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Differential activation of peripheral nerves using low frequency alternating current block combined with stimulation

Novel alternating-current stimulation method achieving deep-first nerve activation without lidocaine or invasive implants.

Researchers at Purdue University have developed a system and method for differential activation of peripheral nerves. When delivering a neuromodulatory waveform, the region of the highest current density will be in the immediate vicinity of the delivering electrode. For circumferential electrodes, this means that superficial fibers will experience the greatest current densities and therefore the greatest changes in polarization, leading to a spatial recruitment order of outside-in.

Purdue researchers have developed a method of inverting the spatial order to inside-out by combining a blocking and activating waveform. As the blocking waveform is most effective in the periphery, the center of the nerve is significantly less desensitized. This allows a pathway to deep-first selectivity if the activating waveform is equally or less superficial fiber selective than the blocking waveform. Further research may allow this technology to eliminate the need for lidocaine or substantially reduce the need for invasive implants

Technology Validation:

Finite Element Method volume conductor simulations of Low Frequency Alternating Currents were delivered. McIntyre-Richardson-Grill fiber model determined the pulse activation threshold.

Advantages:

-Deep-first selectivity

-Desensitizes periphery

-Inside-out special order

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Category
Digital Health & Medtech/Implantable Medical Devices

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Applications:

-Neuropathy

Publications:

1. N. Lazorchak, A. Alhawwash, and K. Yoshida, â€œIn-silico demonstration of center-selective neural activation in peripheral nerves with circumferenceial electrodes using combined puls and low frequency stimulation waveforms",â€ RehabWeek 2025, Chicago, IL, USA.

2. A. Alhawwash, M. R. Horn, N. Lazorchak, and K. Yoshida, â€œCharacterization of motor nerve stimulation using sinusoidal low frequency alternating currents and cuff electrodes,â€ J. Neural Eng., vol. 22, no. 1, p. 016035, Feb. 2025, doi: 10.1088/1741-2552/adafdc.

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