

1 Introduction

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1.1 Motivation and Introduction

1. Signals travel without wires
 - (a) In this module, signals travel as radio waves (optical and acoustic systems ignored)
2. Applications are mostly in communications
 - (a) Signals modulated to carry information
 - (b) Many familiar applications such as radar, navigation, etc.

Example: Modern smart phone has approximately 9 distinct wireless systems. Try identifying them?

1. NFC
2. Cellulars
 - (a) 2G
 - (b) 3G
 - (c) 4G
 - (d) 5G
3. GPS
4. Bluetooth
5. WiFi
6. UWB
7. Lidar

Advantages of Wireless

- Mobility
- Good for one-to-many transmission
- High-capacity point-to-point links (cheaper than wired) (e.g. to serve remote areas)

Advantages of Wired

- Very little leakage
- No interference
- Multiple systems can operate adjacently without issue

but wired has much, much larger overheads.

Wired used for super high capacity lines (eg. fibre-optic transatlantic cables)

1.2 The Wireless Spectrum

The EM spectrum is a shared and limited resource.

Mostly regulated by government agencies.

Frequencies must be carefully given out, but can be reused at different locations as we will see.

Overview of a wireless system:

- Start with raw data
- Source coding (compression)
- Channel coding (error detection & error correction)
- Modulation
- TX
- RX
- Demodulation
- Channel decoding
- Source decoding

This module is mainly about modulation and TX/RX, the rest is information theory.

1.3 Basics of Wireless Transmitter

Amplifier to increase signal power enough to drive the antenna

Multiple Access

- CSMA: Listen to the channel, send if it's clear
- FDMA: Frequency divided MA
- TDMA: Time divided MA

3G uses FDMA and TDMA together.

3G uses CDMA

Also OFMA

1.4 Assessment & Delivery

Component	Timing	Weight
Lab Assignments	Varied (4 labs)	25%

1.5 Module Outline

1.6 Textbooks