Engineering Systems Analysis: Signals

Course Description

Linear system theory offers a powerful set of mathematical tools used broadly across science and engineering. Continuous-time and discrete-time signals represent the transfer of information or power, while systems represent operations on these signals. This course extends material from the first half-semester of Engineering Systems Analysis to focus on fundamental concepts such as frequency response, convolution, modulation, transforms (CTFT, DTFT, and Z-transform), impulse and step response, sampling and aliasing. These concepts are presented within the framework of linear operators and transforms in discrete and continuous time. Applications include filters, system identification, and communications.

Signals is taught in a studio setting, i.e., during class, students work on "In-class Assignments", aka Day Assignments, while the instructor moves from table group to table group, answering questions, checking conceptual understanding, and assisting students individually or in groups.

Course Schedule, Spring 2024

Class Day	Topics	Due dates
1: Mar 12	Continuous-time Fourier Transform (CTFT): frequency response	
2: Mar 15	CTFT: properties. CT unit impulse function (aka the delta fn)	
3: Mar 26	CT convolution. Sampling.	
4: Mar 29	Aliasing. The sampling theorem.	F, Mar 29 HW 1 Due
5: Apr 2	Discrete-time (DT) signals. Difference equations.	
6: Apr 5	DT unit sample response. DT convolution.	F, April 5 HW 2 Due
7: Apr 9	DT convolution. The DTFT (discrete-time Fourier transform)	
8: **Wed 4/10**	DTFT: frequency response. Intro to the Z-transform (ZT)	F, April 12 HW 3 Due
9: Apr 16	Z-transform (cont'd.) Last Day assignment due Apr. 20	
10: Apr 19	Applications: DT filtering and projects	F, April 19 HW 4 Due
11: Apr 23	DT filtering and projects	
12: Apr 26	DT filtering and projects	F, April 26 HW 5
May 1 - 3	May 1: Signals Exam (12 – 3pm)	Project Due F, May 3