Biomedical Systems Modeling & Simulation

Classes: Tuesday & Thursday, 15:00-16:15 P.M.

Units: 3

Lecture Room: #227

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Lecture Homepage: **web.khu.ac.kr/~tskim**

Class Goals:

The aim of this course is to teach the fundamentals of computer modeling and simulation of biomedical systems and more. Focuses are given on mathematical modeling of biomedical systems such as cardiac and respiratory systems, electrophysiology of neurons, medical computed tomography, etc. Computer programming and simulations are practiced under various subjects of simulation projects. After the course the student will be able to:

- Derive mathematical models of biological, medical, biomedical systems, and AI.
- Implement mathematical models into computer programs.
- Simulate biomedical systems on a computer and perform analysis
- Carry out experiments through computer simulations
- Extend the concept of modeling and simulation into other biomedical systems.

Text Book: Modeling and Simulation in Medicine and the Life Sciences, F. C. Hoppensteadt & C. S. Peskin, Springer, 2004

Prerequisites: Linear Algebra, Signals and Systems, Differential Equations, Digital Signal Processing, Basic Human Physiology, Neural Science, Neural Physiology

Lectures

Week 1: Introduction to Biomedical Systems Modeling
Week 2: Introduction to Matlab
Week 3: Modeling Methodology
Week 4: Parameter Models and Estimation
Week 5: Scientific Report Writing
Week 6: Compartment Modeling: Drug Kinetics and Kinetic Modeling
Week 7: Heart and Circulation: Mathematical Models of the Heart and Blood Vessels; Simulation of Aortic Vessel Pressure
Week 8: Midterm Exam
Week 9: Neurons: Action Potentials
Week 10: Neural Systems: Hodgkin-Huxley Equations and Simulation of Neurons
Week 11: Modeling of Imaging Systems I: Projections and Image Reconstruction
Week 12: Modeling of Imaging Systems II: Projections and Image Reconstruction
Week 13: Simulink: Dynamic Simulation of Biomedical Systems
Week 14: Basics of AI I
Week 15: Basics of AI II
Week 16: Final Exams

Homework: Matlab Coding and Simulation Projects

Exams and Evaluations: Attendance (10%), Midterm (20%), Final (20%), Projects & Reports (50%),