Physical Layer (Data and Signals)

ICNE532C - Computer Networks

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Analog and Digital Data

- Analog - Continuos
- Digital - Discrete

Analog and Digital Signals

- Periodic : Completes a pattern within a measurable time frame, called a period and repeats that pattern over subsequent identical periods. The completion of one full pattern is cycle.
- Non - periodic : Changes without exhibiting a pattern or cycle that repeats over time.
- Analog and Digital can be periodic and aperiodic. In data communications, we commonly use periodic analog signal and nonperiodic digital signal.

Periodic Analog Signals

- Sine Wave - Peak amplitude, frequency and phase
- Peak amplitude measured in *volts* when it is electric signals.
- Period - amount of time in seconds, a signal needs to complete 1 cycle.
- Frequency - Number of periods in 1 second. measured in Hertz (Hz)
- Period ($f = a_q \frac{1}{T}$) & Frequecy ($T = \frac{1}{f}$) are inverse
- Phase - Change in the degree

Two Extremes

- Signal doesnot change at all? Constant voltage level? Frequency is 0.
- Signal changes instantaneously? then frequency is infinite.

Wavelength

- Distance a simple signal can travel in one period.
- Wavelength is calculated through Propagation speed and frequency

Time and Frequency Domain

- Time Domain - shows changes in signal amplitude with respect to time.
- Frequency Domain - is concerned only with peak value and the frequency.

Composite Signal

- It is made of many simple sine waves

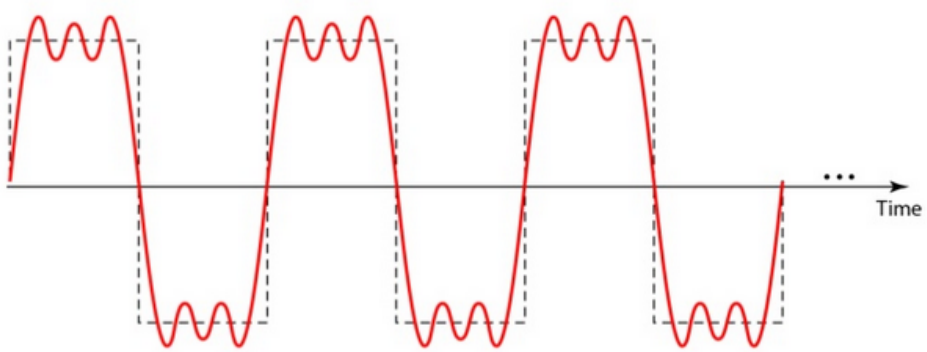


Figure: Composite Signal

Decomposition

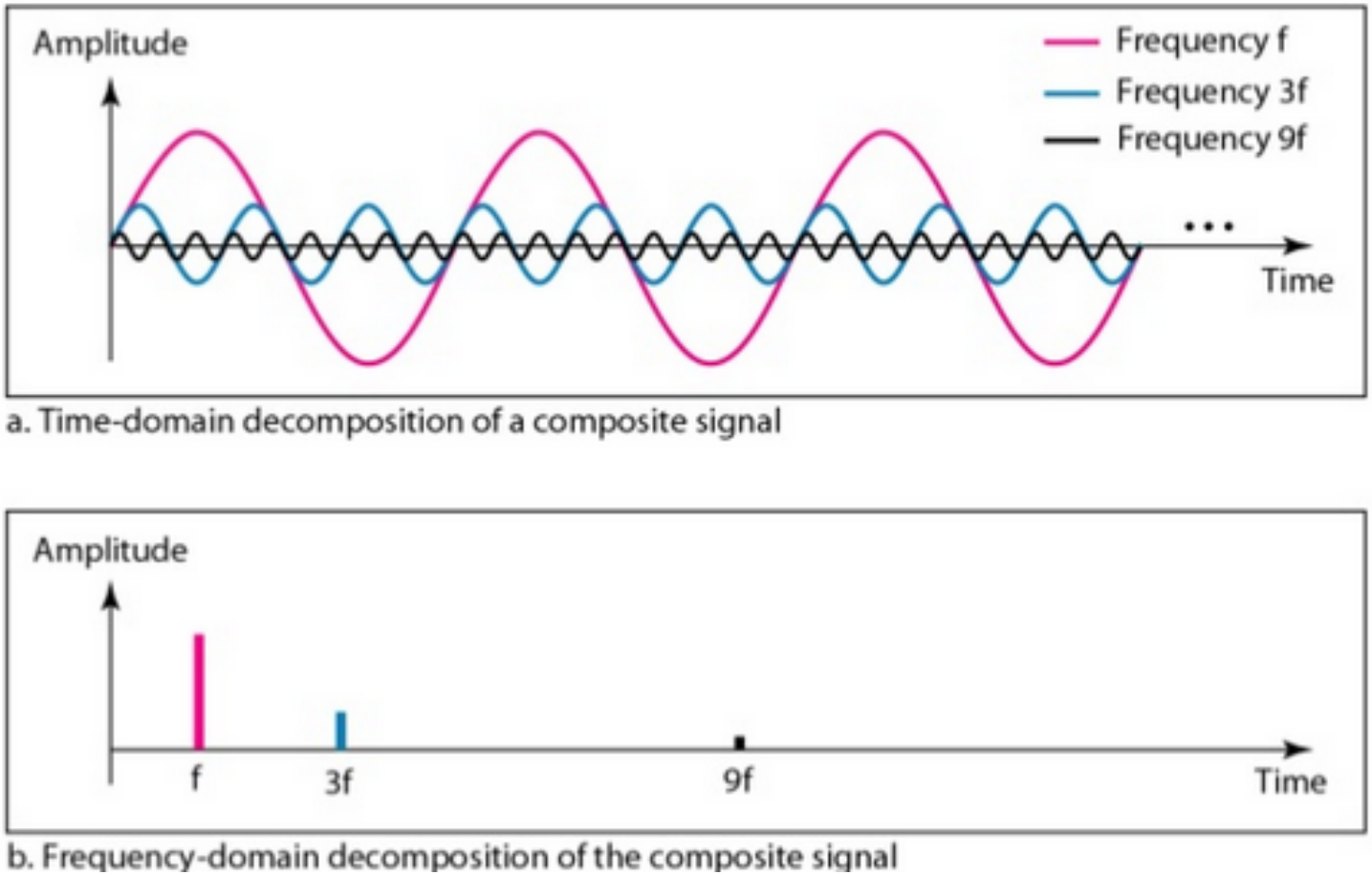


Figure: Decomposition

Bandwidth

- Range of frequencies contained in composite signal is its bandwidth.
- If a composite signal contains frequencies between 1000 and 5000 then its bandwidth is 4000.

Digital Signal

- Bit Rate - number of bits sent in one second.
- Bit Length - distance one bit occupies on the transmission.

Transmission of Digital Signal

- Baseband transmission means sending a digital signal over a channel without changing the digital signal to an analog signal.
- Broadband transmission means changing a digital signal to an analog signal for transmission.

References

[1] Behrouz A. Forouzan *Data Communications and Networking*. McGraw-Hill fifth edition.