

Electrical Charge Balancing Scheme For Functional Stimulation Using Pulse Width Compensation

Tech ID: 30167 / UC Case 2013-304-0

SUMMARY

UCLA researchers in the Department of Bioengineering have developed a novel electrical charge cancellation scheme to effectively remove residual charge on an electrode, achieving greater precision for lesser hardware cost, while maintaining a surgically implantable small size without extra pulse insertion.

BACKGROUND

Functional electrical stimulation is a method adopted by many biomedical implants to restore function to tissues in the human body. This technique involves stimulating tissue with an electrical current to evoke action potentials across neurons. Balancing charge is critical for the safe implementation of the respective implants, since a net residue charge can severely damage tissue and the electrodes. Current solutions for balancing charges have been suboptimal due to their limited precision in amplitude and time, requirement of a large capacitor, or need for extra balancing pulses to raise effectiveness. However, these methods can raise safety concerns, further supporting the need for a calibration method with increased precision within a compact size.

INNOVATION

UCLA researchers have developed a novel electrical charge cancellation scheme to effectively remove residual charge on the electrode by precisely controlling either the width of the anodic or cathodic current stimulus. This approach doesn't require additional short pulses, which are required for a DC capacitor, and allows for high precision net charge and timing control without increasing hardware size. Furthermore, this scheme is effective even if Warburg resistance is significant.

APPLICATIONS

- ▶ Neural stimulation devices
- ▶ Electrode array design
- ▶ Electrode-tissue interface

ADVANTAGES

- ▶ Greater precision
- ▶ Less hardware cost
- ▶ Safe, surgically implantable size
- ▶ No extra pulse required

RELATED MATERIALS

- ▶ Lo, Yi-Kai, Richard Hill, Kuanfu Chen, and Wentai Liu. "Precision control of pulse widths for charge balancing in functional electrical stimulation." In Neural Engineering (NER), 2013 6th International IEEE/EMBS Conference on, pp. 1481-1484. IEEE, 2013.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,700,724	07/11/2017	2013-304

CONTACT

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INVENTORS

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OTHER INFORMATION

KEYWORDS

charge balancing, circuit, neural stimulation, residual charge, pulse insertion, electrode array, electrode tissue interface, surgical implant, implantable device

CATEGORIZED AS

- ▶ **Biotechnology**
 - ▶ Other
- ▶ **Computer**
 - ▶ Hardware
- ▶ **Engineering**
 - ▶ Engineering
- ▶ **Medical**
 - ▶ Devices
 - ▶ Disease: Central Nervous System
 - ▶ Disease: Musculoskeletal Disorders
 - ▶ Therapeutics
- ▶ **Sensors & Instrumentation**
 - ▶ Medical

RELATED CASES

2013-304-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Flexible Stretchable Electrode And Recording Method For Gastrointestinal Prostheses](#)
- ▶ [Methods Of Fabricating A Multi-Electrode Array For Spinal Cord Epidural Stimulation](#)
- ▶ [Selective Chemical Bath Deposition of IrOx on Thin Film Structure](#)
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