EE-658
Advanced Digital Signal Processing

Catalog Description:


Credits: 3.0

Class Schedule: 2 lectures/week.

Prerequisites: EE 556

Course Objectives:

1. Understand FIR and IIR filter approximations
2. Learn how to design FIR and IIR filters
3. Understand quantization effects in digital filters
4. Learn how to design digital filters robust to quantization and round-off errors
5. Understand sigma-delta modulation and its applications in analog-to-digital converters
6. Understand signal modeling such as MA, AR, ARMA
7. Understand parametric and non-parametric spectrum estimation of random signals
8. Understand Levinson recursion
9. Understand lattice filters and their applications
10. Understand optimum Wiener filtering and linear prediction
11. Using MATLAB to simulate the algorithms and solve related problems

Textbooks and References:


Topics Covered:

1. FIR and IIR filter design (Parks-McClellan and eigenfilter methods)
2. Quantization and round-off noise analysis in digital filter
3. Sigma-delta modulation and its applications
4. Random processes and estimation
5. Signal modeling.
6. Non-parametric spectrum estimation (periodograms, minimum variance and multitaper methods)
7. FIR and IIR optimum Wiener filters.
The Program Outcomes to be achieved by each graduate of the Electrical Engineering program are the following:

| (a) | an ability to apply knowledge of mathematics, science, and engineering | 2 |
| (b) | an ability to design and conduct experiments, as well as to analyze and interpret data | 0 |
| (c) | an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability | 0 |
| (d) | an ability to function on multidisciplinary teams | 0 |
| (e) | an ability to identify, formulate, and solve engineering problems | 2 |
| (f) | an understanding of professional and ethical responsibility | 0 |
| (g) | an ability to communicate effectively | 0 |
| (h) | the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context | 0 |
| (i) | a recognition of the need for, and an ability to engage in life-long learning | 0 |
| (j) | a knowledge of contemporary issues | 0 |
| (k) | an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice | 0 |
| (l) | an understanding, beyond the fundamentals of one or more areas of specialization within electrical or computer engineering (e.g., communications, VLSI, instrumentation, DSP, computer networks and computer languages) | 2 |

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