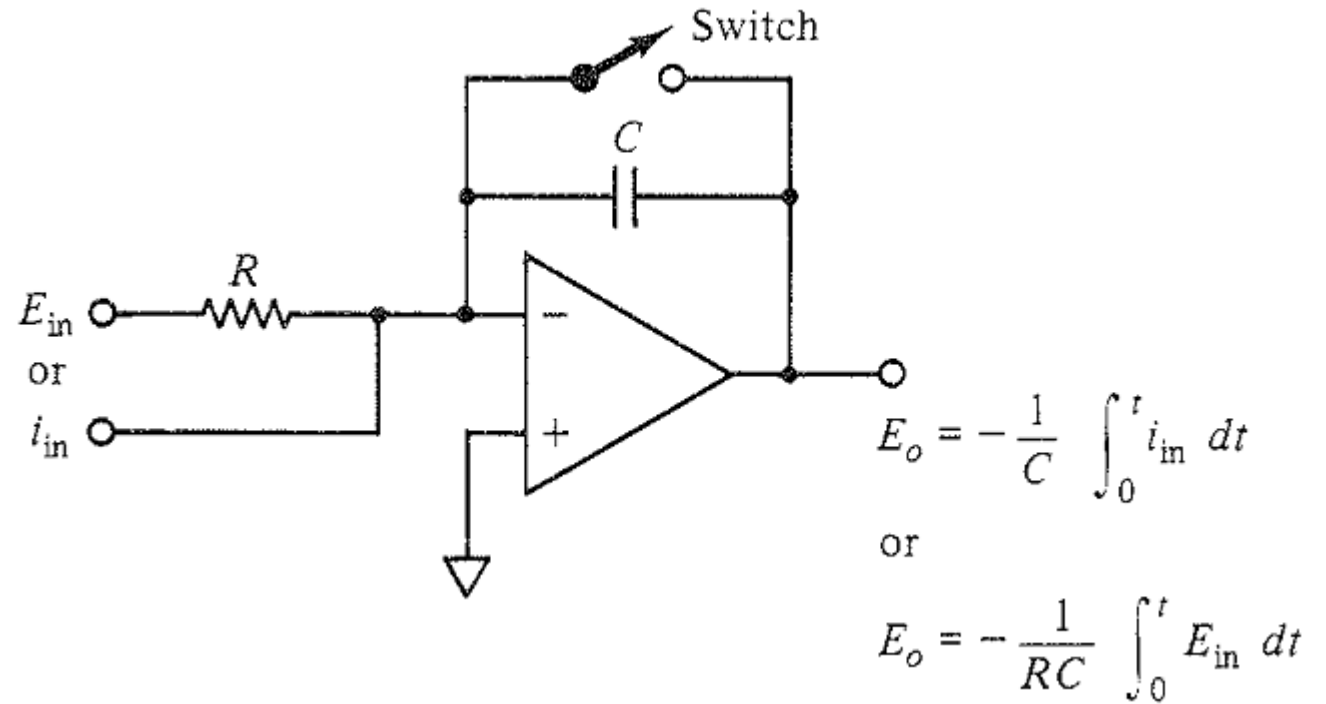
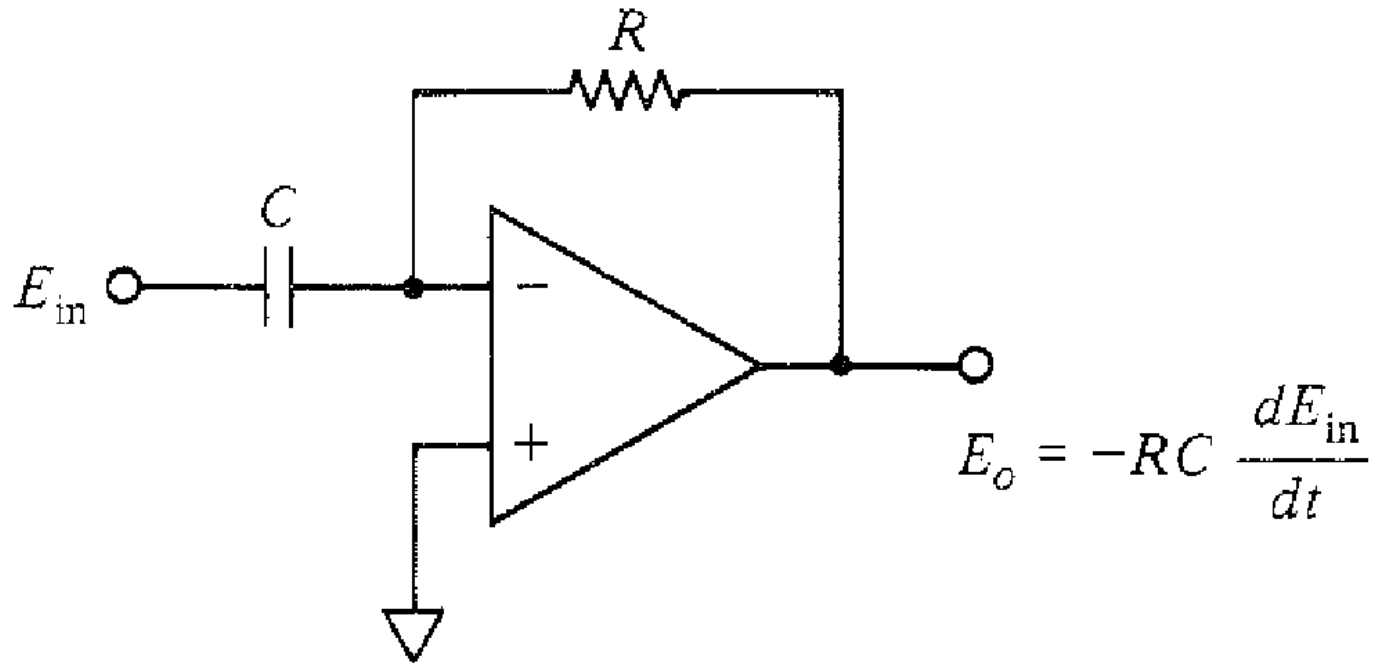


Analog signal processing:

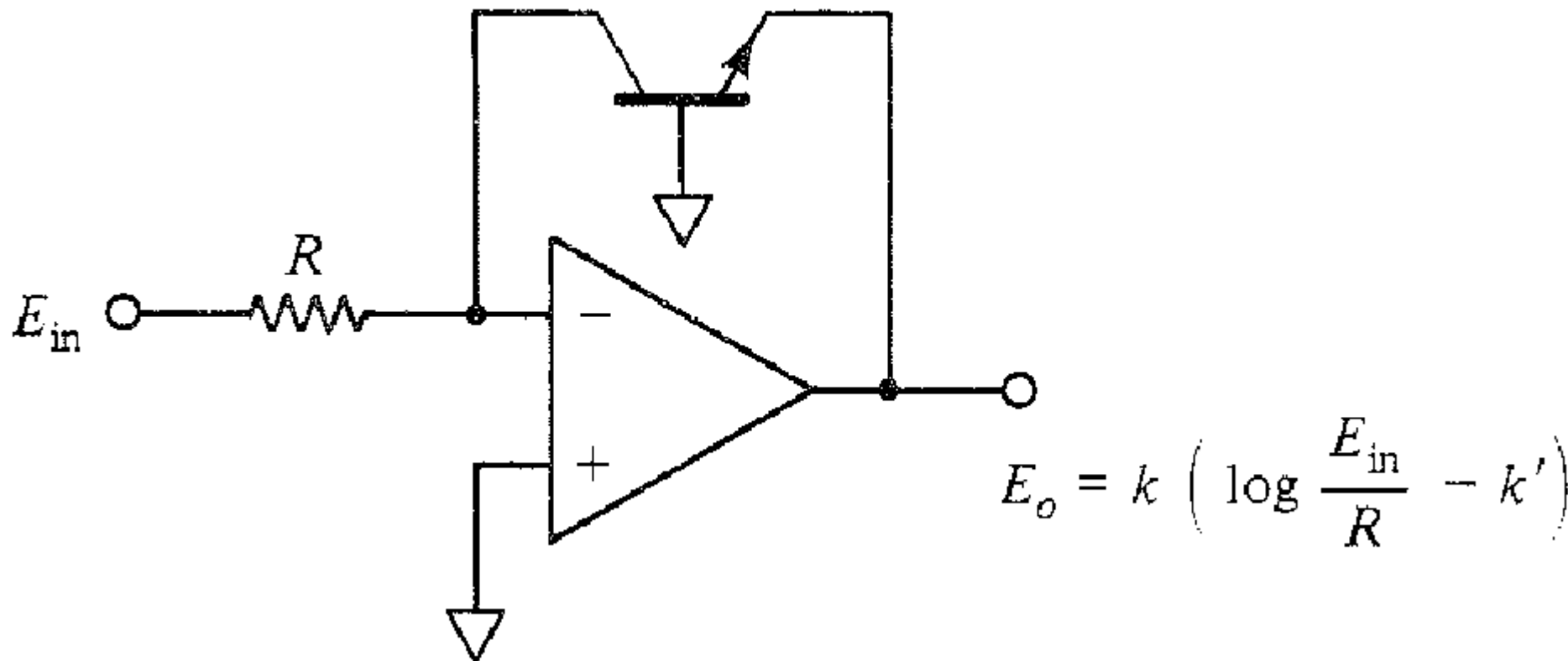
Integrator



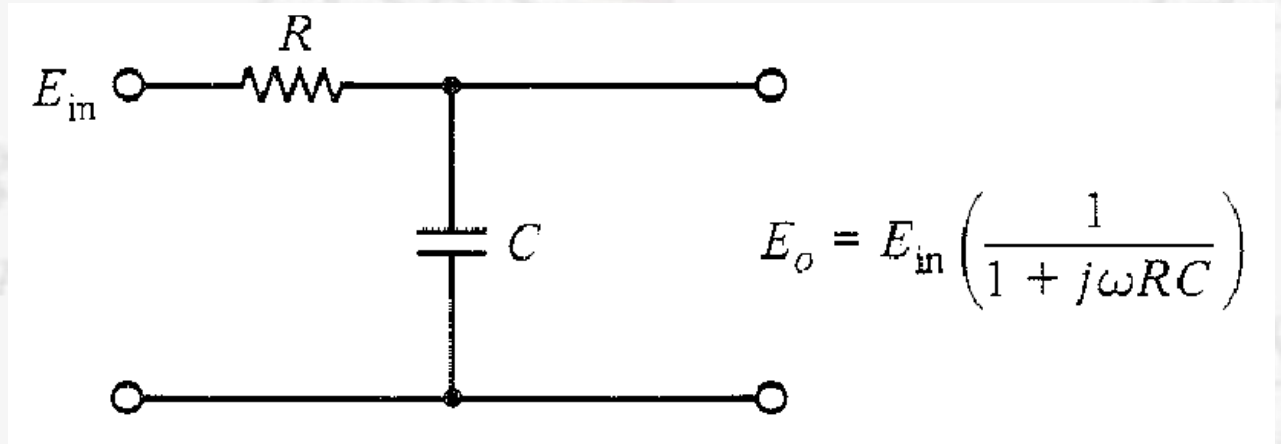
Differentiator



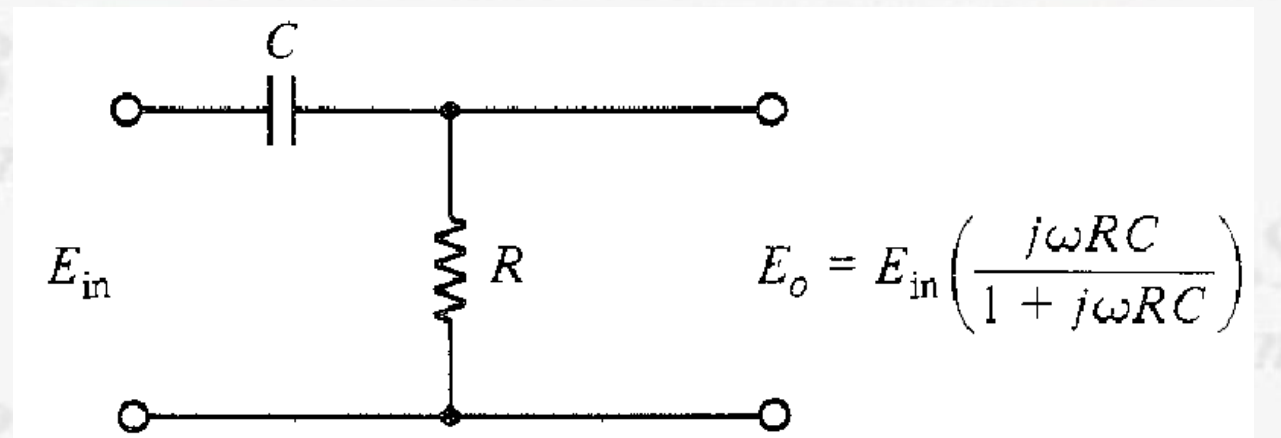
Logarithm + amplification



Low pass filter

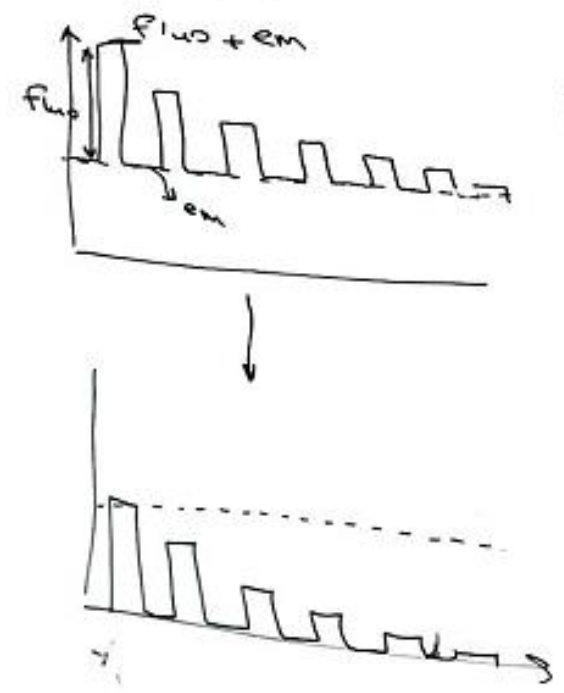


High pass filter

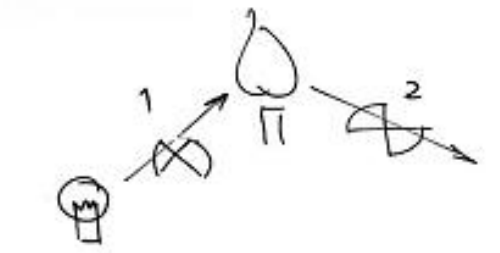


G2 Spect Introd 971117 wed

Modulation:

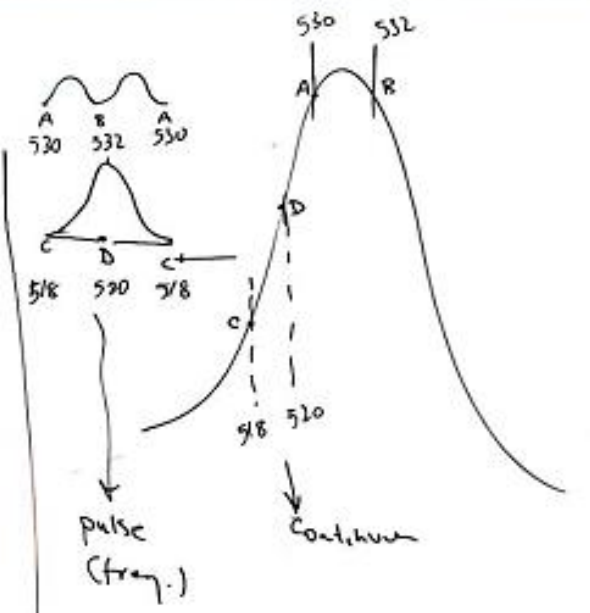


2 condition



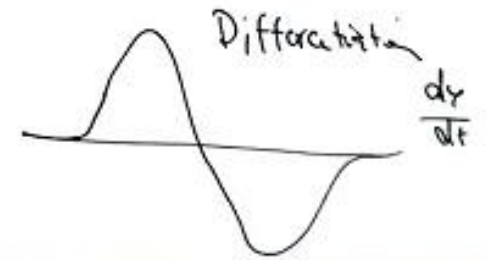
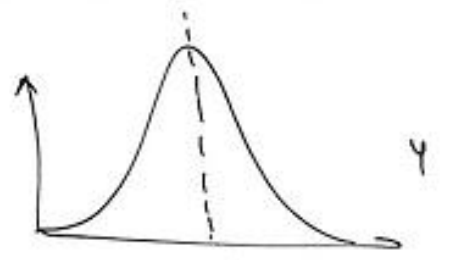
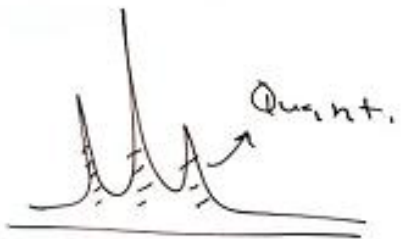
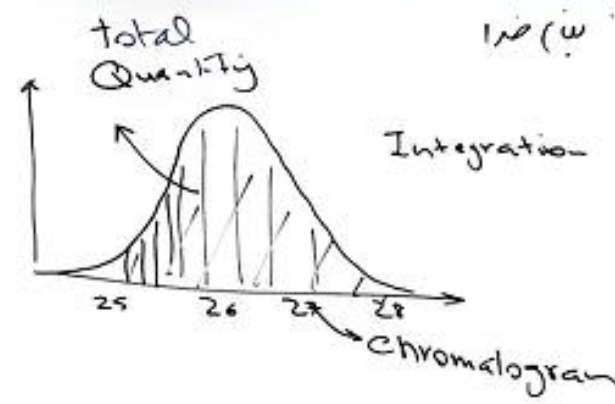
	Chopper 1	Chopper 2
①	off	off →
②	on	off →
③	on	on →
④	off	on →

Sample - black - Sample - black
Sample modul.



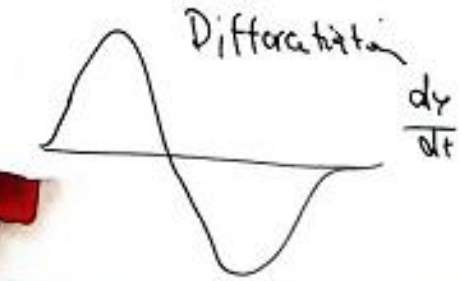
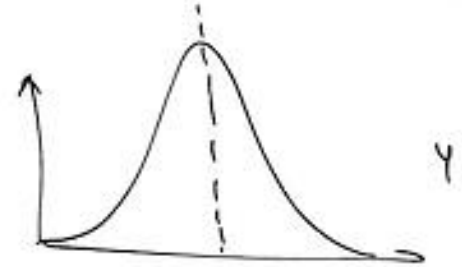
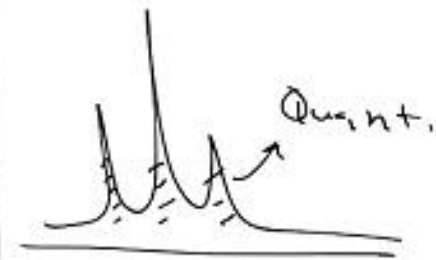
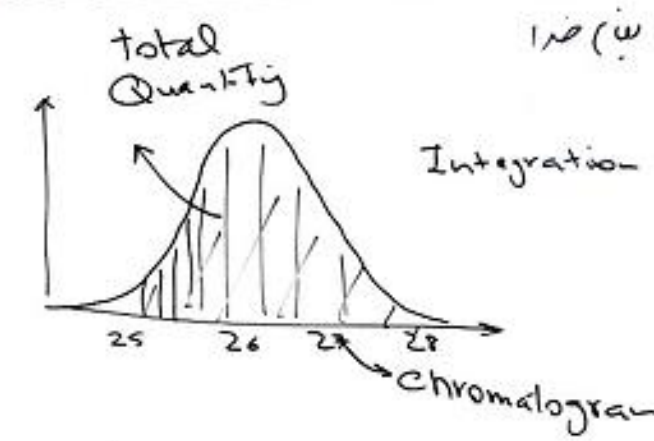
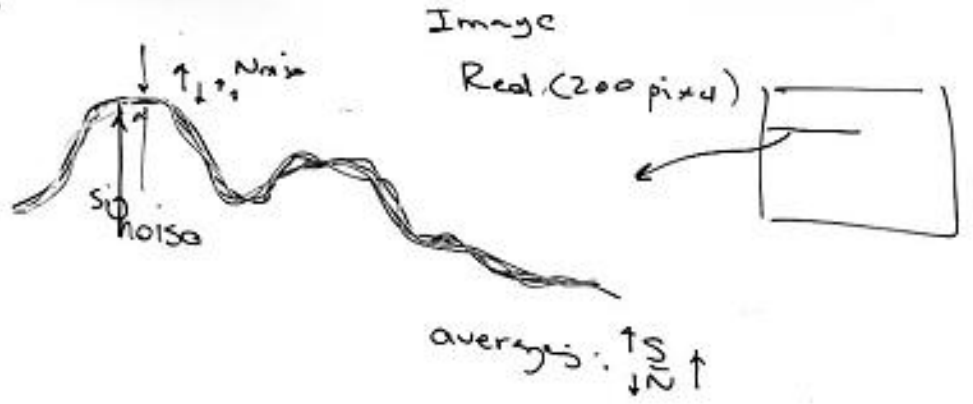
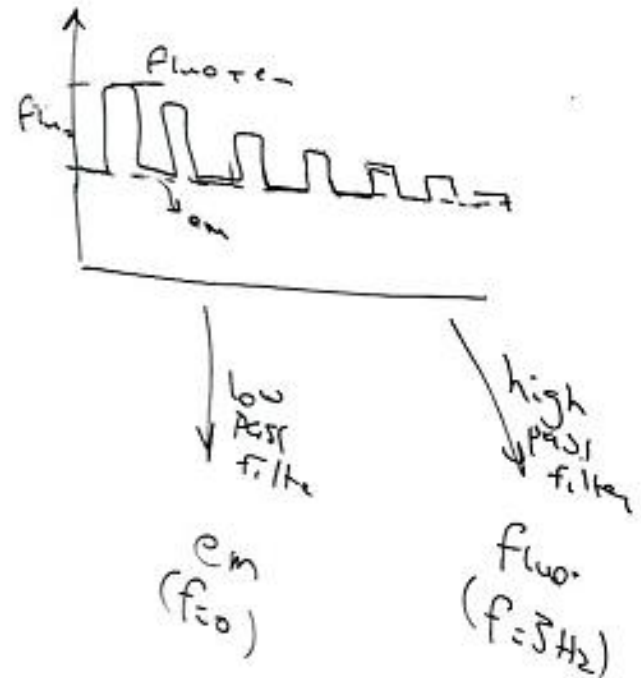
operational amplifier
 gain
 gain

$$A = -\log T$$



G2 Spect Introd 971117 wed

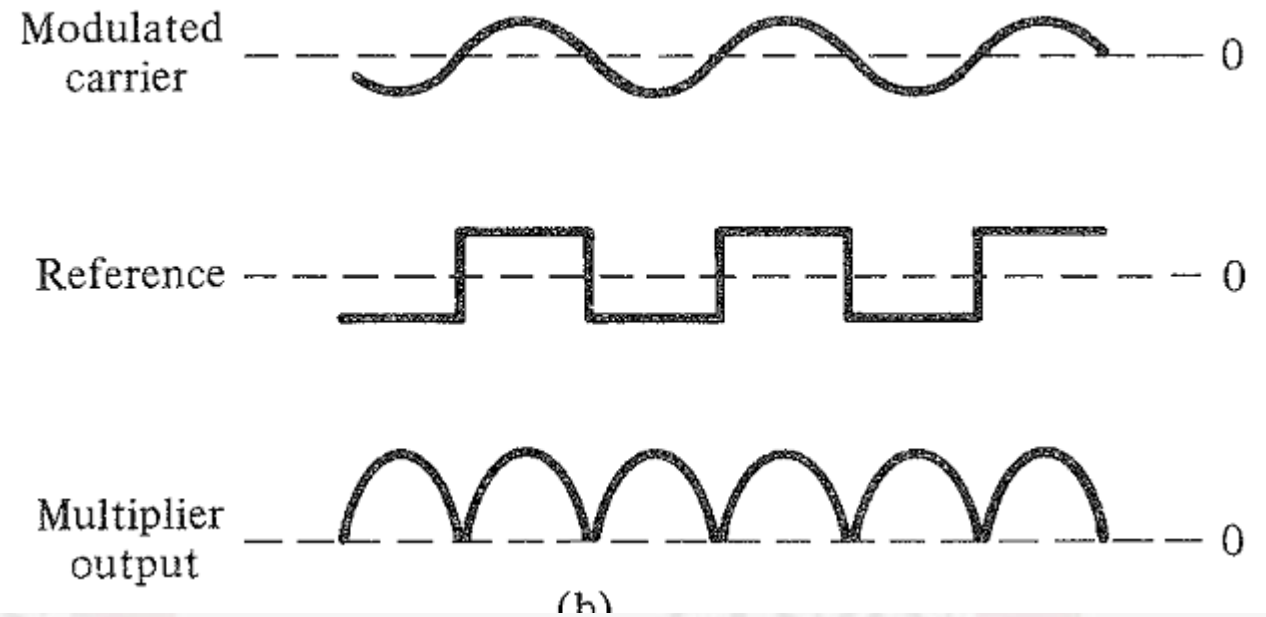
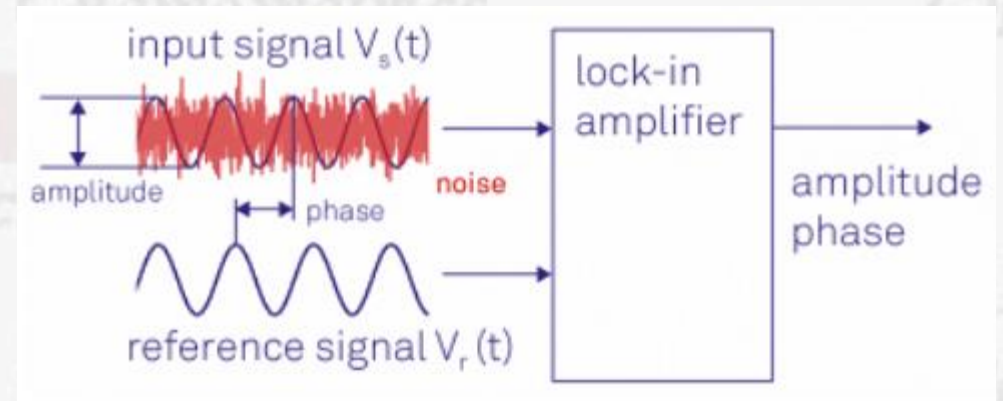
Modulation:



Active low pass filter

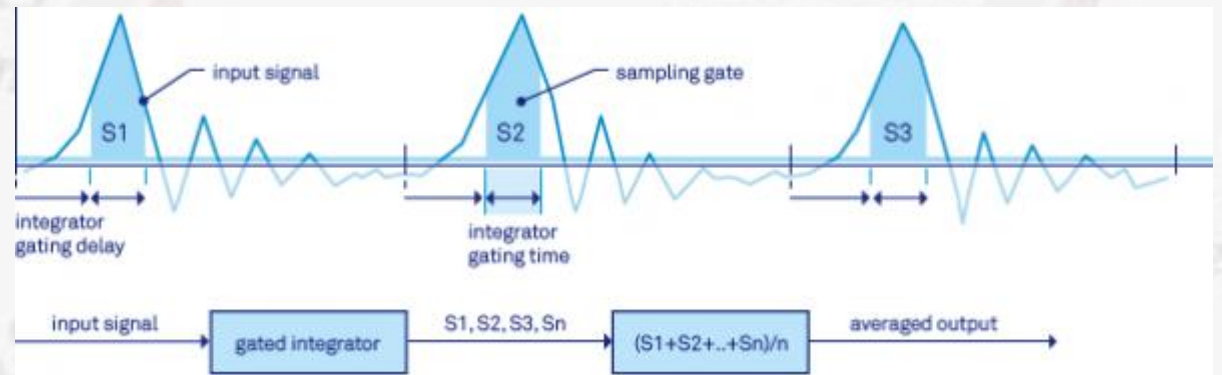
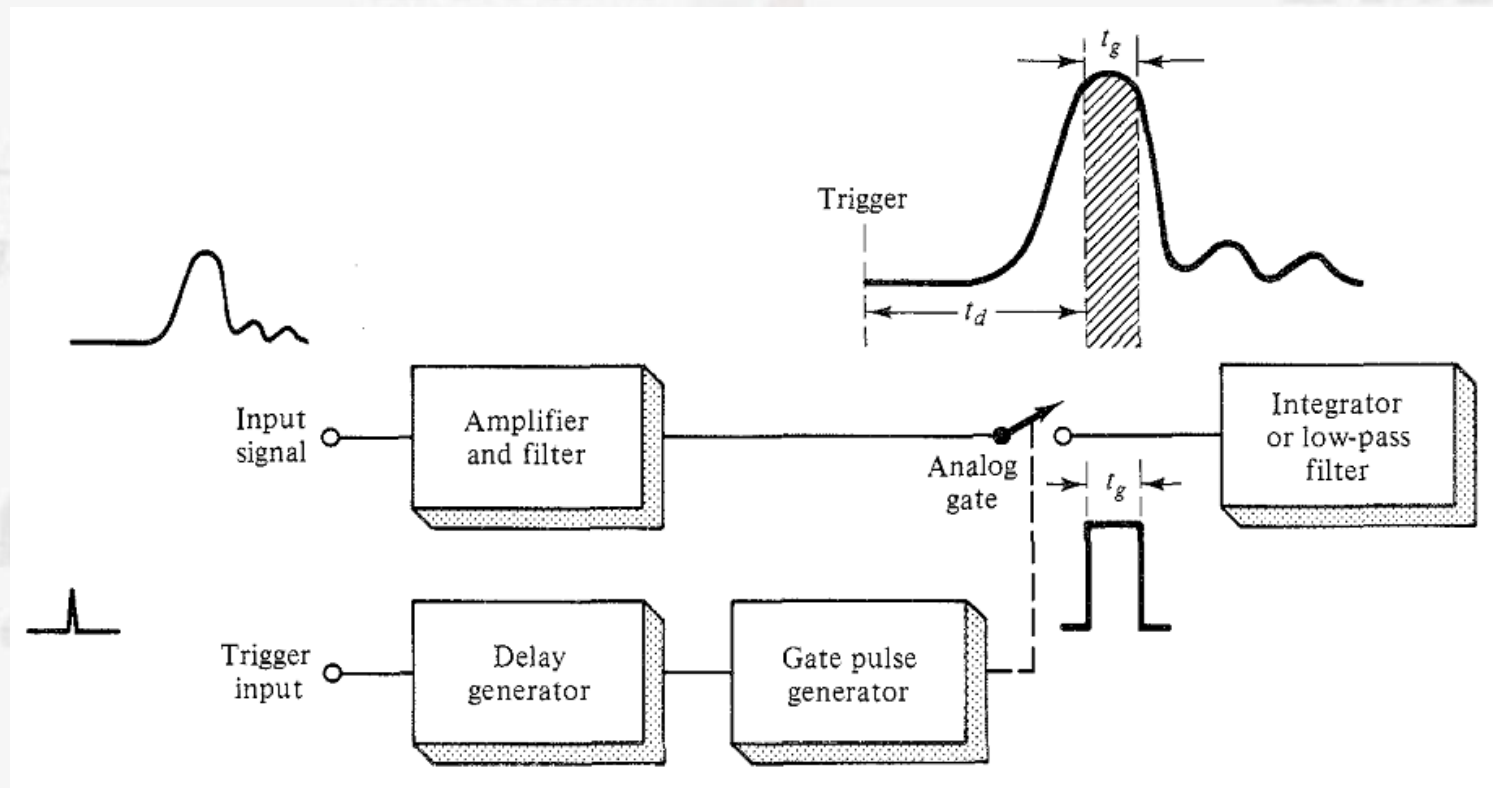
Lock-in Amplifier

Is a synchronous demodulation device that can recovery of signals literally buried in noise.



Boxcar integrator

the boxcar integrator is a versatile instrument for measuring repetitive signals particularly those with short pulse durations and low duty cycles.



Multichannel averaging

Photo diode array → a large number of images

+ integration(averaging)

→ S/N ratio enhancement

Digital signal processing:

- + computer data acquisition (RS232)

- + softwares

 - Integration

 - Differentiation

 - log

 - Filtering (smoothing)

 - Fourier Transform

 - Wavelet transform

 - ...

 - PREPROCESSING**

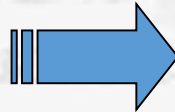
Readout systems:

- Visual representation of output (eyes)
- Voltmeters
- Stripchart recorders
- Oscilloscope
- **Monitor of Computer**

4-6 OPTICAL SPECTROMETERS

1) Single-channel spectrometers (monochromator)

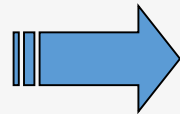
Single-Beam spectrometers



Fixed-wavelength spectrometers

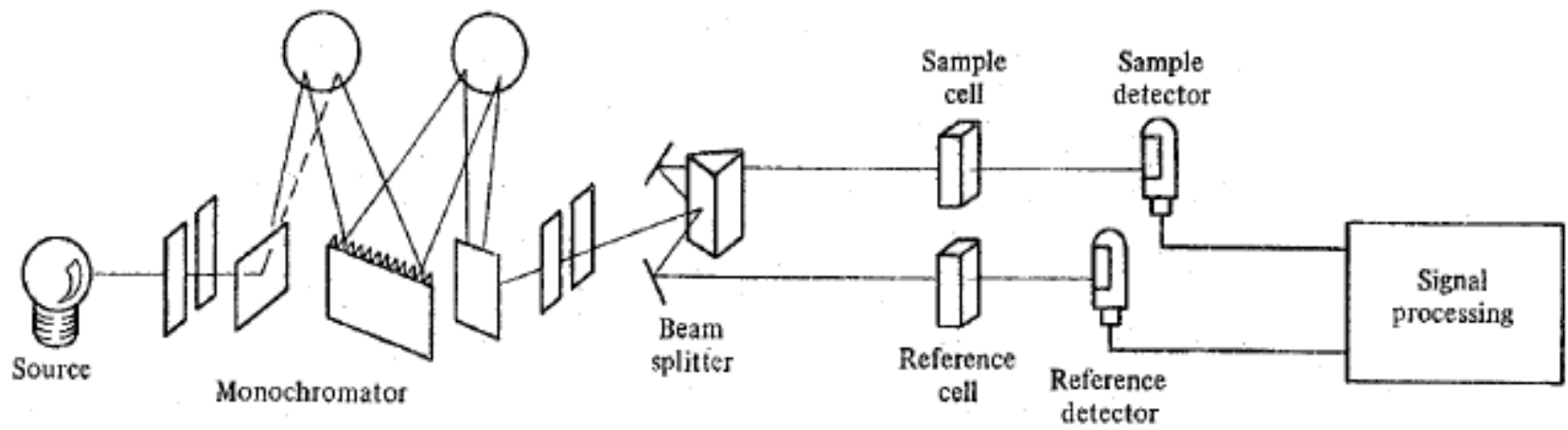
Scanning spectrometers

Double-Beam spectrometers



In-space modulated devices with two detector and prism beam splitter.

In-time modulated devices with one detector and chopper beam splitter.



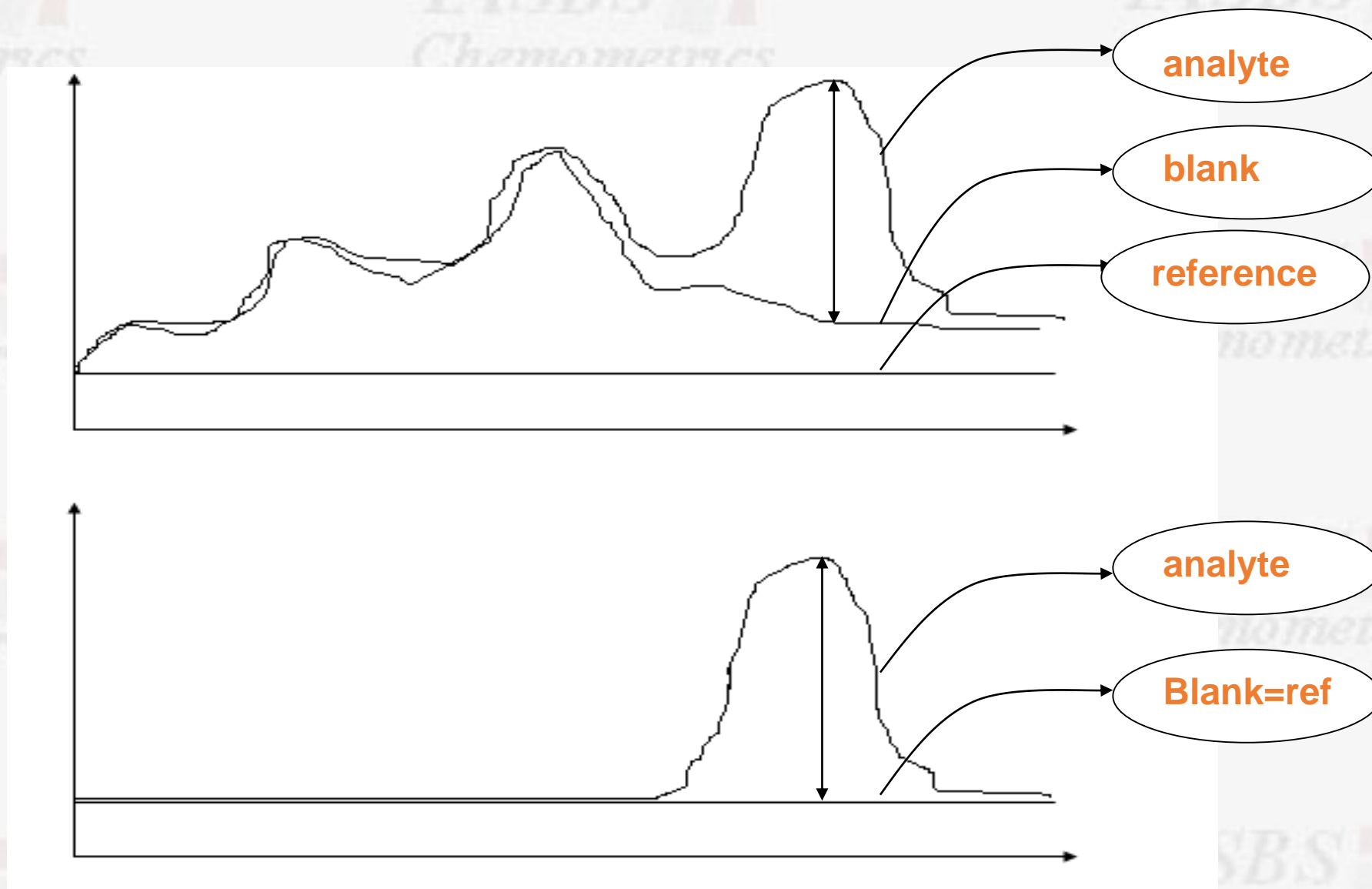
(a)

4-6 OPTICAL SPECTROMETERS

2) Multichannel spectrometers (polychromator)

spectrograph with Diode array

Analyte-Blank-reference signals



Quantitative readout expressions:

Emission and chemiluminescence

$$E_E = mGi_E = mG \int_0^{\infty} B_{\lambda E} Y(\lambda) R(\lambda) d\lambda$$

$\gamma(\lambda)$: throughput factor

Luminescence

$$E_L = mGi_L = mG \int_0^{\infty} B_{\lambda L} Y(\lambda) R(\lambda) d\lambda$$