

Teachers:

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Student assignments:

MSc project assignment

Educational program:

Biomedical Engineering, Electrical Engineering

Topics:

Brain-computer interface, neuromodulation, microcontroller

Required pre-knowledge:

Basics of microcontrollers, programming in MATLAB & C

Introduction:

Large-scale synchronization of brain activity is considered essential for neurophysiology, and is often found altered in pathology like Parkinson's disease. Neuromodulation approaches, including electric stimulation, are capable to modulate such connectivity, but typically focus on one target in the brain. Simultaneous, synchronized stimulation of two remote brain areas may be an important step towards controlled manipulation of specific large-scale networks.

Specifically, targets deeper in the brain can be stimulated invasively via deep brain stimulation (DBS), whereas superficial layers of cortex may be targeted via transcranial alternating current stimulation (tACS). Coupling DBS and tACS in a brain-computer interface would allow a network stimulation of the cortico-subcortical axis which is thought to be highly relevant to Parkinson's.

Assignment:

- Development of a software phase-locked loop (PLL) to couple DBS and tACS.
- Test of the software PLL using commercial stimulation hardware in a phantom.
- If feasible, test of the setup in a patient with implanted DBS leads.

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