ECE 351 Signals and Systems

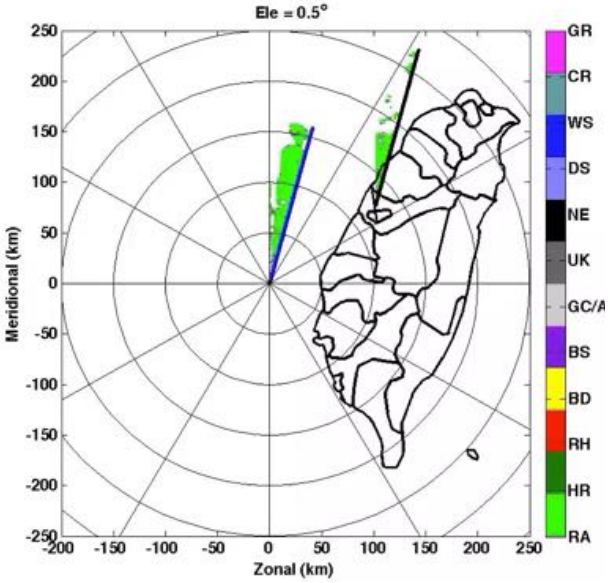
Course Information

- **Instructor**: **Yadong Wang, Ph.D.**
  Office: EB3067, **Tel**: (618)650-2524
- **Textbook**: *Oktay Alkin*, **Signals and systems: A MATLAB integrated approach**
- **Software**: MATLAB
- **Grading**:

Homework:	10%
Exam 1:	20%
Exam 2:	20%
Quizzes:	15%
Project/Simulation:	10%
Final Exam:	25%

- **Prerequisites**: grade of C or better in ECE 211

About Me



Education

Ph.D., Electrical and Computer Engineering,
Advanced Radar Research Center, University of Oklahoma
Dissertation Title: ***The application of spectral analysis and artificial intelligence methods to weather radar***

M.S.E.E., Electrical and Computer Engineering,
Advanced Radar Research Center, University of Oklahoma
B.S.E.E., Electrical and Computer Engineering,
Sichuan University, P. R. China

Professional Experience

2010-2016, Postdoctoral Research Associate/Research Scientist,
National Severe Storms Laboratory, University of Oklahoma
2003-2010, Graduate Research Assistant,
Electrical and Computer Engineering, University of Oklahoma
1999-2003, Radar Hardware Engineer,
Changfeng Science Technology Industry Group Corp. Beijing, China

Research Interests

Radar signal/imaging processing
Radar engineering
Communication
Remote Sensing

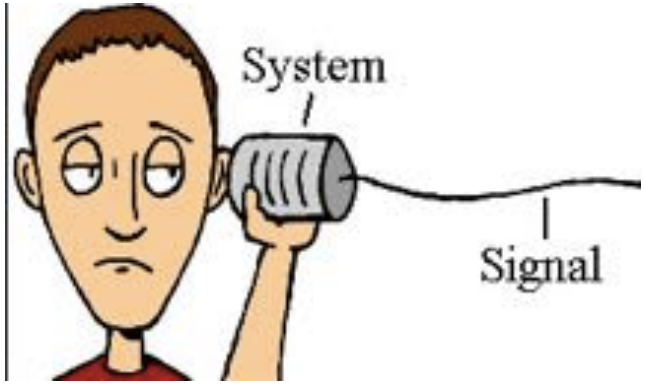
Chapter 1. Signal Representation and Modeling

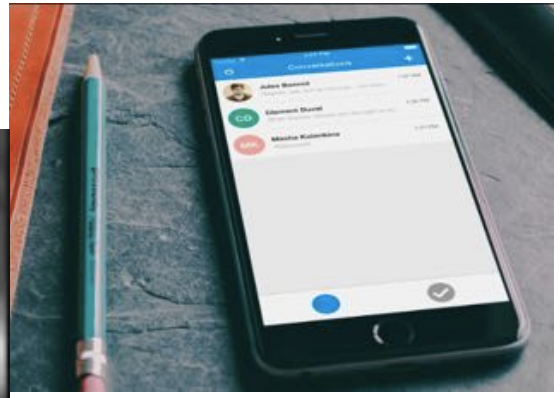
Chapter Objectives

- ✧ The concept of ***signal*** and the ***mathematic model***.
- ✧ Fundamental ***signal types*** and ***signal operations***. Experiment with methods of simulating **continuous**- and **discrete**-time signals with ***MATLAB***
- ✧ Learn various ways of classifying signals and discuss **symmetry** properties
- ✧ Explore characteristics of sinusoidal signals. Learn ***phasor*** representation of sinusoidal signals, and how ***phasors*** help with analysis
- ✧ Understand the ***decomposition*** of signals using ***unit-impulse*** functions of appropriate type
- ✧ Learn ***energy*** and ***power*** definitions

1.1 Introduction

Signals are part of our daily lives





1.1 Introduction

The history of communication is the history of human

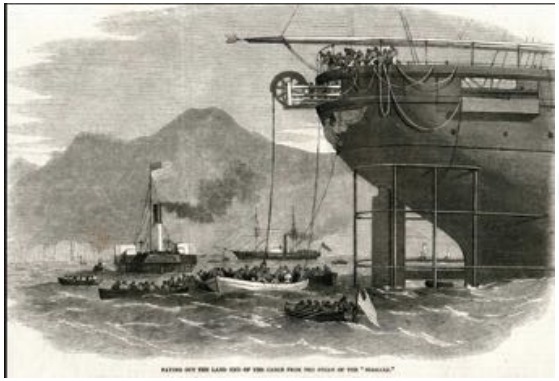
490 BC.

Philippides, the Greek messenger

From the battlefield of Marathon towards Athens. About 26.2 miles.

"We have won!"

1900s



Across Atlantic Cable

More than 2000 miles

"Europe and America are united by telegraphic communication. Glory to God in highest, on earth peace, Goodwill to men"

After 2000.

Wireless communication

"Hello world!"

1.1. Introduction

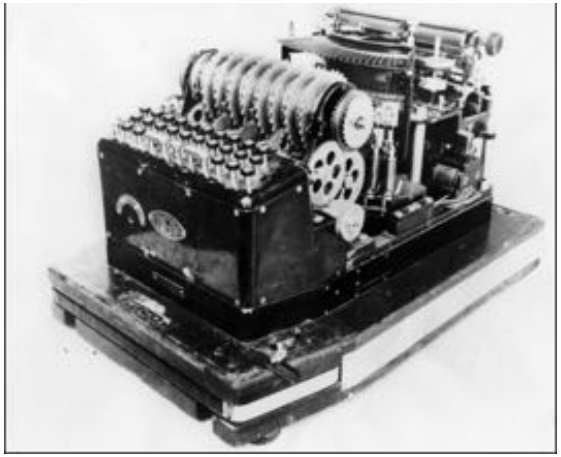
Milestones in Communications

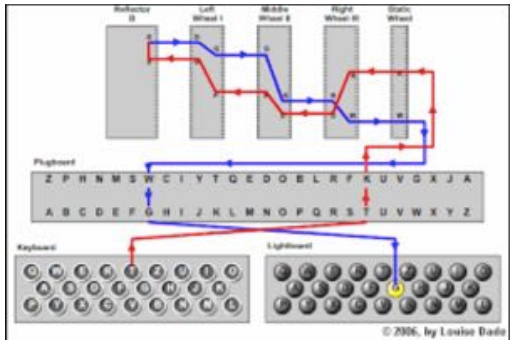
- **1837**, Morse code used in telegraph
- **1864**, Maxwell formulated the electromagnetic (EM) theory
- **1887**, Hertz demonstrated physical evidence of EM waves
- **1890's-1900's**, marconi & Popov, long-distance radio telegraph
  -- Across Atlantic Ocean
  -- From Cornwall to Canada
- **1875,** Bell invented the telephone
- **1906**, radio broadcast
- **1918**, Armstrong invented superheterodyne radio receiver (FM in 1933)
- **1921,** land-mobile communication
- **1947,** microwave relay system
- **1957,** satellite communication began
- **1966,** fiber-optical communications
- **1981,** analog cellular system
- **1988,** digital cellular system
- **2000,** 3G network

1.1. Introduction

Enigma Machine

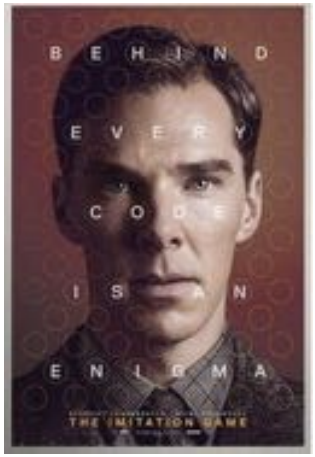
5000 billions possibilities



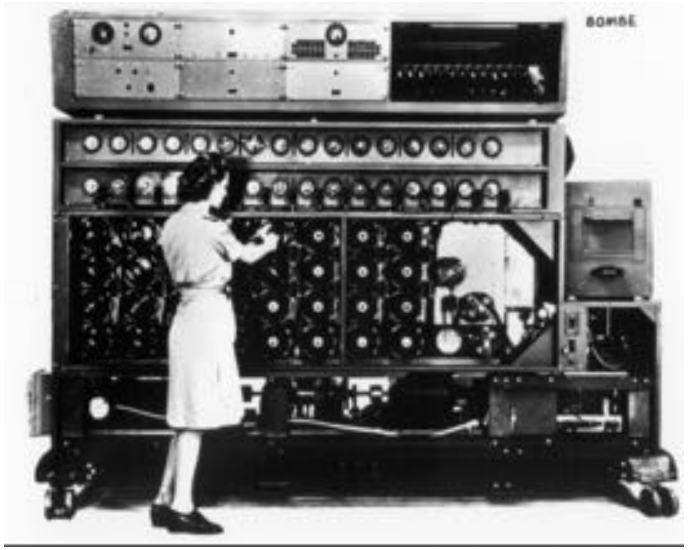


Alan Turing

Movie

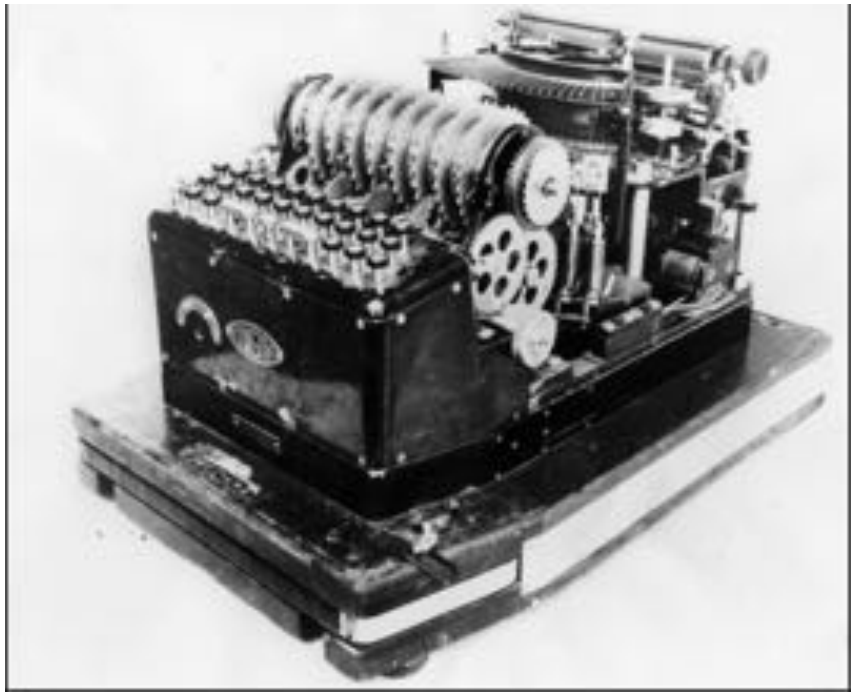


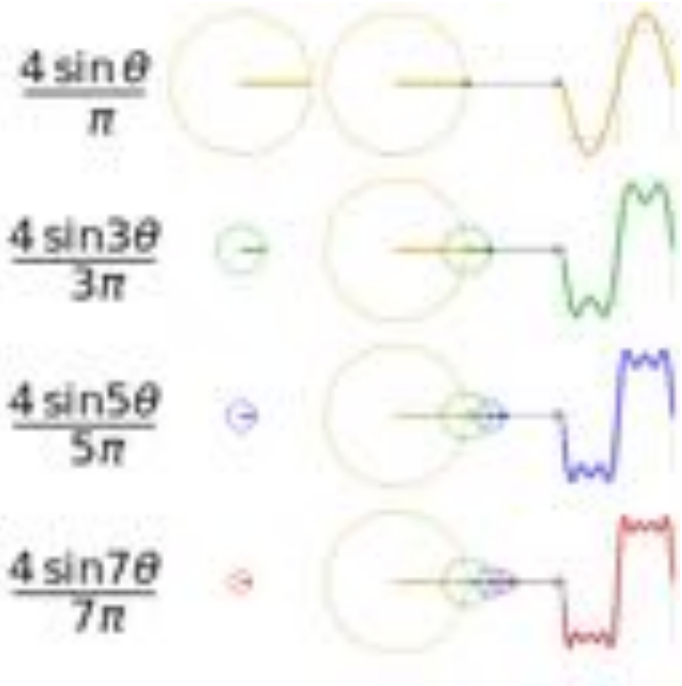
Real



1.1. Introduction

Enigma Machine





1.2 Mathematical modeling of Signals

The mathematical model for a signal is in the form of a formula, function, algorithm or a graph that approximately describe the time variations of the physical signal

Goals

- ***Understand the characteristics of the signals in terms of its behavior in time and in term of the frequencies it contains (signal analysis).***
- ***Develop methods of creating signals with desired characteristics (signal synthesis)***
- ***Understand how a system responds to a signal and why (system analysis)***
- ***Develop methods of constructing a system that responds to a signal in some prescribed way (system synthesis)***