

HY-330

fall semester 2024

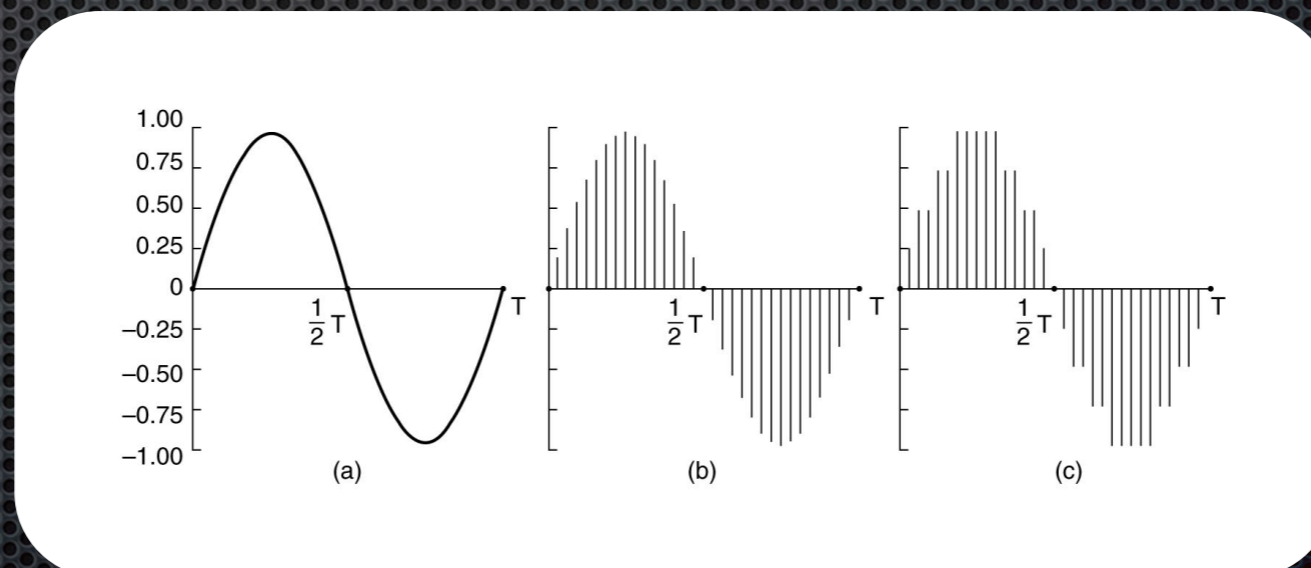
Introduction to telecommunication systems theory

University of Crete
Computer Science Department

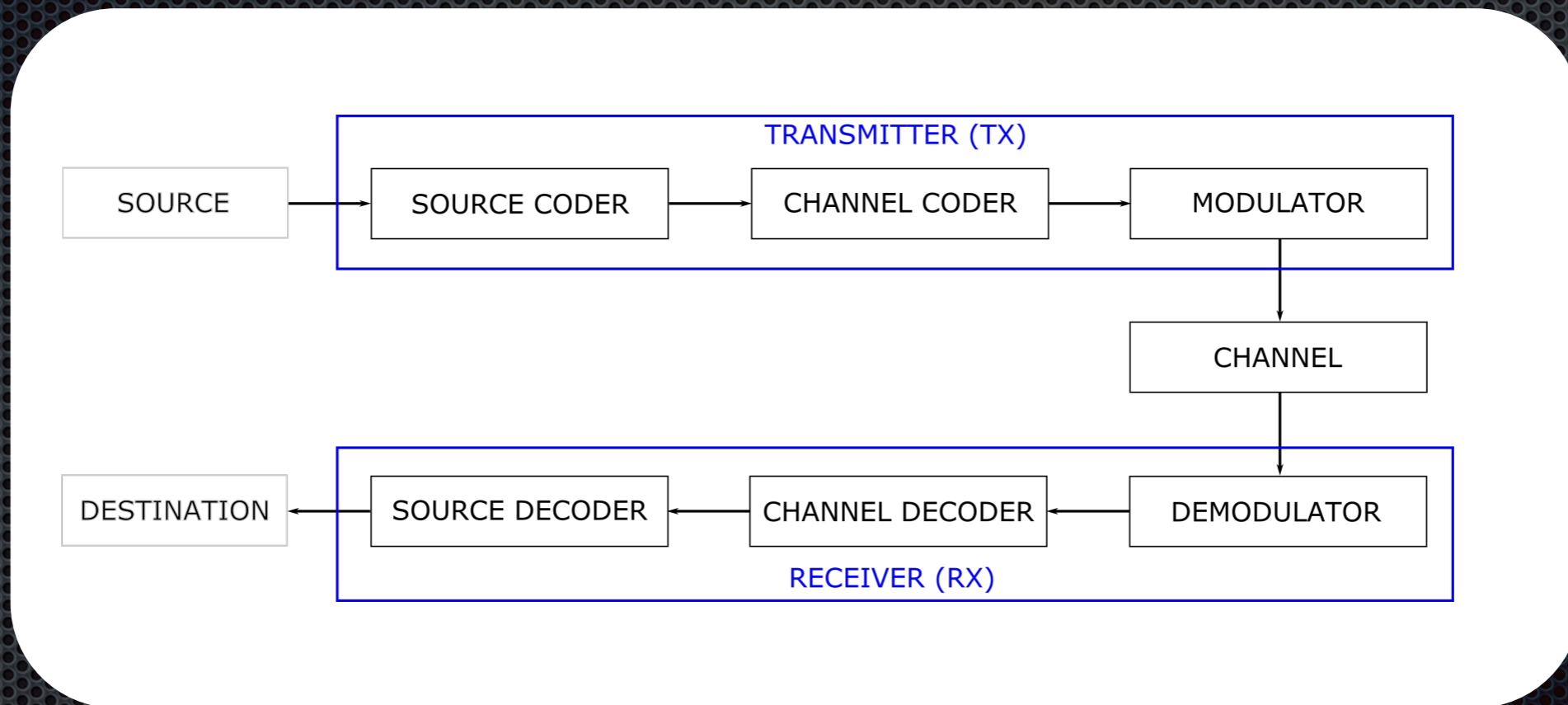
Stefanos Papadakis

Analog & Digital Signals

- ✦ Analog signal
- ✦ Discrete time signal
- ✦ Discrete time and level signal a.k.a. Digital Signal



Telecommunication System



Basic Concepts

- ✦ System
- ✦ Telecommunication
- ✦ Analog telecommunication system
- ✦ Digital telecommunication system

Telecommunication Procedure

- ✦ Message generation
- ✦ Message representation
- ✦ Coding
- ✦ Transmission - Reception
- ✦ Message Decoding
- ✦ Message reproduction

Basic Elements

- ✦ Transmitter
 - ✦ Tx
- ✦ Receiver
 - ✦ Rx
- ✦ Channel

Telecommunication Resources

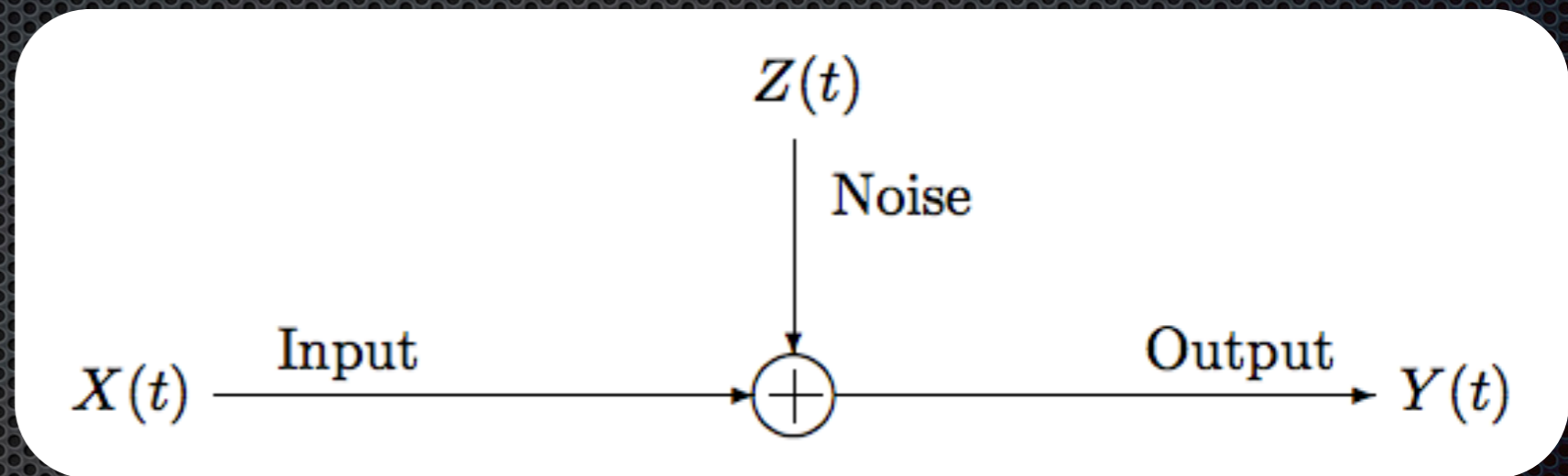
- ✦ Band / Carrier Frequency
- ✦ Tx Power
- ✦ Channel Bandwidth

Telecommunication Impairments

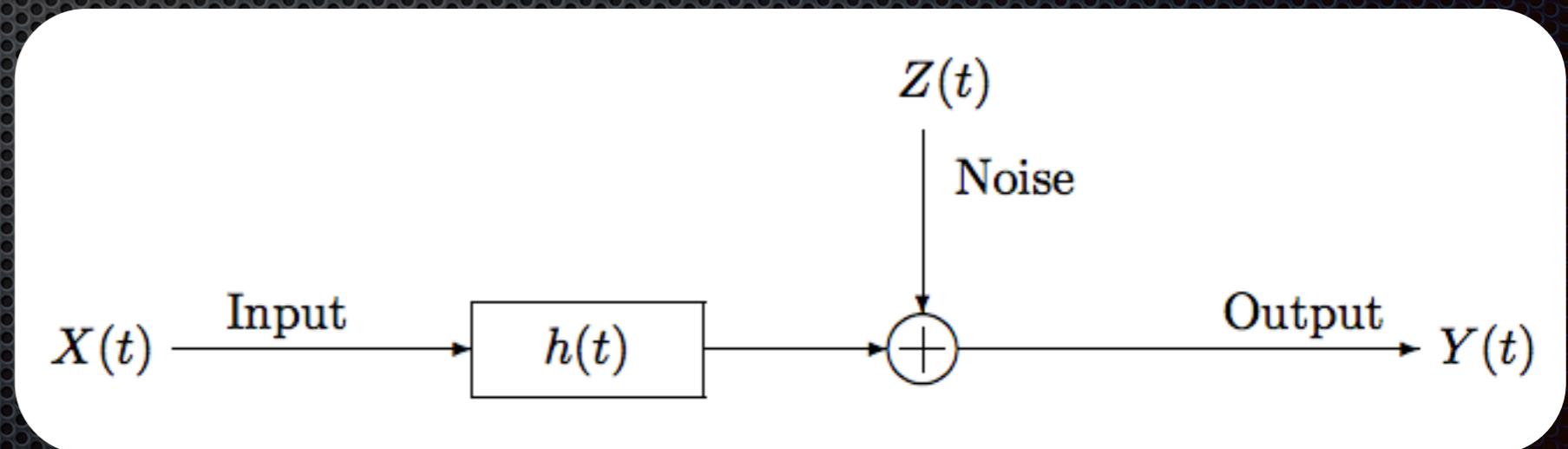
- ✦ Noise & Interference
- ✦ Channel distortion
- ✦ Technological limitations

Telecommunication Impairments

- AWGN channel



- Linear Gaussian channel



Channel Capacity

- SNR/SINR

$$SNR = \frac{P_{signal}}{P_{noise}}$$

- Shannon–Hartley theorem:

$$C = B \log_2 \left(1 + \frac{S}{N} \right)$$

- Thermal Noise:

$$P_{noise} = k_B T B$$

Channel Capacity

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Channel Capacity

- SNR/SINR

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- Shannon–Hartley theorem:

$$C = B \log_2(1 + SNR)$$

- Thermal Noise:

$$P_{noise} = k_B T B$$