Introduction to Error Control Coding and Channel Coding Theorem

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Outline

1. **Introduction**

2. **Problem Statement**

3. **Framework of Communication System**

4. **Shannon Limit**

5. **Historical Milestones**

6. **Outline of the Course**

Introduction

- Digital communication part of live.

- Shannon's landmark paper (1948).

- An era of error control coding.

- Close-to-bound error correcting codes.

- Turbo codes, low-density parity-check codes.

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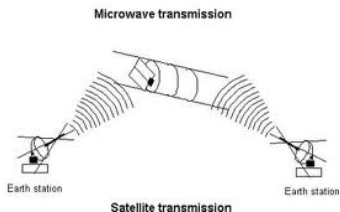- Turbo codes, low-density parity-check codes.

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Problem statement

- What is channel?

- What is substitution error?

- What is the aim?

Microwave transmission

Earth station   Earth station
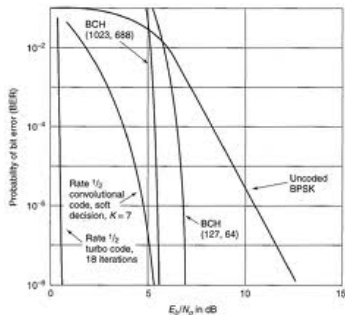
Satellite transmission

Problem statement

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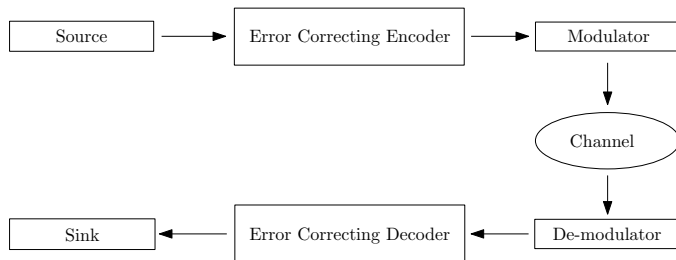- What is substitution error?

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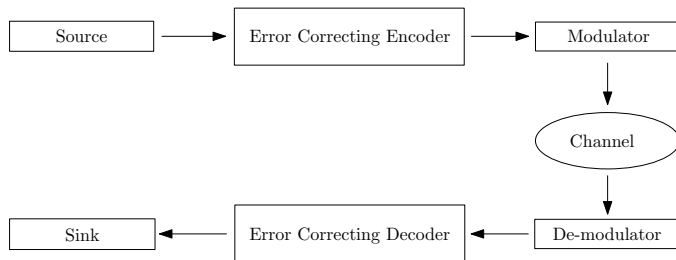- What is substitution error?

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A Simple Communication Model

- Source coding and modulation coding.

- Image, computer data, voice etc.
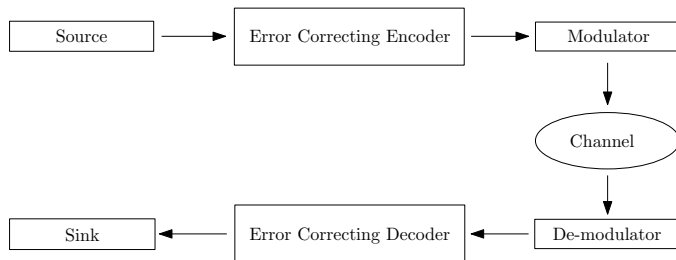
- ARQ/FEC

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Shannon Limit

$$C = B \log_2(1 + \frac{S}{N})\text{bits/sec},$$

Milestones

- Channel Coding Theorem (1948).
- Hamming Codes (1950).
- Convolutionals Codes (1955).
- Cyclic Codes (1957)
- BCH, Reed-Solomon Codes and Decoding Algorithm (1960)
- LDPC Codes (1962)
- 2400 bps modem commercially available
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- Chapter 2: Block Code.
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    - Reed-Solomon Code
    - Berlekamp-Massey Decoding
    - Low-Density Parity-Check Code
    - Tanner Group
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- Chapter 3: Convolutional Code.
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