DIGITAL TO ANALOG CONVERSION

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ASPECTS OF DIGITAL-TO-ANALOG CONVERSION

- Bit rate is the number of bits per second.
- Baud rate is the number of signal elements per second.
- In the analog transmission of digital data, the baud rate is less than or equal to the bit rate.

CARRIER SIGNAL

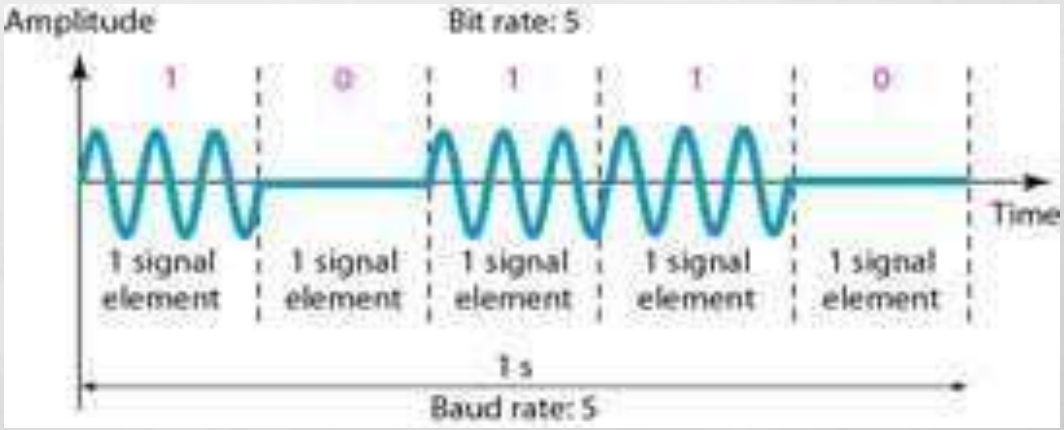
- A carrier signal is a transmitted electromagnetic pulse or wave at a steady base frequency of alternation on which information can be imposed by increasing signal strength, varying the base Frequency, phase or Amplitude.

- This modification is called modulation.

AMPLITUDE SHIFT KEYING (ASK)

- ASK is a form of modulation that represents digital data as variations in the amplitude of a carrier wave.

- The amplitude of the carrier (modulating signal), keeping frequency and phase constant.

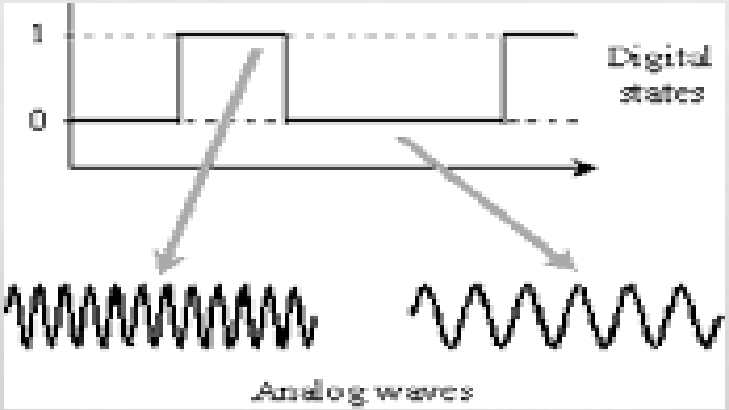


AMPLITUDE SHIFT KEYING (ASK)

- Advantages
  - Very simple modulation and demodulation
- Disadvantages
  - High sensitivity to noise
  - Low bandwidth efficiency

FREQUENCY SHIFT KEYING (FSK)

- FSK is a method of transmitting digital signals.
- The two binary states, logic 0 (low) and 1 (high), are represented by an analog waveform.
- Logic 0 is represented by a wave at a specific frequency, and logic 1 is represented by a wave at a different frequency.

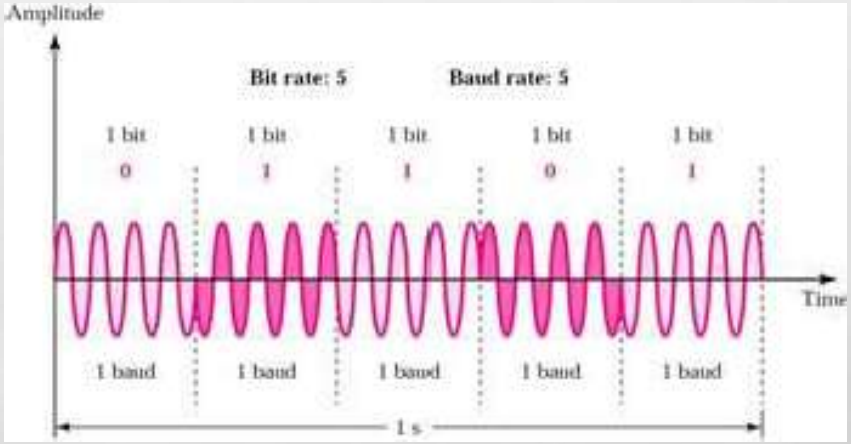


Peak amplitude and phase are constant

PHASE SHIFT KEYING

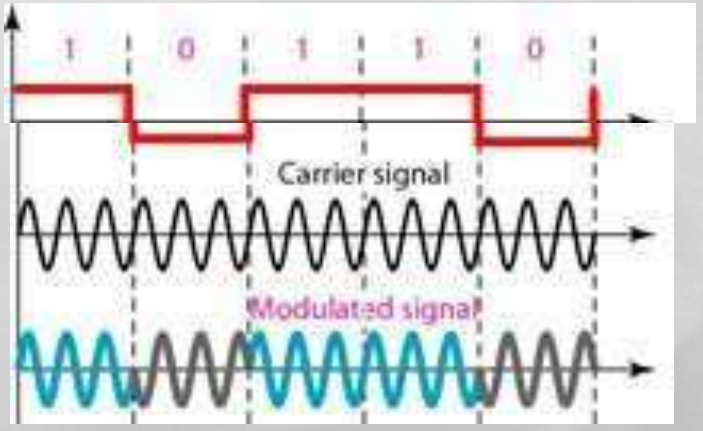
- Phase-shift keying (PSK): the phase of a transmitted signal is varied to convey information.

- There are several methods that can be used to accomplish PSK.



PHASE SHIFT KEYING

- The simplest PSK technique is called 2-PSK or BPSK. It uses two opposite signal phases (0 and 180).
- The state of each bit is determined according to the state of the preceding bit.
- If the phase of the wave does not change, then the signal state stays the same (0 or 1).
- If the phase of the wave reverses that is changes by 180 then the signal state is flipped.



PHASE SHIFT KEYING

- PSK minimum bandwidth = ASK minimum bandwidth.

Advantages of PSK:

- Not susceptible to noise.
- No bandwidth limitation.

Disadvantages:

- Distinguishing small difference in phase depending on the equipment used.

Multiplexing Techniques

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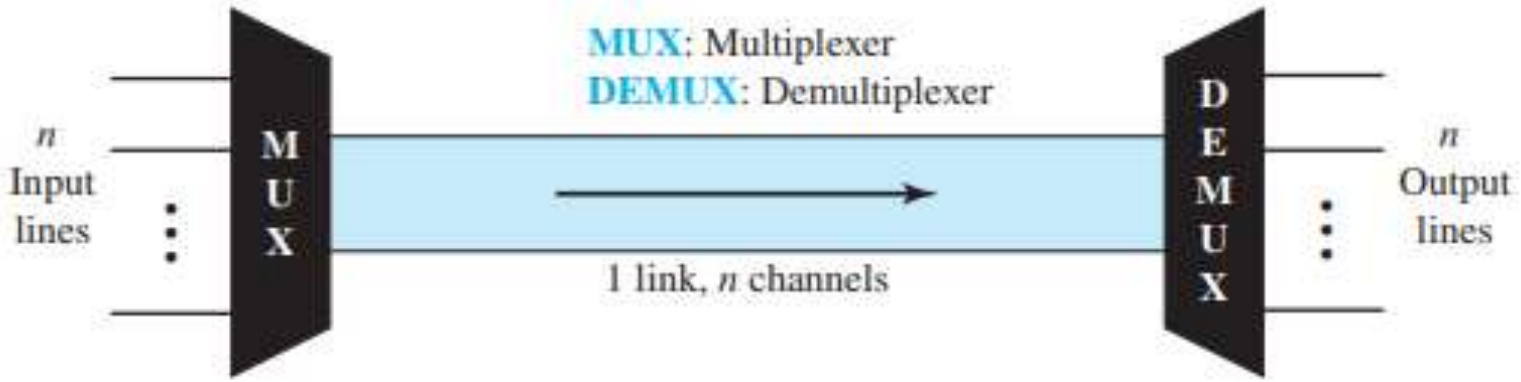
Multiplexing :

- Whenever the bandwidth of a medium linking two devices is greater than the bandwidth needs of the devices, the link can be shared.

- Multiplexing is the set of techniques that allow the simultaneous transmission of multiple signals across a single data link.

- In a multiplexed system, n lines share the bandwidth of one link.

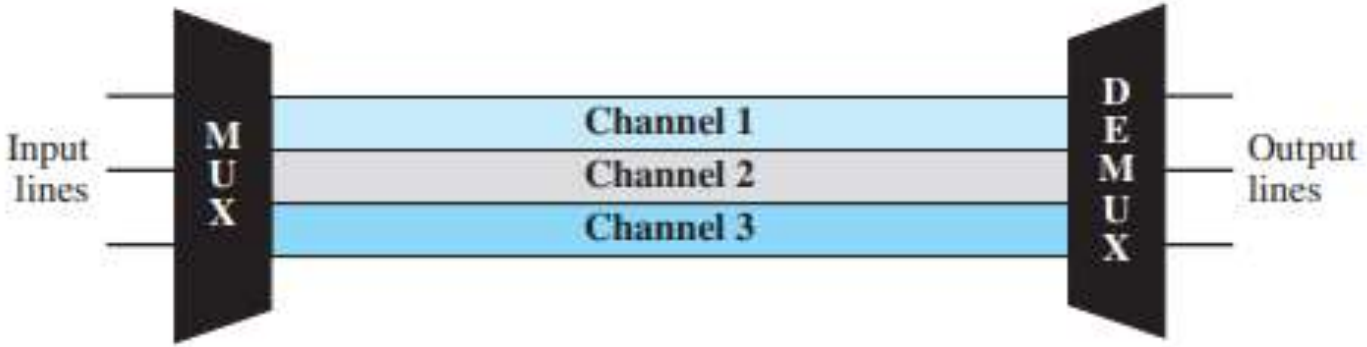


Frequency-division multiplexing (FDM):

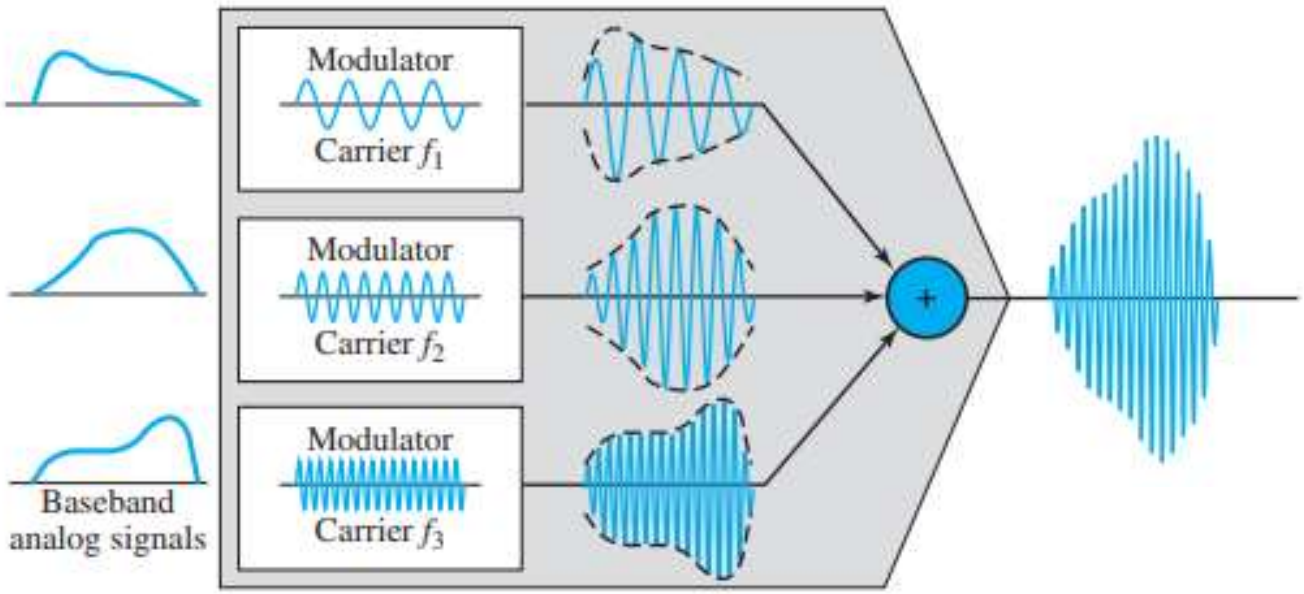
- Frequency-division multiplexing (FDM) is an analog technique that can be applied when the bandwidth of a link (in hertz) is greater than the combined bandwidths of the signals to be transmitted.

- In FDM, signals generated by each sending device modulate different carrier frequencies.

- Carrier frequencies are separated by sufficient bandwidth to accommodate the modulated signal.

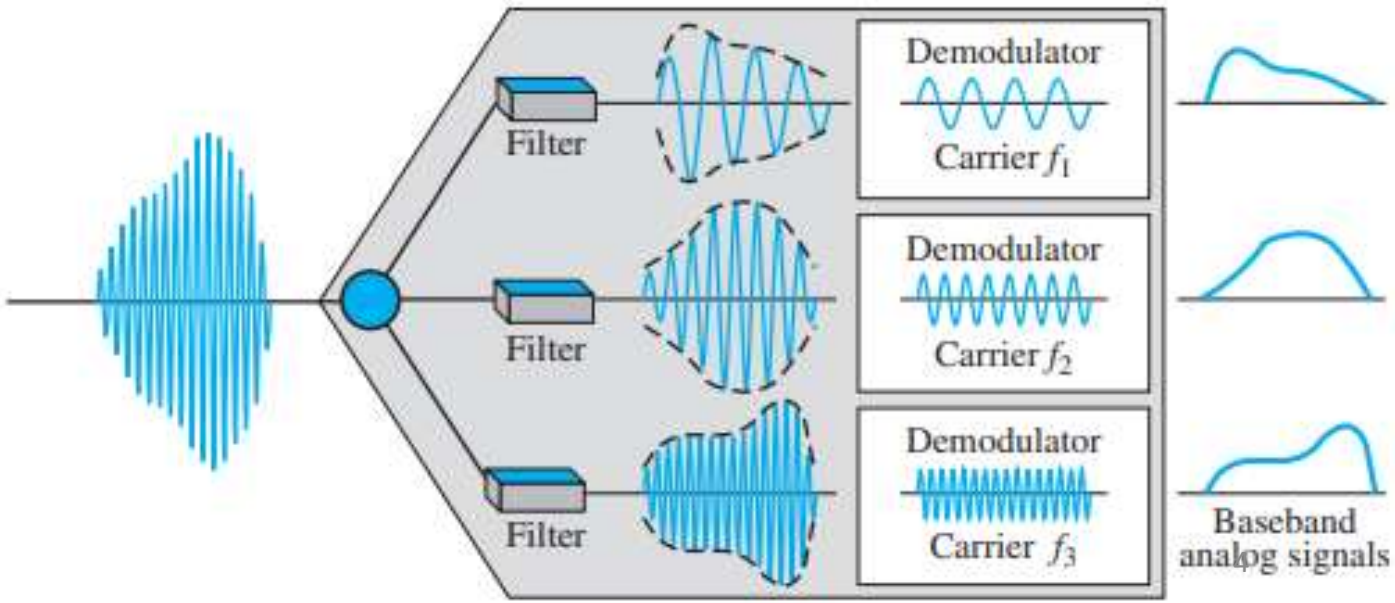


FDM Process:



Multiplexing

De-Multiplexing



Application of FDM:

- A very common application of FDM is AM and FM radio broadcasting. Radio uses the air as the transmission medium. A special band from 530 to 1700 kHz is assigned to AM radio. All radio stations need to share this band.

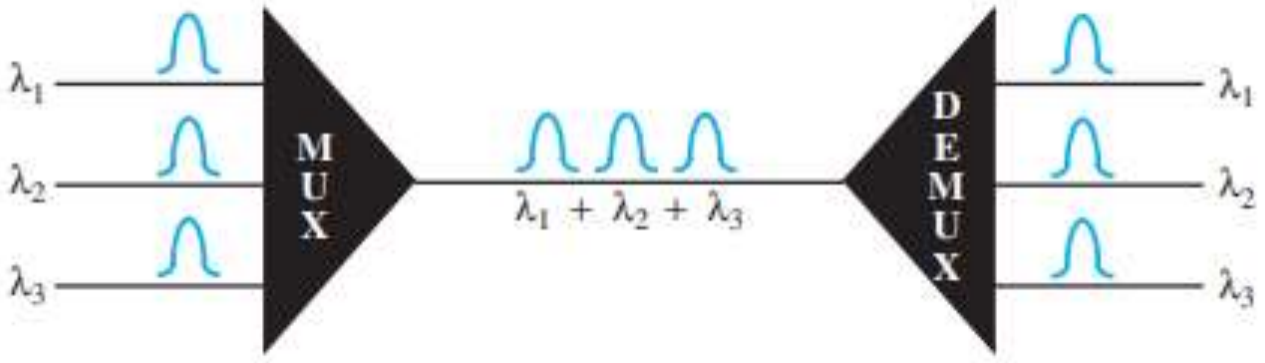
- The first generation of cellular telephones also uses FDM. Each user is assigned two 30-kHz channels, one for sending voice and the other for receiving.

Wavelength-division multiplexing (WDM):

- Wavelength-division multiplexing (WDM) is designed to use the high-data-rate capability of fiber-optic cable.

- The optical fiber data rate is higher than the data rate of metallic transmission cable, but using a fiber-optic cable for a single line wastes the available bandwidth.

- One application of WDM is the SONET network, in which multiple optical fiber lines are multiplexed and demultiplexed.



Time-division multiplexing (TDM):

- Time-division multiplexing (TDM) is a digital process that allows several connections to share the high bandwidth of a link.

- Instead of sharing a portion of the bandwidth as in FDM, time is shared.