EEE 5286 Biosignal Processing

Credits: 3 credits

Textbook, title, author, and year: Bioelectrical Signal Processing in Cardiac and Neurological Applications by Leif Sornmo and Pablo Laguna. Elsevier Academic Press, ISBN: 978-0-12-437552-9, 2005.

Reference materials:

M. Rangayyan, Biomedical Signal Analysis: A Case-Study Approach, 1st Edition IEEE and Wiley, 2002
A.V. Oppenheim and A.S. Willsky with S. Hamid, Signals and Systems, 2nd Edition, Prentice Hall, 1996.
A.V. Oppenheim and R.W. Schafer with J. Buck, Discrete-Time Signal Processing, 3rd Edition, Prentice Hall, 2010.
Demonstration of work will be done with synthetically generated waveforms and real data, which is available from the public database: http://www.physionet.org/

Specific course information:

Catalog description:

This course covers the generation of bioelectrical signals, their acquisition, modeling and analysis. Modeling and analysis tools cover adaptive filtering, time-frequency analysis, model-based spectral analysis, stochastic signals, and signal representation in orthogonal bases: wavelet transforms. The physiology of electrical signal generation covers ionic transport in cellular membranes and propagation of electrical signals in cells and tissues. The range of biomedical signals covered includes such common signals as the electroencephalograms, evoked potentials, electromyograms, electrocardiograms. The students write MATLAB codes to perform common signal analysis such as filtering, autocorrelation and covariance, Fourier-based spectral analysis, the short-time Fourier transform, and noise reduction.

Prerequisites: EEL 4656 Analysis of Linear Systems or permission of instructor.

Specific goals for the course:

This course provides a comprehensive overview of techniques of processing bioelectrical signals. It is problem-based and programming oriented. Students are expected to code in MATLAB at a level where they can use programming to verify and demonstrate concepts. Demonstration of work will be done with synthetically generated waveforms and real data.

Brief list of topics to be covered:

- Basics of Bioelectrical Signals
- The Electrocardiogram Signal Processing
- ECG Signal Processing
- Evoked Potentials
- The Electroencephalogram
- EEG Signal Processing
- The Electromyogram