



Interference pickup \propto antenna area

Transmission Systems

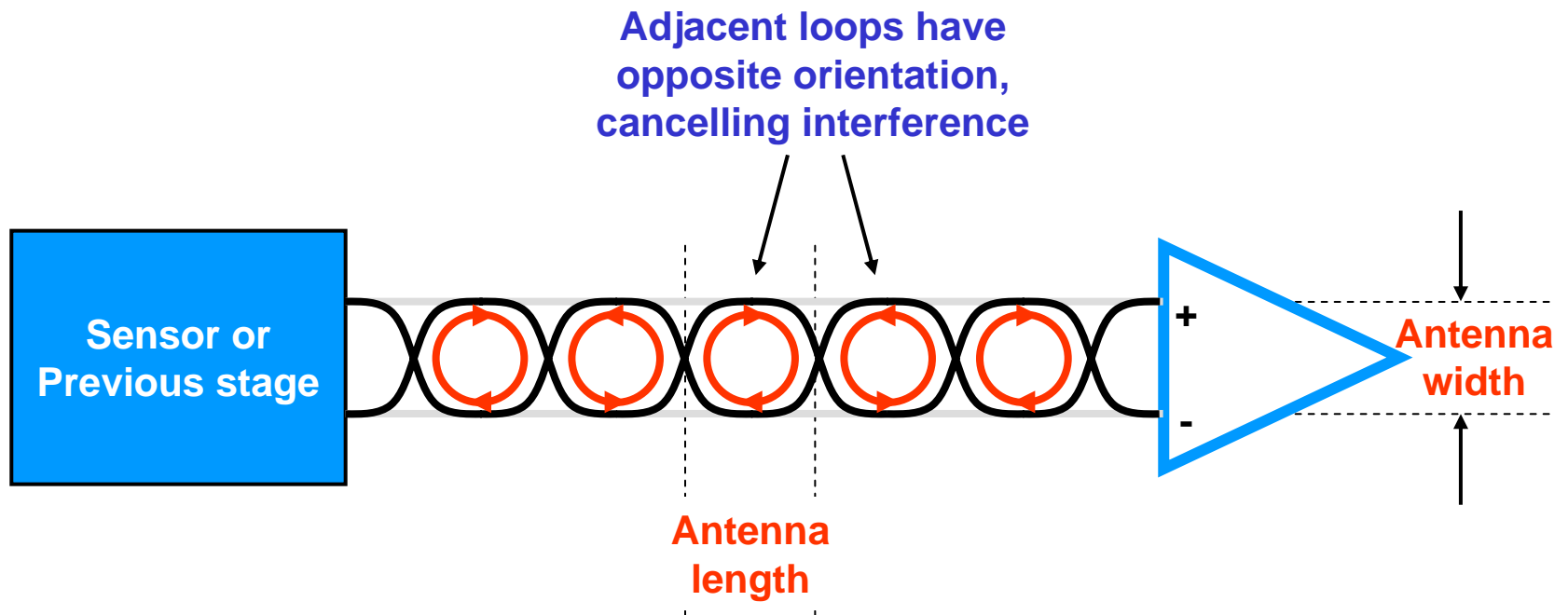
- Controlling interference with twisted pair cabling



Interference pickup \propto antenna area

Transmission Systems

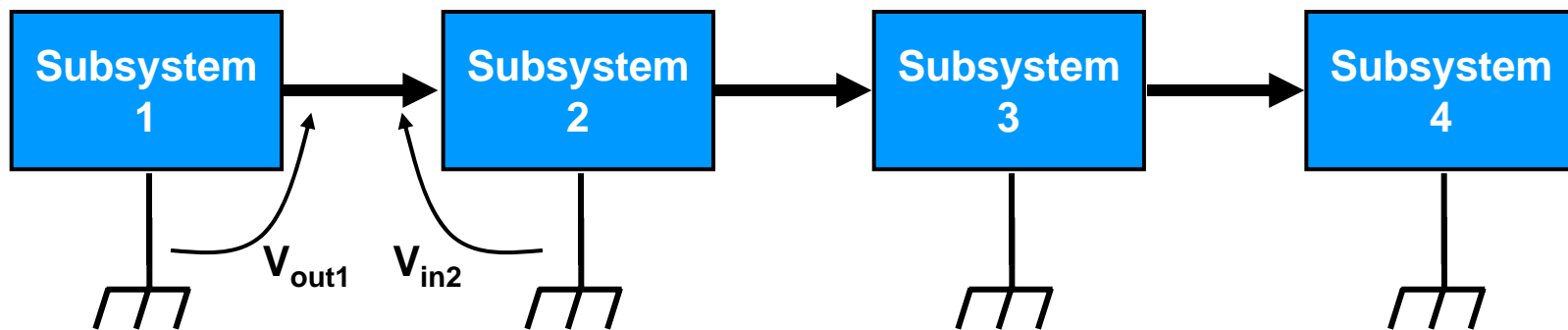
- Controlling interference with twisted pair cabling



Interference pickup \propto antenna area

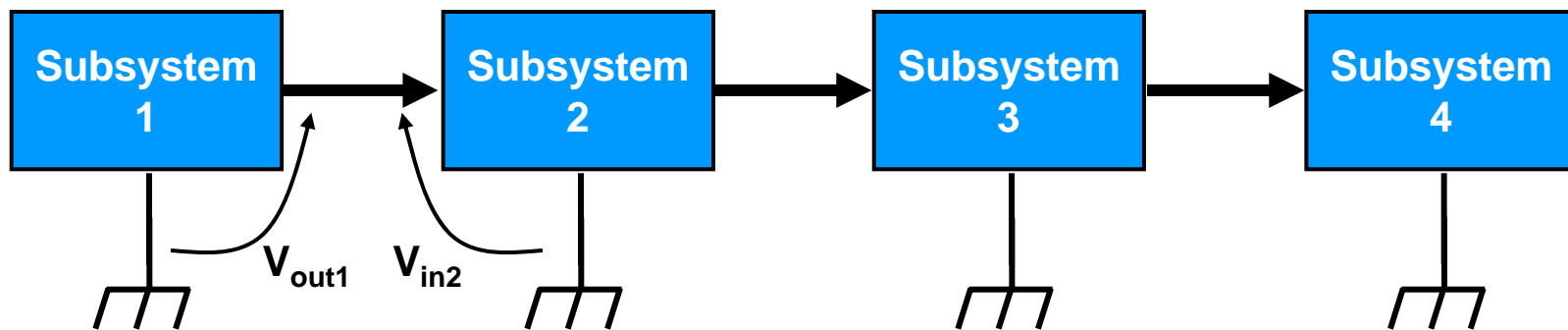
Transmission Systems

- Ground loops



Transmission Systems

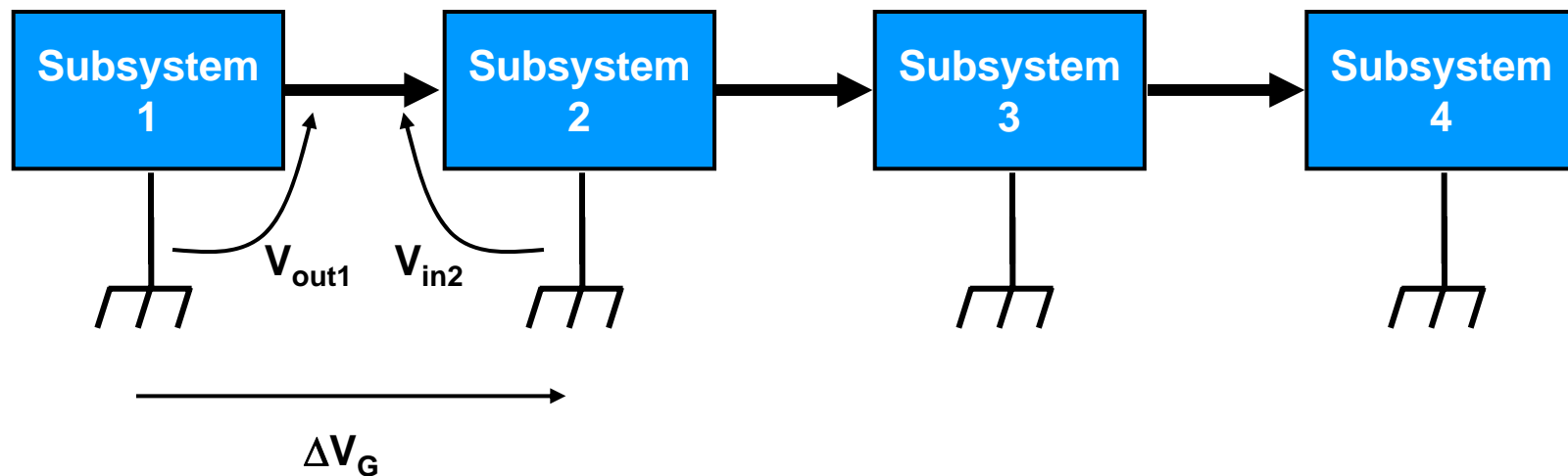
- Ground loops



Why might V_{out1} and V_{in2} differ?

Transmission Systems

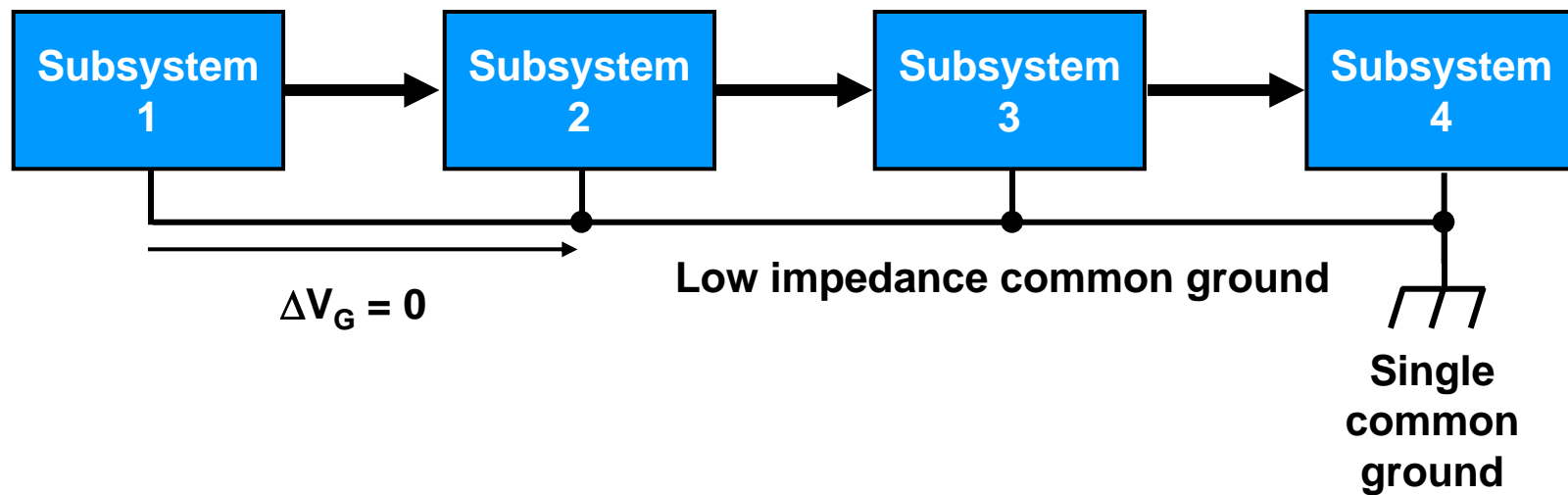
- Ground loops



**Why might V_{out1} and V_{in2} differ?
Difference in ground voltage shows up as input noise.**

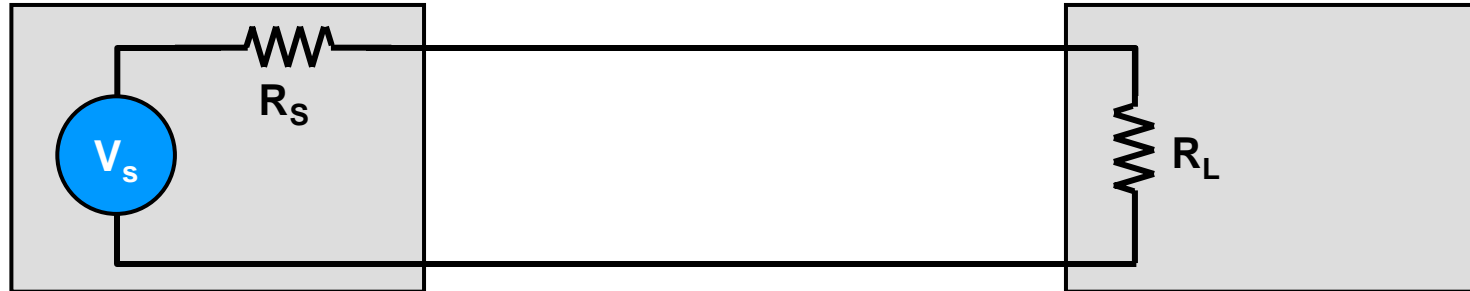
Transmission Systems

- Controlling ground loops



Transmission Systems

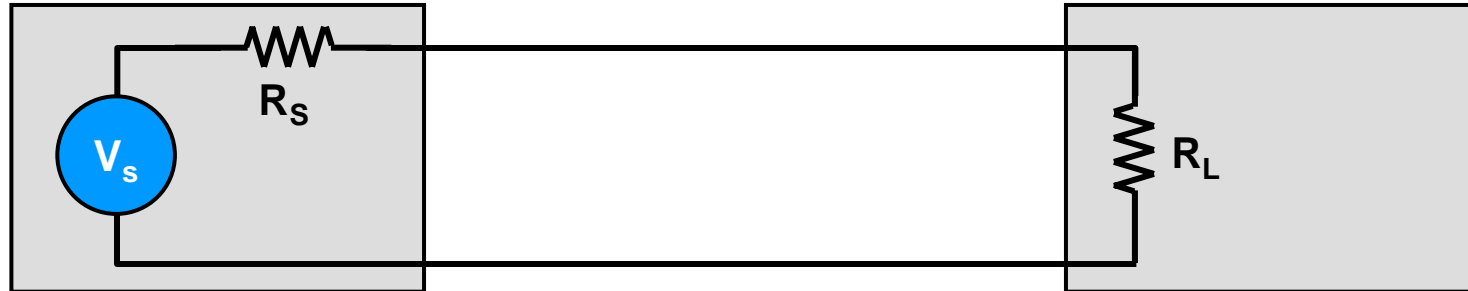
- Voltage vs. current transmission



Maximizing R_L minimizes loading

Transmission Systems

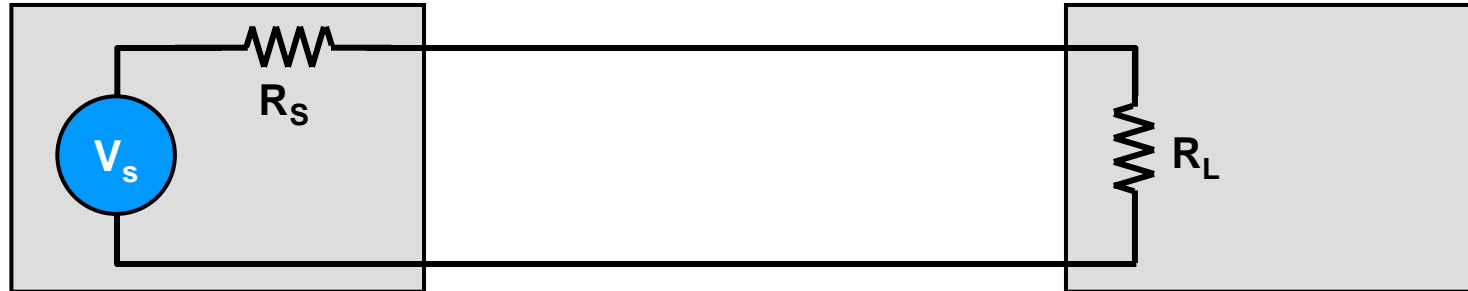
- Voltage vs. current transmission



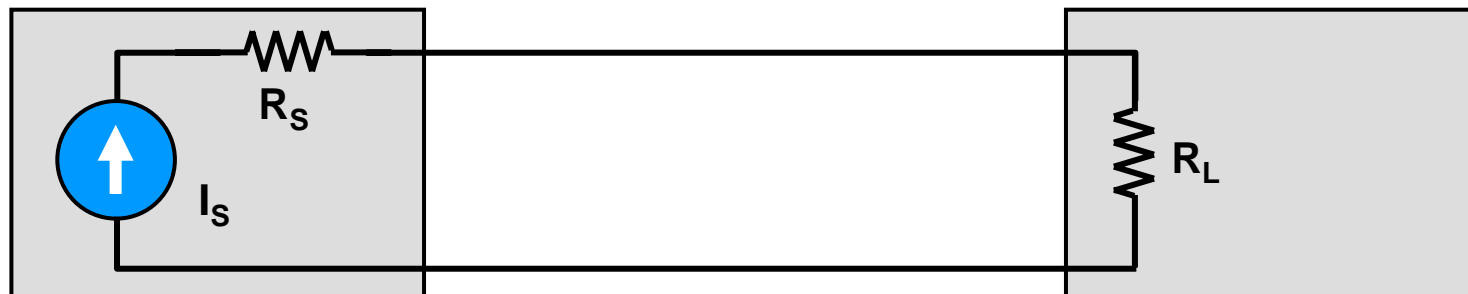
**Maximizing R_L minimizes loading
but maximizes susceptibility to interference**

Transmission Systems

- Voltage vs. current transmission



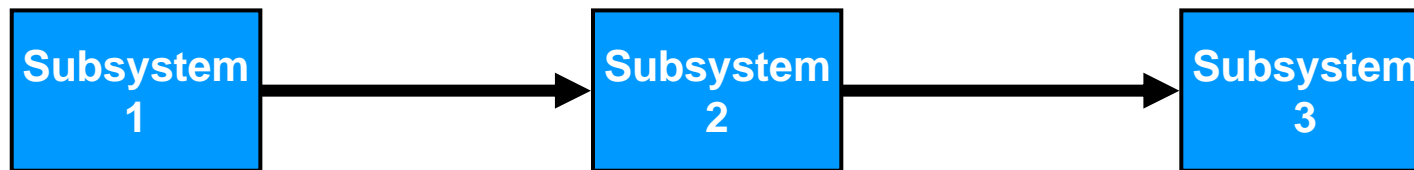
Maximizing R_L minimizes loading
but maximizes susceptibility to interference



Smaller R_L can be used
reducing susceptibility to interference

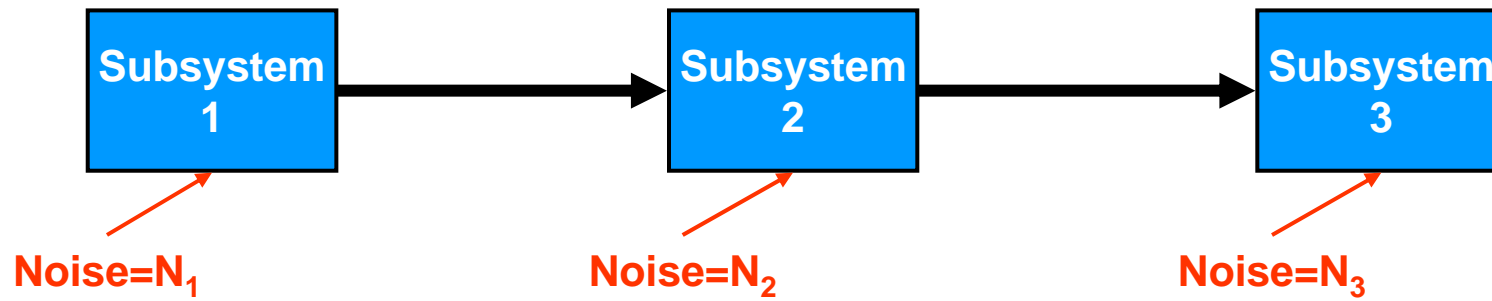
Transmission Systems

- Analog signal transmission



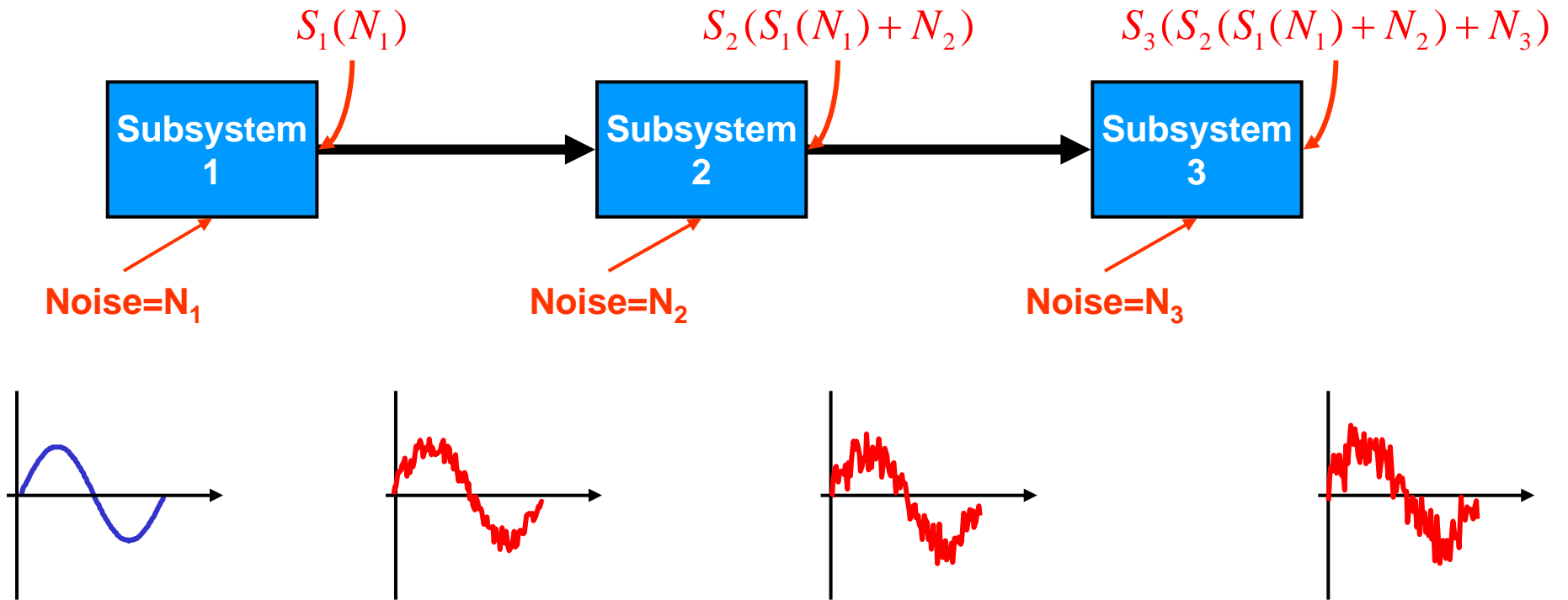
Transmission Systems

- Analog signal transmission



Transmission Systems

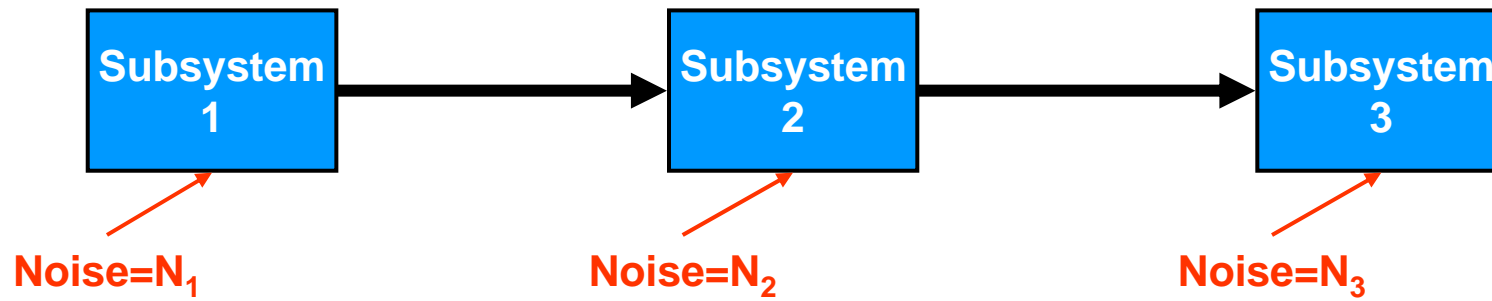
- Analog signal transmission



Noise from each stage combines with input noise and cannot be removed

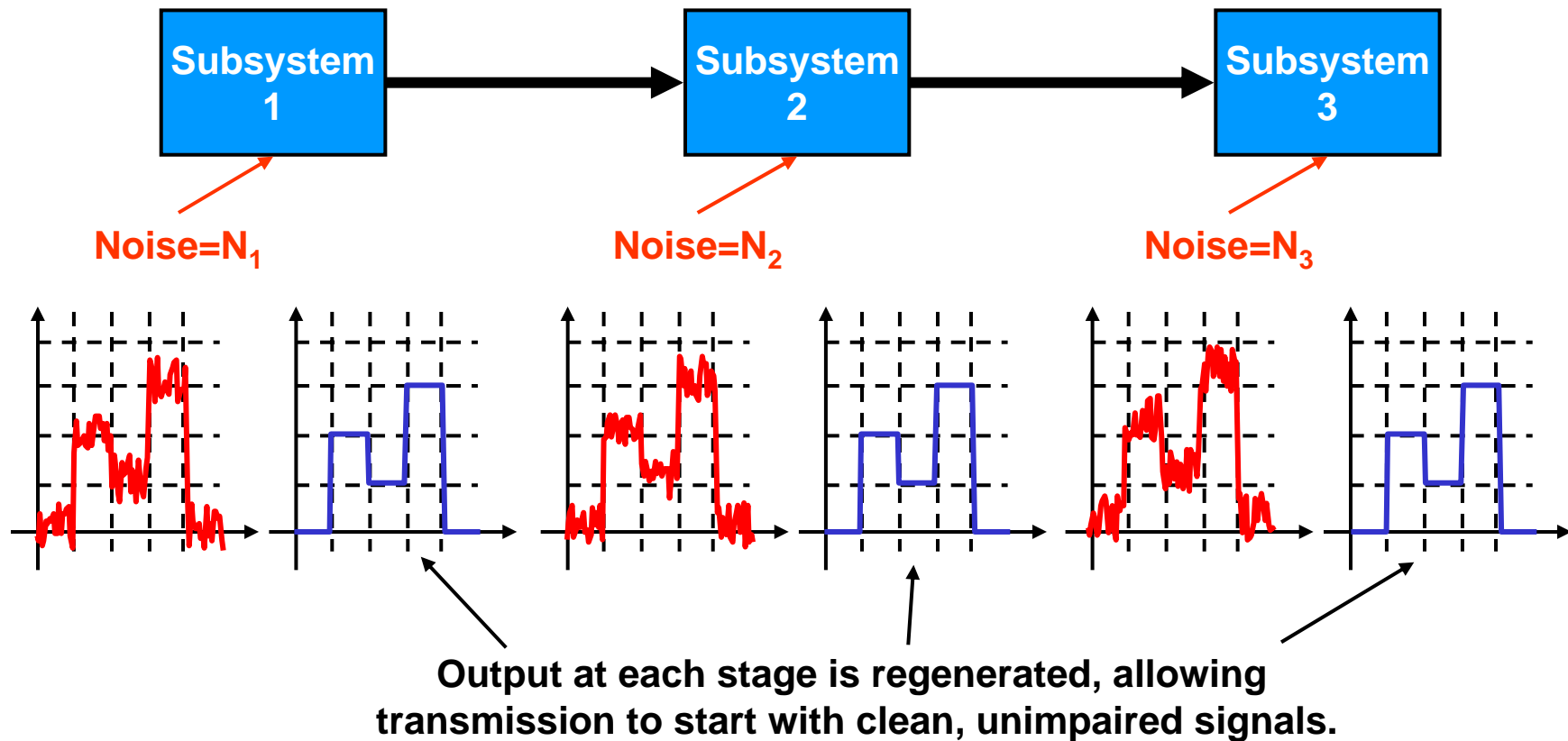
Transmission Systems

- Digital signal transmission



Transmission Systems

- Digital signal transmission



Signals change at established points in time, with specific allowed levels

Next topics

- Computerized Data Acquisition
 - Signal representation
 - Components
 - A/D conversion
 - Sampling
 - Quantization effects
 - Fourier Transform and frequency domain analysis

Homework 3

- Read Chapter 4
- Problems 3.17, 3.24, 3.26