Al-Mustaqbal University
College of Engineering & Technology
Computer Techniques Engineering Department

Digital Communication

Lecture 11

Binary Amplitude Shift Keying (BASK)

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Introduction to BASK (ASK/OOK)

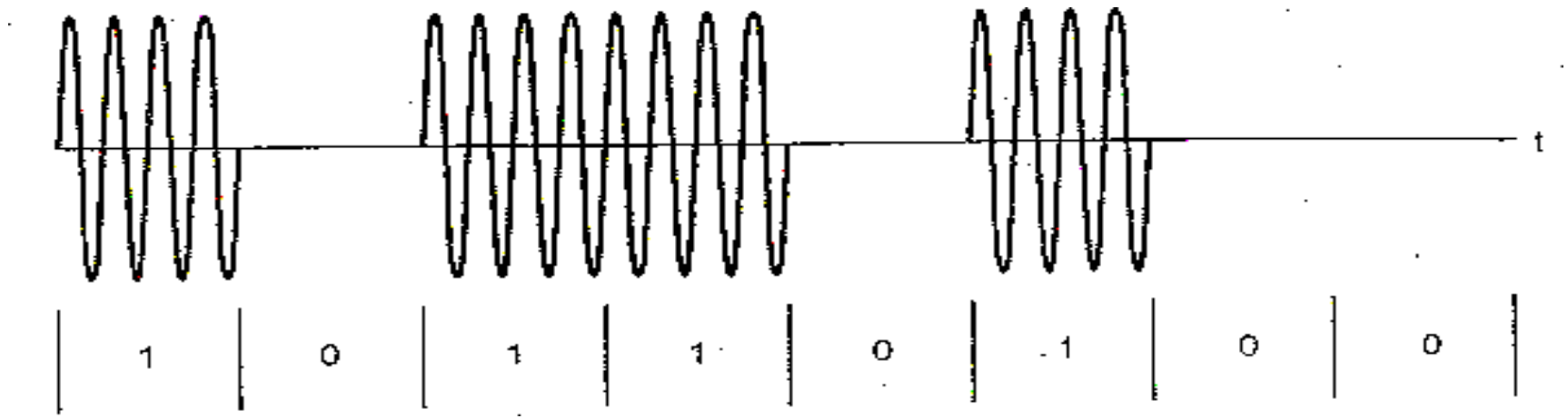
- **Definition:**
  - BASK (Binary Amplitude Shift Keying) is a digital modulation technique.
  - The presence or absence of a carrier represents binary data (ON-OFF Keying).
- **Mathematical Representation:**
  - When transmitting "1": $s(t) = \sqrt{2P_s}\cos(2\pi f_0 t)$
  - When transmitting "0": $s(t) = 0$ (no signal).

ASK Waveform Representation

- **Equation for the signal for "1":**

$$s(t) = \sqrt{P_s T_b} \times \sqrt{\frac{2}{T_b}} \cos(2\pi f_0 t)$$

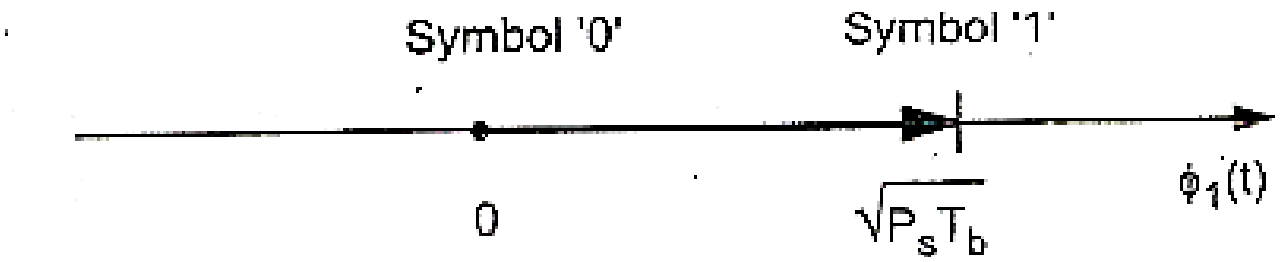
  - The carrier is present for "**1**" and absent for "**0**".



Signal Space Representation

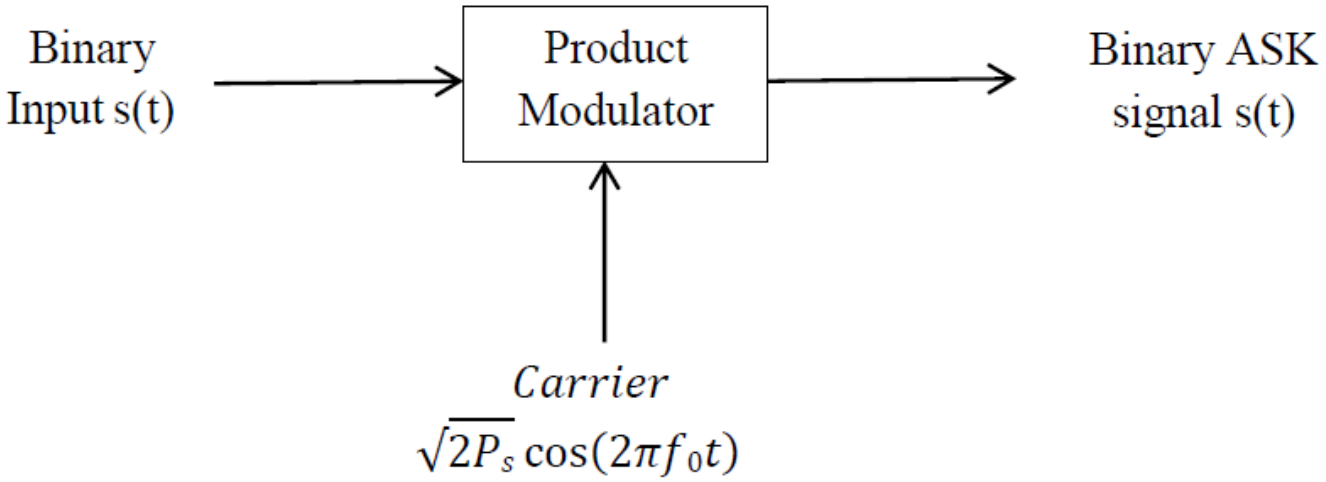
- Orthonormal Basis Function:
  - $\phi_1(t) = \sqrt{\frac{2}{T_b}} \cos(2\pi f_0 t)$
- Distance between signal points:

$$d = \sqrt{P_s T_b} = \sqrt{E_b}$$



Generation of BASK (ASK Modulator)

- **How It Works:**
  - A binary sequence is fed into a **product modulator**.
  - The modulator **passes the carrier** when the input is "1" and **blocks it** when input is "0".



Bandwidth of ASK

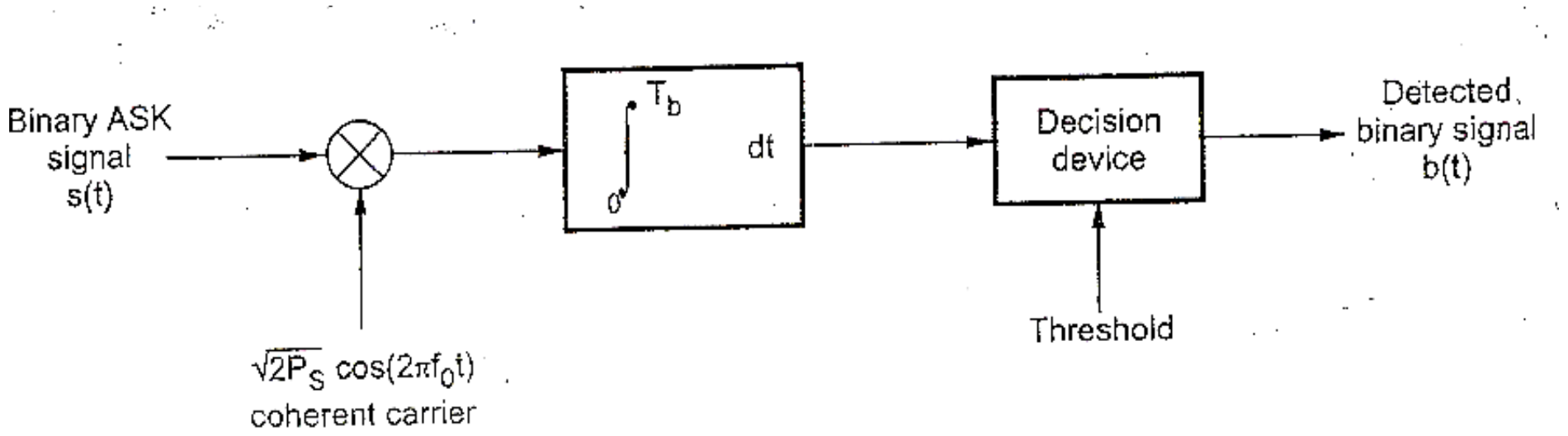
- **Formula:**

$$BW = (1 + r)R$$

  - R = Bit Rate
  - $0 < r < 1$ (depends on signal filtering).
- **Key Concept:** ASK has a **narrow bandwidth** but is more susceptible to noise.

ASK Detector (Receiver)

- **How It Works:**
  - The received ASK signal is processed through a **correlator** (multiplier + integrator).
  - A **locally generated coherent carrier** is applied to a **multiplier**.
  - The **output of the integrator** is compared to a **threshold**.
  - A decision is made at the end of each bit period.



Advantages of ASK

- **Simple Implementation** – Uses basic ON/OFF modulation.
- **Low Bandwidth Requirement** – More bandwidth-efficient than FSK.
- **Efficient Power Usage** – Consumes less power for binary "0".
- **Widely Used** – Found in **RFID systems, optical fiber communication, and remote controls**.

Disadvantages of ASK

- **Highly Susceptible to Noise** – Amplitude variations are easily affected by interference.
- **Poor Performance in Long Distances** – Attenuation can cause signal loss.
- **Not Power-Efficient** – Requires extra power to transmit "1".

Applications of ASK

- **Optical Fiber Communication** – ASK is used in light intensity modulation.
- **RFID and Wireless Key Fobs** – BASK is implemented in low-power communication devices.
- **Early Modem Communication** – Used in early digital data transmission.

Conclusion

- BASK (ASK) is the simplest digital modulation technique.
- Uses amplitude variations to transmit binary data.
- **Easy to implement but highly susceptible to noise**.
- Commonly used in low-power and optical communication systems.

Thank You