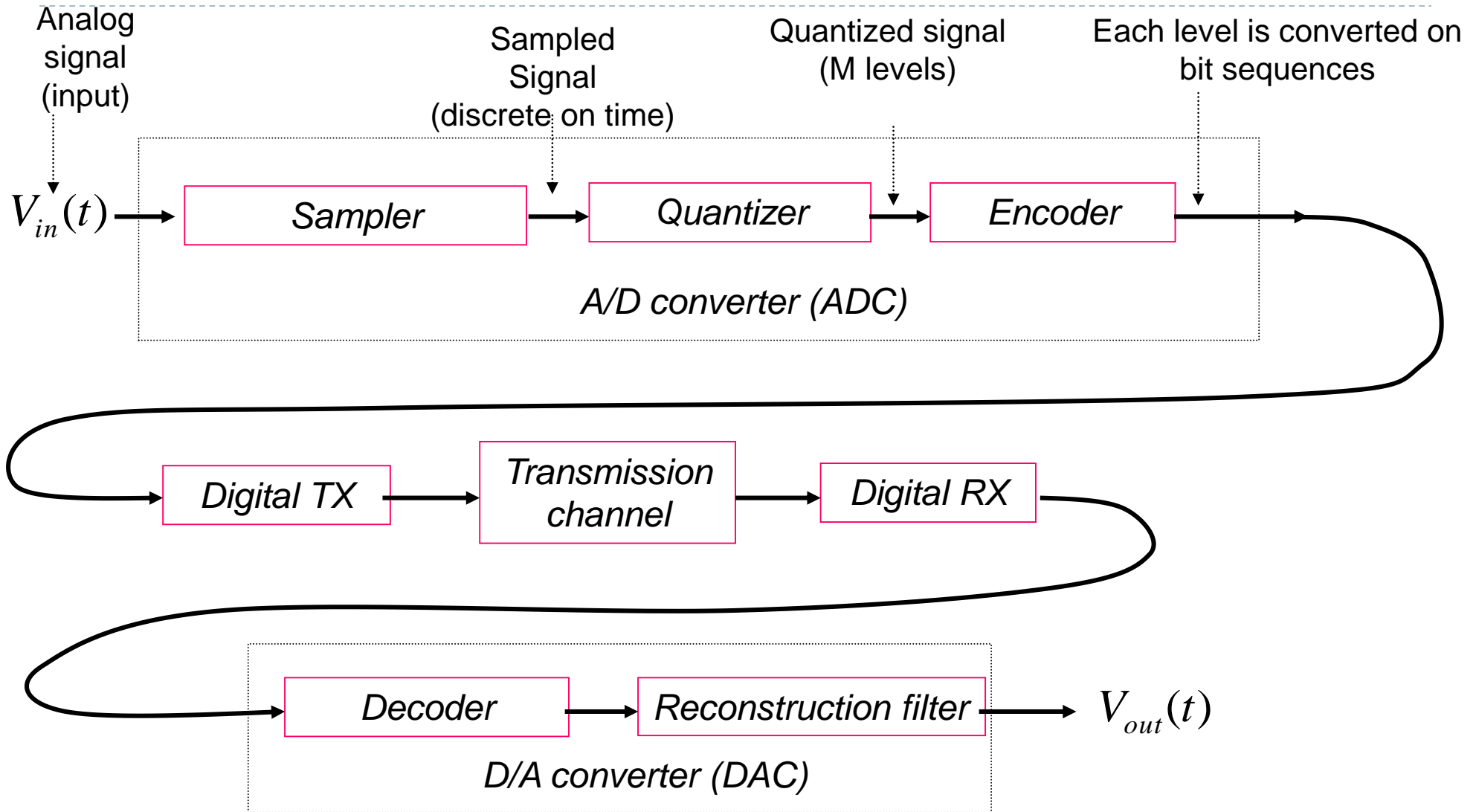


LAB #1

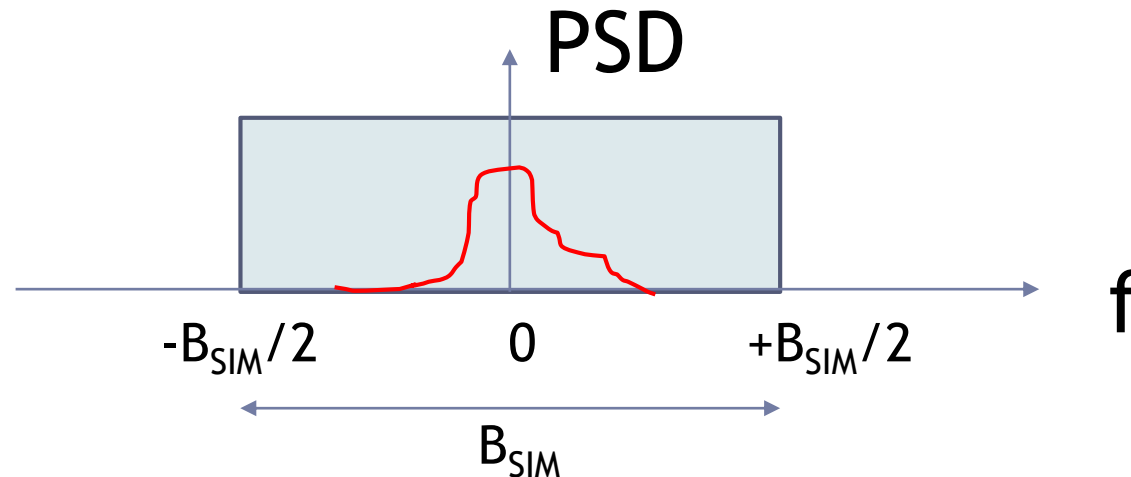
PCM block diagram



SAMPLING AND SIMULATION BANDWIDTH

Rule: satisfy sampling theorem $f_c > 2B_{signal}$

$$T_c = \frac{1}{f_c} \quad \longrightarrow \quad B_{SIM} = \frac{1}{T_c}$$



WHERE IS THE SAMPLER?

- ▶ You will start with a sampled signal
 - ▶ Software generated by Matlab (uniform distribution)
 - ▶ Taken from an audio file

SNR MEASUREMENT

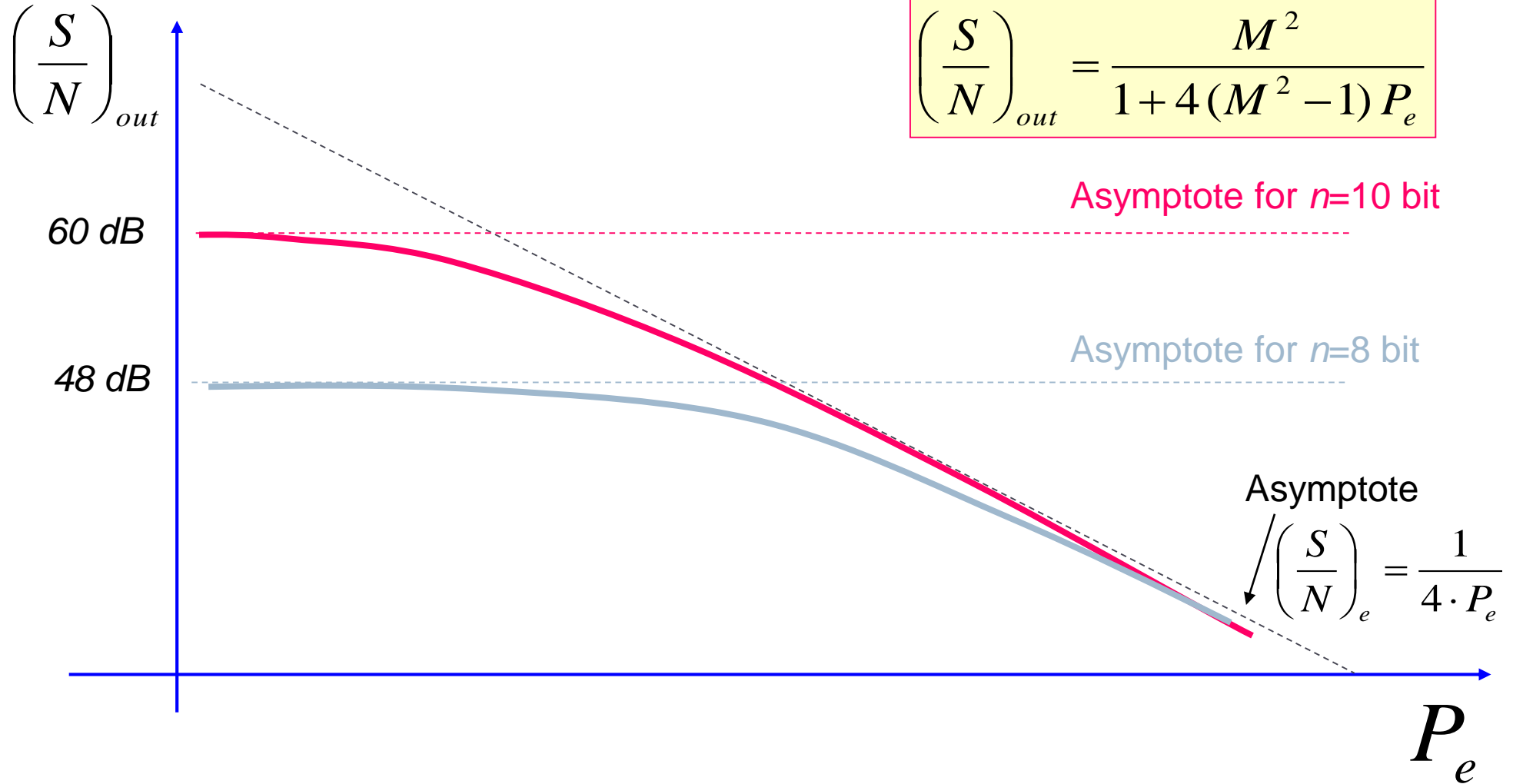
- ▶ Let's use the SNR definition applied to our system:
 - ▶ ratio between signal power and noise (error) power
- ▶ It can be obtained as the ratio between variances:

$$\left(\frac{S}{N} \right) = \frac{\sigma_{V_{in}}^2}{\sigma_e^2}$$

where

$$e = V_{out} - V_{in}$$

PCM performance (signal with uniform pdf)



MATLAB COMMAND - I

- ▶ **SIGNAL WITH UNIFORM PDF GENERATOR**

- ▶ `sig=rand(sz1,sz2);`

- ▶ **QUANTIZER**

- ▶ `[index,quants]=quantiz(sig,partition,codebook);`

- ▶ **ENCODER**

- ▶ `words=de2bi(index,nbit);`

- ▶ **BINARY SYMMETRIC CHANNEL**

- ▶ `outdata=bsc(indata,probability);`

- ▶ **DECODER**

- ▶ `index=bi2de(words);`

MATLAB COMMAND - II

- ▶ PDF plot

- ▶ `histogram(x,nbin,'Normalization', 'pdf');`

- ▶ PSD plot

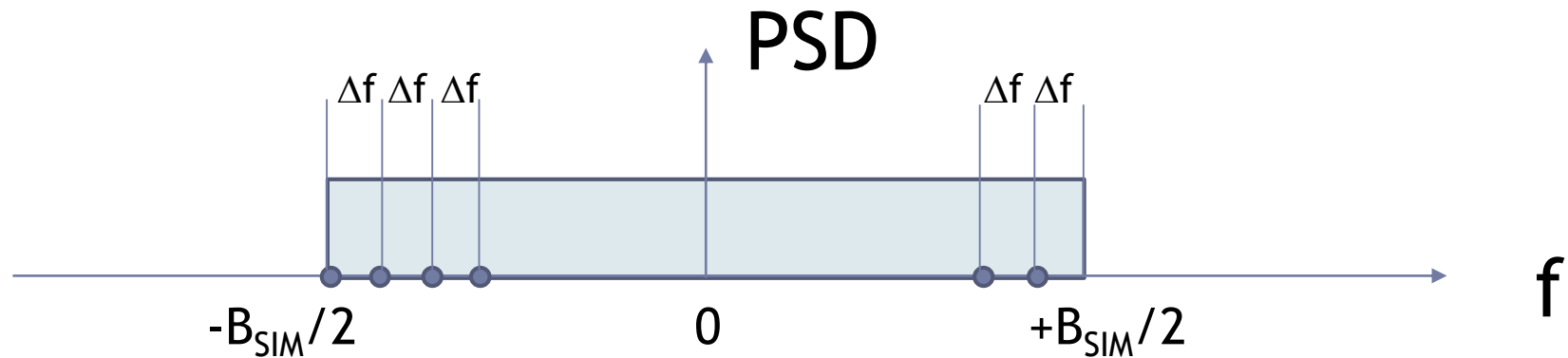
- ▶ `psd=abs(fft(x)).^2;`

- ▶ `plot(f,fftshift(psd));`

FFT

N_{FFT} frequency points

Frequency spacing: $\Delta f = B_{\text{SIM}} / N_{\text{FFT}}$



$$f = [B_{\text{SIM}}/2 : \Delta f : B_{\text{SIM}}/2 - \Delta f];$$