

Lecture 1

EENG 31400-M1400

Digital Filters & Spectral Analysis

Course Structure, Prerequisites, Reading Lists,
Blackboard, Assessment

Course Structure

1. Fourier Analysis

- Fourier Series (FS)
 - Fourier Transform (FT)
 - Sampling
 - Aliasing
 - Discrete Time Fourier Transform (DTFT)
 - Discrete Time Sampling
 - Discrete Fourier Transform (DFT)
 - Spectral smearing
 - Time-frequency trade-offs
 - Implementation of DFT
 - Fast Fourier Transform (FFT)
 - Applications of DFT
-
- Continuous Time Signal Transforms
- Sampling of continuous time signals, transform for the resulting discrete time signals, and sampling rate changes
- A fully discrete transform & problems arising from this type of frequency analysis
- Fast implementations of the DFT
- OFDM, fast filtering

Course Structure

2. Digital Filters

- Design by pole-zero placement
 - Design of finite response filters (FIR)
 - Windowing
 - Frequency sampling
 - Optimisation methods
 - Design of infinite impulse response filters (IIR)
 - Impulse invariance
 - Bilinear transform
 - Implementation of digital filters
-
- Simple FIR /IIR filters,
Resonators, Notch filters,
Comb filters
- Linear Phase Response,
Advantages/Disadvantages
of design methods,
Optimisation
- Advantages/Disadvantages
of IIR filters,
Advantages/Disadvantages
of design methods
- Different implementation
structures, Effect of real
world limitations

Course Structure

3a. Multirate Digital Signal Processing

- Down-sampling
- Up-sampling

} Covered in part 1 under
Discrete Time Sampling

- Filter Banks
- Discrete Wavelet Transforms (DWT)

} Depending on time

3b. Multidimensional Digital Signal Processing

- Image Processing

} Depending on time
Examples in lectures

Pre-requisites

1. Signals & Systems (EENG 21000)

- Some necessary maths
- Laplace transforms & Analogue filters
- Z transforms & Digital Filters



Read Course Handout
Pages 2 to 9



Read Course Handout
Pages 10 to 11



Read Course Handout
Pages 11 to 13

References and brief revision when necessary

Reading List

1. **Lecture Slides** - Everything that you need to know
2. For more or other explanations
 - Course handout
 - Books
 - Blackboard

Reading List - Books

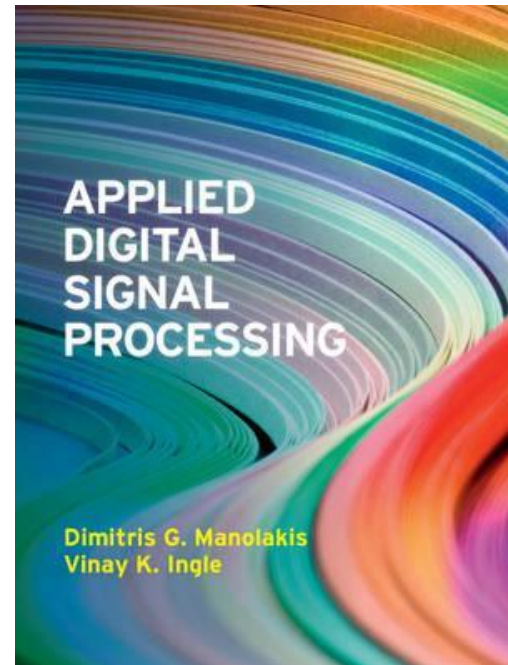
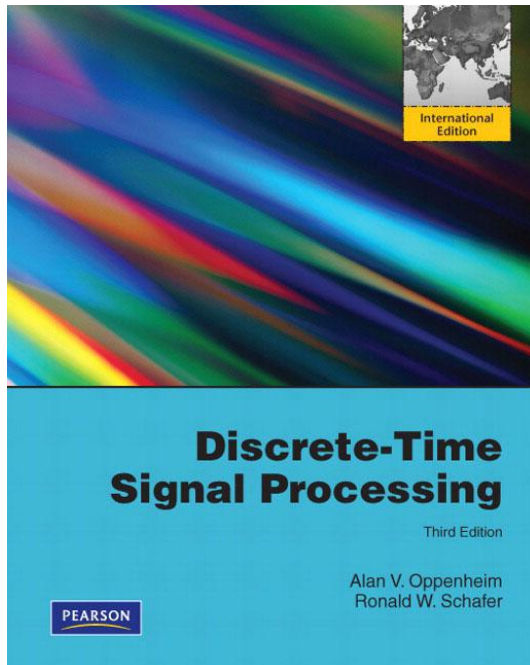
- E. Ifeachor and B. Jervis, 'Digital Signal Processing: A Practical Approach', Addison Wesley
- J. Proakis and D. Manolakis, 'Digital Signal Processing: Principles, Algorithms and Applications', Macmillan
- B. Mulgrew, P. Grant and J. Thompson, 'Digital Signal Processing Concepts and Applications', Macmillan
- C.T.Chen, 'Digital Signal Processing: Spectral Computation and Filter Design' Oxford University Press.
- P. Lynn and W. Fuerst, 'Introductory Digital Signal Processing with Computer Applications (2e)', Wiley.
- S. Mitra, 'Digital Signal Processing. A Computer Based Approach', McGraw Hill

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Reading List - Books – If I had to choose two....

- Alan. V. Oppenheim, Ronald W. Schafer '[Discrete Time Signal Processing](#), Pearson Education
- Dimitris G. Manolakis, Vinay K. Ingle, '[Applied Digital Signal Processing](#)', Cambridge



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Blackboard

The screenshot displays the Blackboard learning management system interface for the University of Bristol. The top navigation bar includes links for 'My Places', 'MyBristol', and 'Logout'. Below this, a secondary navigation bar features 'Home', 'Help', 'Courses', 'Content', and 'Personal Learning Space'. The main content area is titled 'Lecture 02: The Fourier Series' and includes sub-sections for 'Build Content', 'Assessments', and 'Tools'. The 'Lecture 02 Slides : The Fourier Series' section is expanded, showing a list of items with their availability and tracking status. A sidebar on the left provides a quick navigation menu for various lecture topics.

University of BRISTOL Blackboard

My Places MyBristol Logout

Home Help Courses Content Personal Learning Space

Help

Lecture 02: The Fourier Series
Availability: Item is not available. It will be available on 11/11/2023 at 12:00:00 AM.
Enabled: Statistics Tracking

Lecture 03: The Fourier Transform
Availability: Item is not available.

Lecture 04: Sampling
Availability: Item is not available.

Lecture 05: The Discrete Time Fourier Transform
Availability: Item is not available.

Lecture 06: Discrete Time Sampling
Availability: Item is not available.

Lecture 07: The Discrete Fourier Transform
Availability: Item is not available.

Lecture 02: The Fourier Series

Build Content Assessments Tools

Lecture 02 Slides : The Fourier Series
Enabled: Statistics Tracking
Attached Files: Lecture 02 - The Fourier Series.pdf (2.066 MB)

Further Reading
Enabled: Statistics Tracking

Matlab & Other Examples
Enabled: Statistics Tracking

Problems & Solutions
Enabled: Statistics Tracking

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Assessment

EENG 31400

Name	Type	% of final mark	Description
Assignment	MATLAB	5	Spectral analysis of audio signal
Assignment	MATLAB	5	Digital filter design
Assignment	MATLAB	5	Digital filtering of audio signal
Terminal Exam	Exam	85	2 hour written paper

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Assessment

EENG M1400

Name	Type	% of final mark	Description
Assignment	MATLAB	5	Spectral analysis of audio signal
Assignment	MATLAB	5	Digital filter design
Assignment	MATLAB	5	Digital filtering of audio signal
Assignment	MATLAB	5	Phase correlation for watermark detection
Terminal Exam	Exam	80	2 hour written paper