



The
University
Of
Sheffield.

Electronic &
Electrical
Engineering.

EEE6209 ADVANCED SIGNAL PROCESSING

Credits: 15

Course Description including Aims

This unit focuses on introducing advanced signal processing methods and technologies and their applications. The aims are:

1. Provide an understanding of advanced filter design concepts and applications.
2. Extend filter design into scenarios where sampling rate conversions, filter bank and adaptive filtering are required.
3. Develop the concept of transforms.
4. Develop the concept of random signals and their analysis and apply them to the area of adaptive filtering with various applications.
5. Introduce the general area of array signal processing and study basic techniques for beamforming.

Outline Syllabus

Multi-rate signal processing, filter bank theory, signal transforms, random signal analysis, adaptive filtering theory and array signal processing. The coursework component of this unit aims to provide an understanding of using software tools, such as MATLAB, in solving problems and implementing simple signal processing algorithms.

Time Allocation

36 lectures plus additional 12 hours of additional support material.

Recommended Previous Courses

Digital signal processing.

Assessment

2 hours formal examination 3/4 questions (70%) plus coursework based assessment (30% - 2 assignments of 15%.)

Recommended Books

1. Digital Signal Processing : Concepts and Applications -- Mulgrew, Grant and Thompson.
2. Digital Signal Processing - J. Proakis & D. Manalokis (Prentice Hall).
3. Wavelets & Subband coding -- M. Vetterli & J. Kovacavic. (available online at <http://www.waveletsandsubbandcoding.org/>)
4. Discrete-time Signal Processing – A. Oppenheim and R. Schafer
5. Wideband Beamforming: Concepts and Techniques, W. Liu and S. Weiss

Objectives

By the end of the unit, a candidate will be able to demonstrate the ability to:

1. Carry out filter design and implementation for sampling rate conversions including decimation (d), interpolation (i), and a rational factor (i/d).
2. Understand the polyphase representations of filter banks, formulate different filter bank design provide the corresponding solutions and application of designing wavelet transforms.
3. Understand the concept of transforms, design, implement and use signal transforms in various applications.
4. Perform simple analysis and compute statistics of random signals.
5. Understand the Wiener filter solution and the least mean square type adaptive algorithms and apply them to solve adaptive filtering problems.
6. Have a general knowledge about the area of array signal processing and understand some basic beamforming techniques.
7. Use MATLAB in designing and implementing the above concepts and using them in suitable applications.