ENEL 420 **Assignment 2** **2018**

Submission and marking:

Submit a progress report due by 5 p.m. on **Wednesday 12 September** using the Learn upload facility.

Demonstrate your project during the week commencing **8 October** (times to be arranged).

Submit a final report by **5pm on Friday 19 October** using the Learn upload facility.

This project is worth 30**%** of your final mark: 5% for the progress report, 10% for the demonstration and 15% for the final report.

Description:

The assignment is to be done in groups of two (same groups as for Assignment 1). Each group submits a single report.

You investigate the specific topic assigned to your group, choose an application to illustrate the topic, and develop a demonstration (one demonstration per pair) of the topic and application. The presentation should be at a level suitable for an "average" final year student.

As part of the project you should

- Develop an in-depth understanding of the theory behind the topic
- Discuss some typical applications
- Choose a particular application and implement it using MATLAB and/or Python
- Obtain some results from the simulation
- Evaluate the topic and results by, for example, making comparisons with alternative techniques, discussing the effects of different parameters, discussing different properties or tradeoffs.

The **progress report** should include a description of the topic, the application you have chosen and a plan for the rest of the project. The progress report should be a PDF and not exceed 4 pages.

Each group presents their **demonstration** in CAE2 during a 10-minute period (times will be arranged the previous week). Make sure that you have the demonstration ready to go on time (ten minutes goes very fast).

In the **final report** you should show your understanding of the theory and give an overview of the range of applications. You should then describe your chosen application, describe your implementation, and present your results. Use your results to discuss characteristics of the method, advantages and disadvantages of the technique, comparison with other techniques, etc. A simple regurgitation of course notes or passages from a book is not sufficient, and use of the library is important (the *IEEExplore* database should be especially useful). It is likely that better marks will gained by straightforward demonstrations presented and explained well than by complicated systems that are poorly presented and explained. The report should be machine printed and not exceed 15 pages in total. Make sure that you include references that are cited in the report. Your MATLAB or Simulink code itself should NOT be included in the report.

Possible applications

Some possible applications are listed below but there are many others. You may choose from these or come up with a suitable alternative.

Ripple control over power system networks	Digital telemetry
Data transfer over communications channels	SONAR or ultrasound imaging
Medical imaging or medical image processing	Hearing aid technology
Digital audio (CD, MP-3)	Optical communications
Harmonic analysis of power systems	Processing medical signals (ECG, EEG, …)
Digital radio or television	Digital telephony
Signal compression	Speech processing

Consider the following in preparing your demonstration and final report:

Quality of technical content and understanding of the topic: You need to demonstrate a clear and thorough understanding of the topic given. Keep in mind that if the marker cannot understand what you are saying they can only assume that you don't understand either.

Appropriateness of the application chosen to illustrate the topic and understanding demonstrated of the role of signal processing: Many people gain understanding by examples. Your task is to choose an application wisely and use it to "bring the topic alive".

MATLAB/Python demonstrations: The demonstrations should accurately and clearly demonstrate the principles involved.

Quality of written report and overall impression: The material used in the report should be presented in such a way that it would be easy for the "average" final year student to understand.

Topics (Groups are those for Assignment 1):

	Group
Genetic algorithms in signal processing	1
Deconvolution of images	2
Image representation and compression using the DWT	3
Reconstruction from projections (tomography)	4
Projections onto convex and nonconvex sets	5
Applications of the amplitude and phase of the 2D Fourier transform	6
Phase retrieval	7
Iterative projection algorithms	8
Signal feature detection using the wavelet transform	9
Point-spread-variant blurring and recovery methods	10
Maximum likelihood estimation of signal parameters	11
Bandpass sampling and its practical limitations	12
Non-linear quantization	13
Use of different window functions for the window method of FIR filter design	14
Finite precision effects in FFT computation	15
Spline signal interpolation	16
Lattice filters	17
Signal aliasing and anti-aliasing filters	18
Narrowband bandpass filtering with multirate methods	19
Designing IIR filters for minimum sensitivity to coefficient quantisation	20
Using up- and down-sampling to change the timing of samples	21