EE2023 Signals & Systems
Chapter 0 – Introduction

TAN Woei Wan

Dept. of Electrical & Computer Engineering
National University of Singapore

Course Information

- Format :
  - Small group team teaching method : Team of 3 instructors share the planning and instruction of students in a coordinated fashion.
  - Group 2 Instructor: TAN Woei Wan (陈玮雯)
    - Office: E4-06-18 & AS8-03-01
    - Tel: 6516-8323
    - Email: wwtan@nus.edu.sg
    - Office hours: Microsoft Teams Chat or Call
- Classes :
  - Tuesdays 1000 - 1145 hours
  - Thursdays 1000 - 1145 hours
  - Both time slots will be used interchangeably for lectures and tutorials. Tutorials will be scheduled as and when sufficient content have been covered.

Assessment

- Continual Assessment :
  - Math assignment (10%) – Functions, Complex Functions & Circuits due in Week 3.
  - Mid Term Quiz (25%) – Materials in Chapters 0 to 5 around Week 7.
  - Assignment on Systems (15%) – Materials in Chapters 6 to 10. Released around Week 11 and due in Week 13.
- Final Exam (50%)

Reference Text

- Douglas K Lindner, Introduction to Signals & Systems, McGraw Hill
- Hwei Hsu, Schaum's Outline of Signals and Systems, McGraw Hill

The following books may also be useful :

- Erhan Kudeki and David Munson, Analog Signals and Systems, Prentice Hall
- Simon Haykin, An Introduction to Analog & Digital Communications, John Wiley & Sons Inc
- A.V. Oppenheim, A. S. Willsky, Signals & Systems, Prentice Hall, 2nd ed.

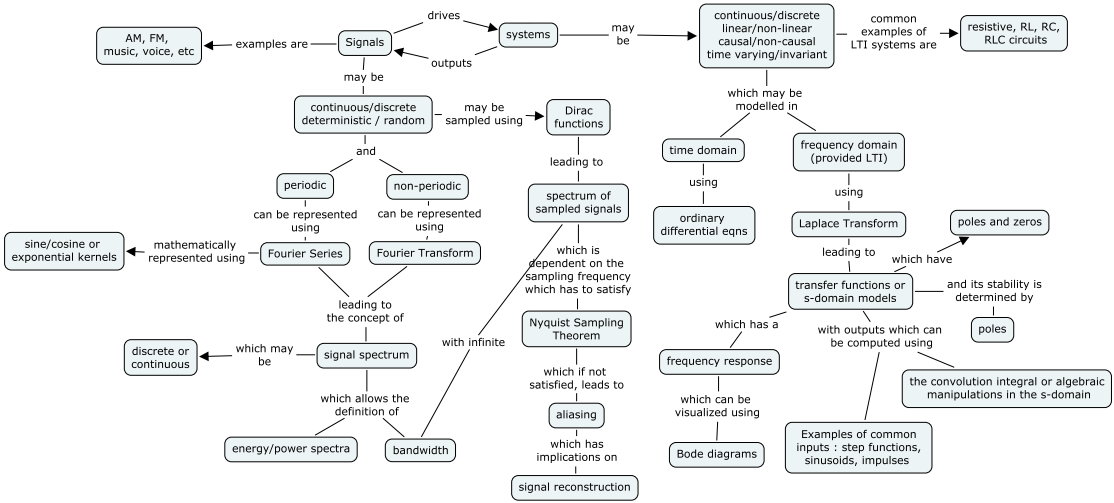
Pre-Requisite Knowledge

- Linear algebra and calculus
  - Sinusoidal functions, $A\sin(\omega t + \phi)$ and $A\cos(\omega t + \phi)$.
    - Converting between frequency in Hz and angular frequency (radians/sec)
    - Converting between period and frequency
    - Computing the phase angle, ϕ
  - Solving first and second order ODE
- Complex number arithmetic and Complex functions
  - Cartesian form – Real and Imaginary parts of complex number
  - Polar form – Magnitude and Phase of complex numbers
  - Complex conjugate
  - Complex exponential functions and the Euler Identity
    $$e^{j\theta} = \cos\theta + j\sin\theta$$
- Basic circuit theory (EE1111 & EE1112) :
  - Ohms law, $I - V$ relationships for Capacitor and Inductor
  - Kirchoff circuit laws
  - Voltage and Current Division Laws
- Some familiarity with Fourier Series and Laplace transform

Topics to be covered

1. Signals & Classification of Signals
2. Discrete-frequency Spectrum – Fourier Series
3. Continuous-frequency Spectrum – Fourier Transform
4. Energy Spectra Density, Power Spectra Density and Bandwidth
5. Sampling & Reconstruction of Signals
6. Systems & Classification of Systems
7. Laplace Transform – Review
8. Linear Time Invariant (LTI) Systems
9. Unit Step Response of LTI Systems
10. Frequency Response of LTI Systems

EE2023 Concept Map



Learning Outcomes

Signals (Chapters 1–5)

- Describe a signal in time and frequency domains
- Compute the Laplace and Fourier Transforms of simple systems and signals : Spectrum of Periodic and Aperiodic Signals
- Calculate the bandwidth, power and energy spectra of signals
- Explain aliasing and evaluate the impact of the Nyquist sampling theorem

Systems (Chapters 6–10)

- Describe and identify the characteristics of linear time invariant systems
- Derive a linear time invariant system model using mathematical tools such as differential equations and transfer functions
- Compute the outputs of LTI systems when driven by steps, impulses & sinusoids using convolution integrals and transfer functions
- Evaluate the stability of system through its poles
- Construct the frequency response of systems via Bode plots