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강연제목: 멀티스케일 모델링을 활용한 신경 조절 기술의 시뮬레이션 연구

Simulation Study of Neuromodulation Techniques Using Multiscale Modeling

Abstract:

Neuromodulation involves targeted regulation of brain activity using techniques like electric and focused ultrasound stimulation. These techniques can be optimized by customizing stimulation parameters and targeting neural networks, though uncertainties and incomplete mechanistic understanding persist. Computational models are essential for exploring a wider range of stimulation parameters and understanding experimental work. Previous studies used head models from medical images to estimate activation levels via electric fields. Multi-scale computational modeling integrates macroscopic and microscopic models, using cortical neuronal models and head model calculations to simulate neural responses. Recent models use neuronal networks to study neuronal oscillations induced by tACS. Low-intensity focused ultrasound (LIFU) has been explored for its higher spatial resolution and penetration depth. Multi-scale models for LIFU simulate neuronal activation and microbubble dynamics, categorizing oscillations into stable and inertial cavitation. These models combine a nonlinear cavitation equation with 3D acoustic simulations, considering skull anatomy and transducer structure. This presentation discusses multi-scale modeling in various brain stimulation types.

Brief Biosketch

2022.03 ~ Current: Assistant Professor, School of Computer Science and Engineering, Gyeongsang National University

2019.05 ~ 2023.02: Researcher, Medical Device Development Center , Daegu Gyeongbuk Medical Innovation Foundation (DGMIF)

2013.03 ~ 2017.02: Ph. D. in School of Electrical Engineering and Computer Science, Gwangju Institute of Science and Technology

Research interest: Neuromodulation, Electrical/Magnetic/Ultrasound brain stimulation, Neuronal modeling, Multi-scale modeling, Simulation