ECE 57500 - Bioelectromagnetism, Modeling and Simulation Methods

Type of Course
Graduate Course

Catalog Description
Fundamental physical knowledge and electrostatic and magnetic field equations. Fundamentals of bioelectromagnetism. Bioelectric sources and conductive environment. Electrodynamics of bioelectrical fields. Concepts of bioelectrical and biomagnetic measurement. Measurement methods, modeling and simulation techniques.

Credits
3

Contact Hours
1

Prerequisite Courses
ECE 31100 or equivalent courses OR instructor approval

Textbook
Jaakko Malmivuo and Robert Plonsey, Bioelectromagnetism - Principles and Applications of Bioelectric and Biomagnetic Fields. New York, Oxford University Press 1995.

Course Objectives
Provide a fundamental understanding of the theory of an electric and magnetic field and illustrate an origin and a propagation of the electromagnetic fields in a living organism. To inform students about modelling and simulation of these fields and sources.

Course Outcomes

Students who successfully complete this course will have demonstrated
1. Fundamental understanding of electric and magnetic fields [1]
2. Fundamentals of wave reflection, transmission [1]
3. Understanding of waves propagation in a living organism [1]
4. Understating of bioelectromagnetic fields and sources [1]
5. Familiarity with bioelectromagnetic measurement methods [1]
6. Familiarity with modeling and simulation methods [1]

Lecture Topics
1. Basic physics attainments and equations.
2. The electromagnetic field, current and stationary magnetic field.

3. The non-stationary field, the electromagnetic waves.
4. The electrodynamics of moving mediums.
5. Application of theory of electromagnetic field in the biology.
6. Anatomical and physiological primer of bioelectromagnetism.
7. Bioelectric sources and conducting medium.
8. Integral equations of electrodynamics of bioelectric fields.
9. Electrodynamics aspects of mathematical modelling of electrocardiography.
10. A topological conception of bioelectric measurement.
11. A topological conception of biomagnetic measurement.
12. Methods and techniques of measurement.
13. An electric and a magnetic stimulation.
14. Modeling and Simulation Methods
15. Computer Usage
16. Medium

Laboratory Experience

None

Design Experience

Medium

Coordinator

Guoping Wang

Date

September 30, 2018