PENGENALAN TEKNIK TELEKOMUNIKASI

Modul : 04
Konversi Sinyal Analog - Digital

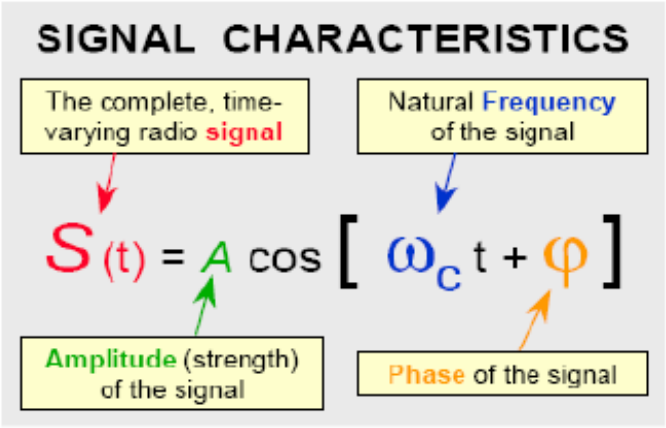
Faculty of Electrical Engineering

BANDUNG, 2015

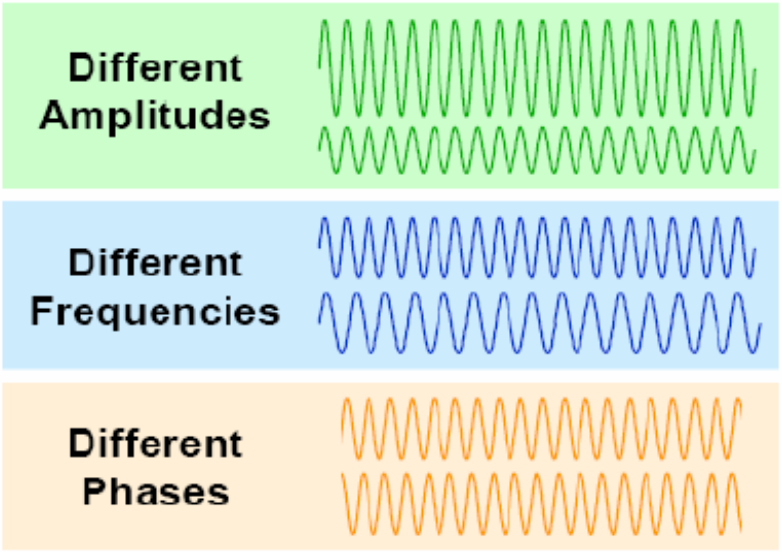
Media Transmisi

- Getaran sinyal pembawa itu harus disampaikan kepada penerima
- Proses penyampaian ini harus dilakukan melalui suatu media
- Analogi dengan pembawa truk maka maka jalan rayanya disebut media transmisi
- Proses perambatan sinyal gelombang pembawa dari satu tempat ketempat lain disebut propagasi.
- Didalam media, carrier dalam bentuk gelombang pembawa. (carrier wave).

KARAKTERISTIK SINYAL RADIO



Compare these Signals:



Pengirim dan penerima harus saling memiliki pemahaman sama ttg arti variasi parameter

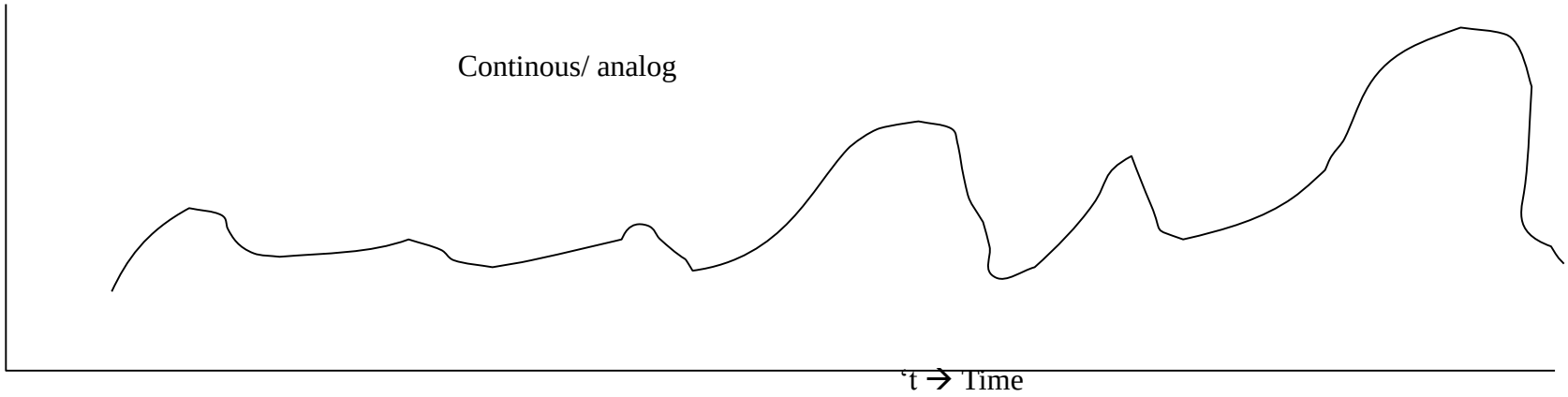
Karaktristik sinyal RF dpt divariasikan sesuai informasi yg ditransmisikan menurut :

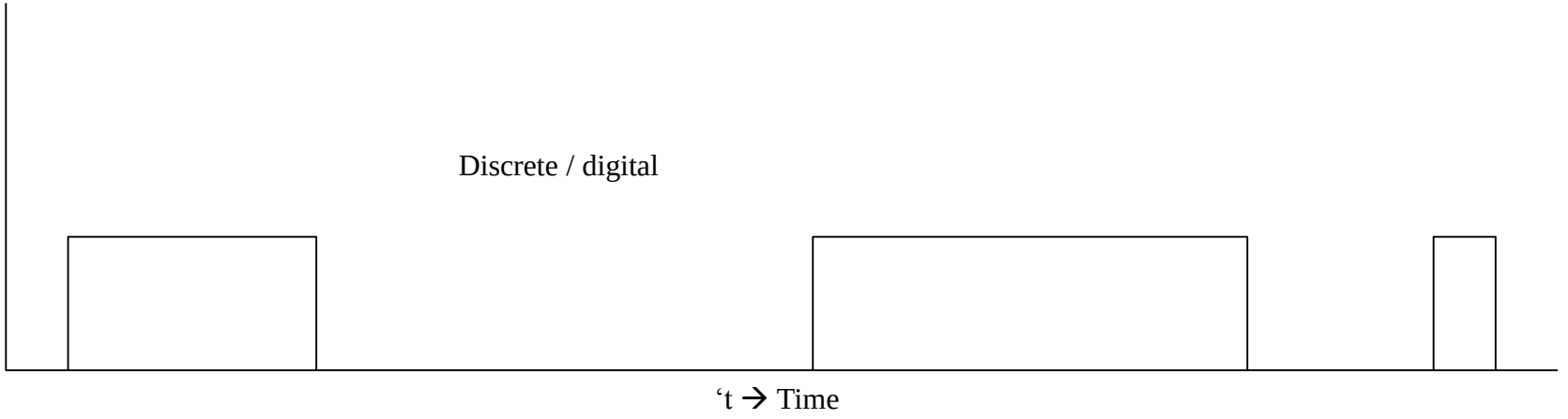
- Amplitudo

- Frekuensi

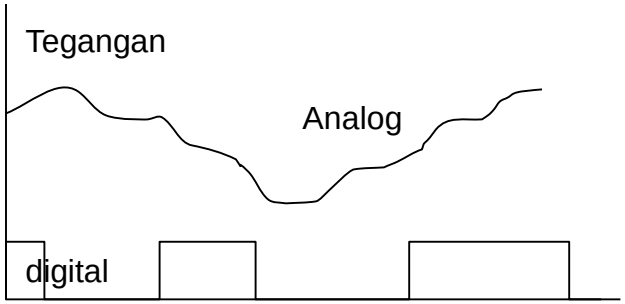
- Phasa

Sinyal Continous dan Sinyal Discrete





Transmisi digital



- Bentuk tegangan pada analog sesuai dengan perubahan informasi
- Bentuk tegangan pada digital adalah bit (tegangan tinggi “1” atau teg rendah “0”)
- Lebih mudah mengirim digital karena :

1. Untuk deteksi “on” dan “OFF” mudah
2. Pembuatan rangkaian digital lebih mudah. (Menggunakan IC VLSI)
3. Dengan sistem koding, maka error yang terjadi selama perjalanan pada sinyal digital dapat diperbaiki.
4. Sinyal digital dapat compress walau dengan mengorbankan kwalitas
5. Sistem digital dapat diproses terpadu dengan sistem komputer. (misalnya Video CD, dll)
6. Transmisi digital lebih handal dibandingkan transmisi analog.
7. Sinyal digital jauh lebih mudah digabungkan (Multiplexing) dengan sinyal dari berbagai – bagai sumber maupun tujuan dan sangat flexibel

Merubah analog menjadi digital

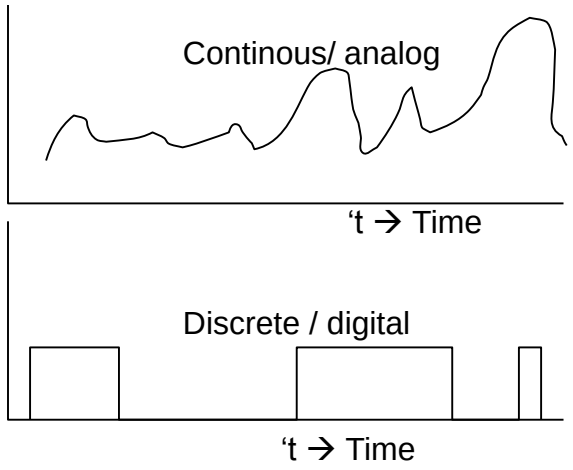
- Sistem transmisi digital menyalurkan informasi digital.
- Proses sampling
- Proses kwantisasi
- Out put adalah sinyal digital.

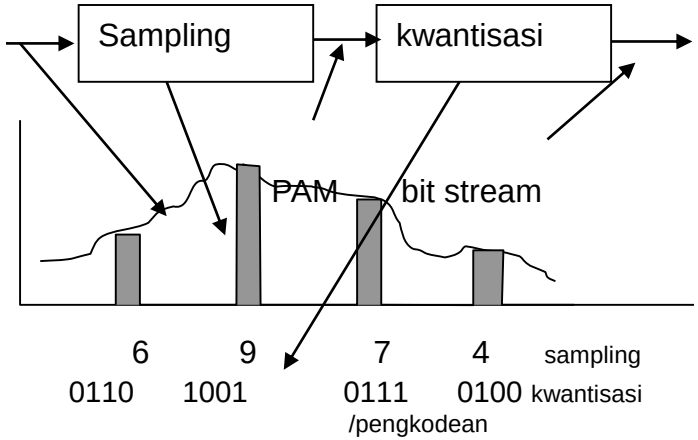
Jumlah sampling ~ 2 x 4000 bh/s

Jumlah bit kwantisasi = 8 / sampling

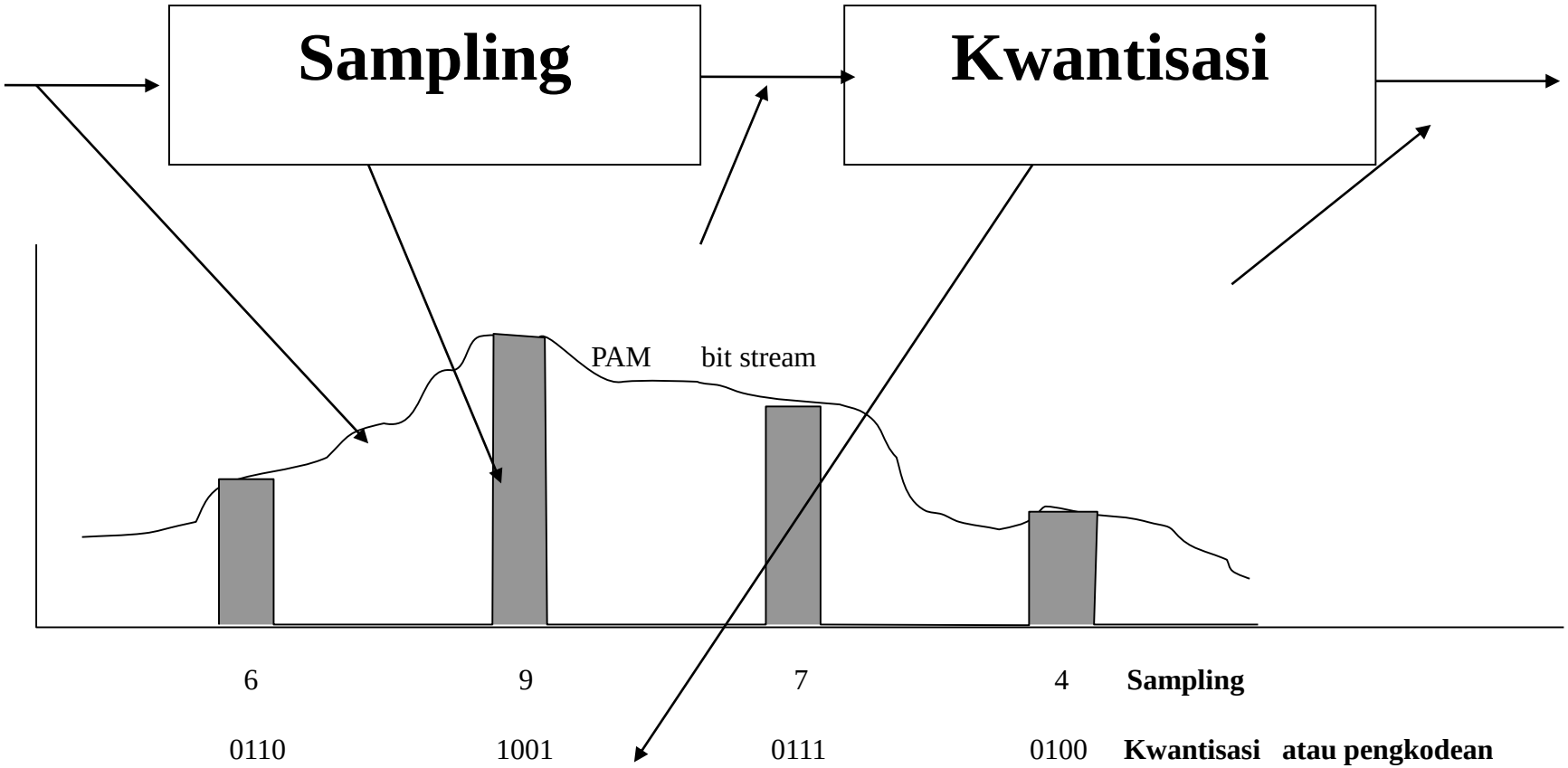
Maka jumlah bit perdetik adalah

2 x 4000x 8 = 64.000 bit /det.

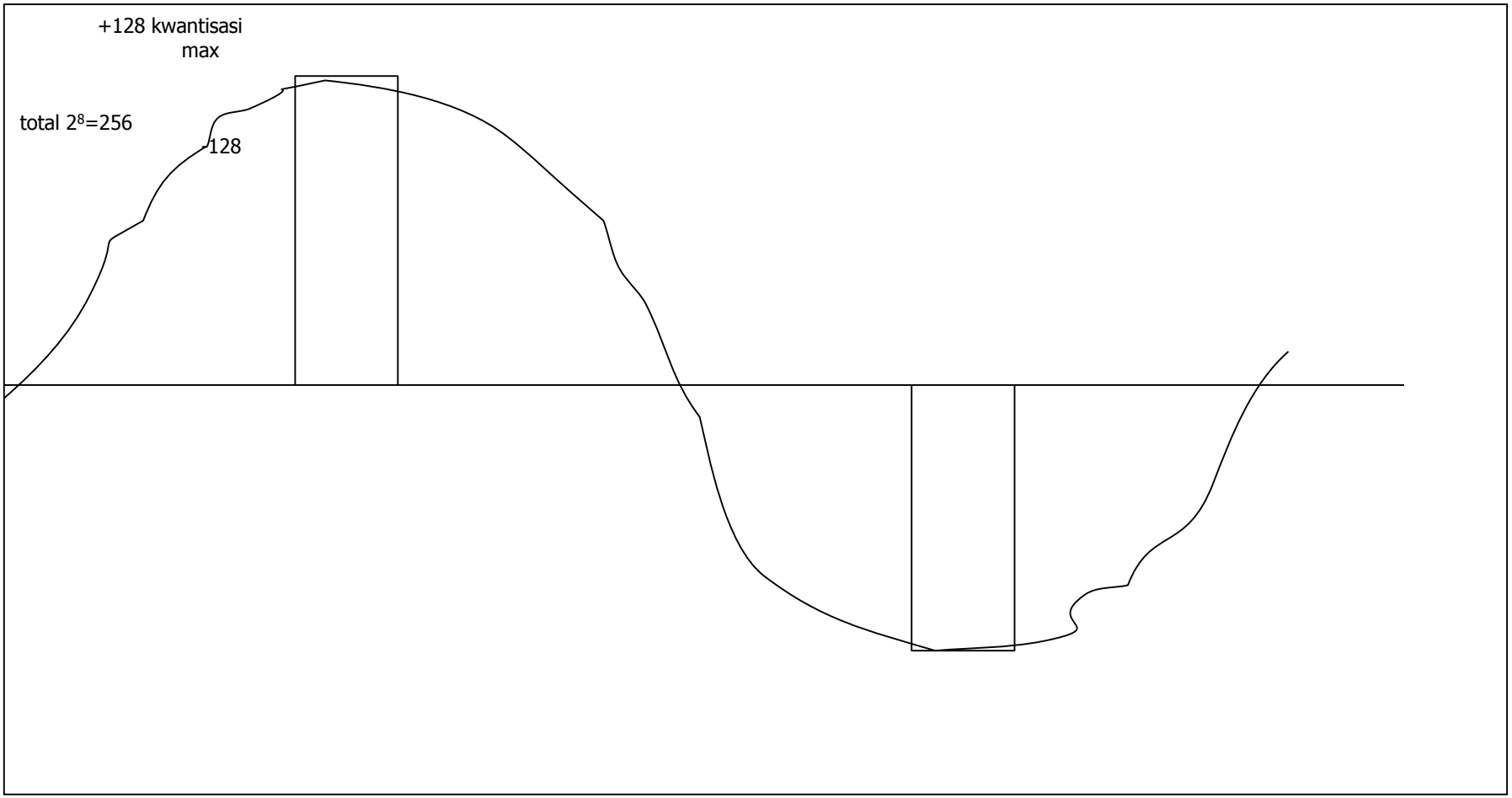




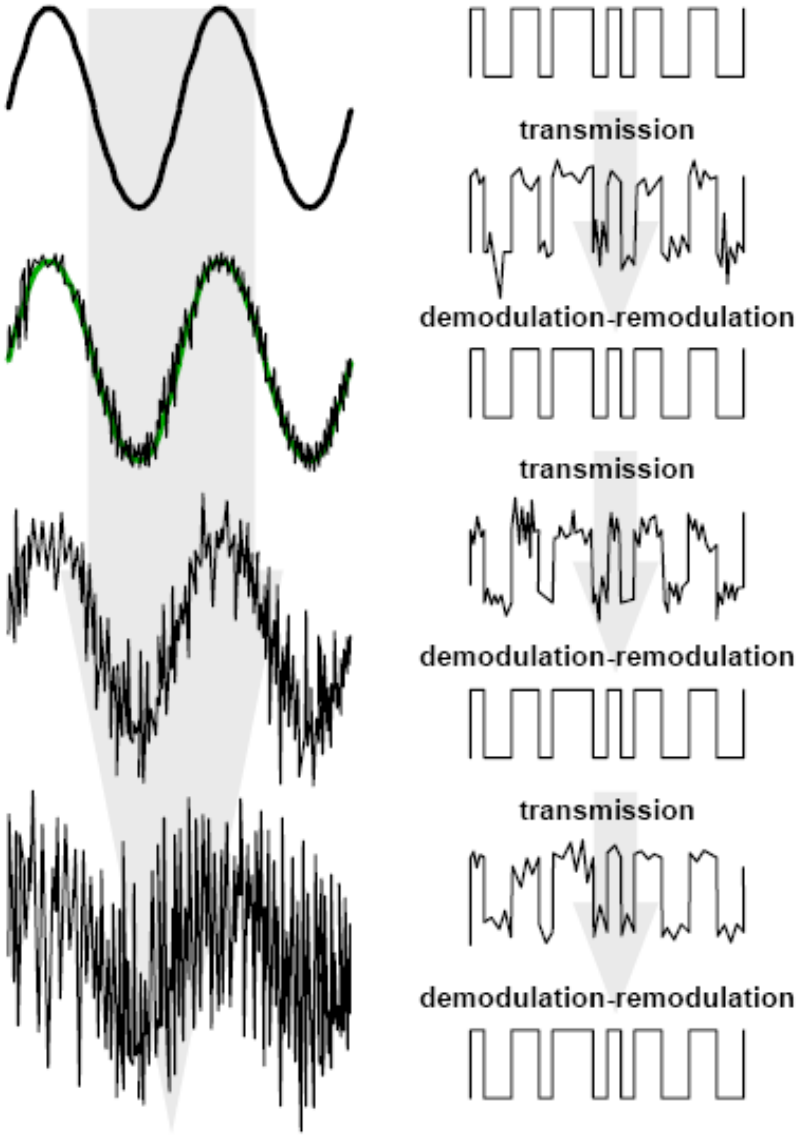
Sampling dan Kwantisasi



Proses Kwantisasi Sinyal

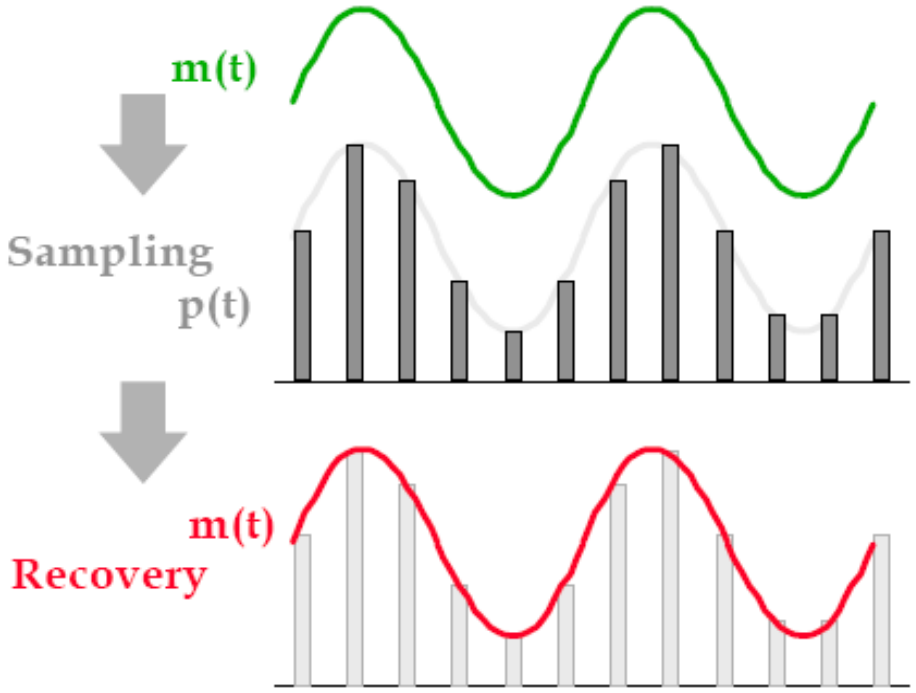


Introduction to Digital Modulation



- The modulating signals shown in previous slides were all analog. It is also possible to quantize modulating signals, restricting them to discrete values, and use such signals to perform digital modulation. Digital modulation has several advantages over analog modulation:
- Digital signals can be more easily regenerated than analog
  - in ***analog*** systems, the effects of noise and distortion are *cumulative*: each demodulation and remodulation introduces new noise and distortion, added to the noise and distortion from previous demodulations/remodulations.
  - in ***digital*** systems, each demodulation and remodulation produces a *clean* output signal free of past noise and distortion
- Digital bit streams are ideally suited to many flexible multiplexing schemes

Theory of Digital Modulation: Sampling



- Voice and other analog signals first must be sampled (converted to digital form) for digital modulation and transmission
- The ***sampling theorem*** gives the criteria necessary for successful sampling, digital modulation, and demodulation
  - The analog signal must be band-limited (low-pass filtered) to contain no frequencies higher than f_M
  - Sampling must occur at least twice as fast as f_M in the analog signal. This is called the ***Nyquist Rate***
- Required Bandwidth for p(t)
  - If each sample p(t) is expressed as an n-bit binary number, the bandwidth required to convey p(t) as a digital signal is at least N*2* f_M
  - this follows ***Shannon's Theorem***: at least one Hertz of bandwidth is required to convey one bit per second of data

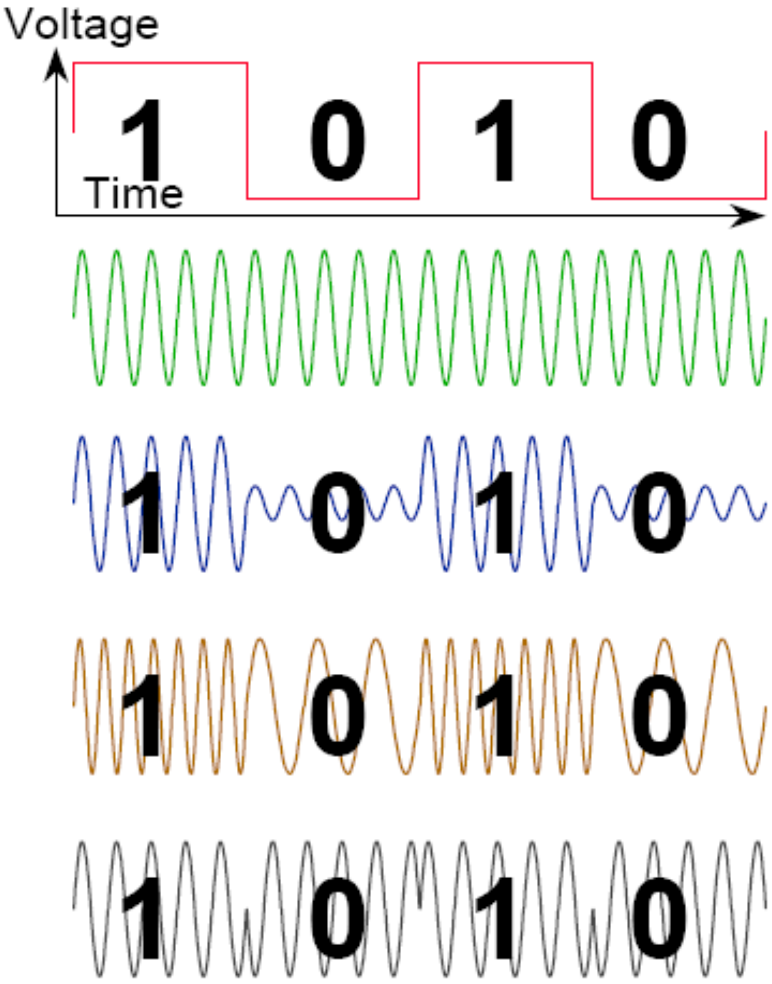
The Sampling Theorem: Two Parts

•If the signal contains no frequency higher than f_M Hz., it is comletely described by specifying its samples taken at instants of time spaced 1/2 f_M s.

•The signal can be completely recovered from its samples taken at the rate of 2 f_M samples per second or higher.

Modulation by Digital Inputs

Our previous modulation examples showed continuously-variable analog inputs. If we quantize the inputs, restricting them to digital values, the following simple visualizations result.



- For example, let this **digital** waveform modulate a signal. No more continuous analog variations, now we're "shifting" between discrete levels. We call this "shift keying".
- Steady **Carrier** without modulation
- **Amplitude Shift Keying**
  ASK example: digital microwave
- **Frequency Shift Keying**
  FSK example: control messages in AMPS cellular; TDMA cellular
- **Phase Shift Keying**
  PSK examples: TDMA cellular, GSM & PCS-1900

Masalah dan feature dalam transmisi digital

- Masalah pengkodean. → BW menjadi lebih besar
- Error dalam kwantisasi karena yang dikodekan hanya sampling
- Noise / derau di sepanjang jalan
- Features digital
- Perbaikan kesalahan di penerima
- Kompresi
- Pemaketan / relay