Saturation-Tolerant Electrophysiological Recording Interface

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SUMMARY

Researchers at UCLA have designed an electrophysiological signal processing device that can measure EEG, ECG, and EMG signals with high sensitivity in noisy environments that would otherwise drown out weak signals.

BACKGROUND

Weak electrophysiological input signals (EEG, ECG, EMG) are often detected by digitizing them using a large voltage gain in order to achieve a low background noise level. However, in noisy environments, the loud signals from motion artifacts, unrelated biological signals, or man-made interferers saturate the input signal. The saturation of the input signal in noisy environments prevents any hope of detecting and recording weak electrophysiological signals.

INNOVATION

UCLA researchers from the department of electrical engineering have designed a signal processing device that allows the recording of weak electrophysiological signals in the presence of large signals. This is accomplished by using a voltage-controlled-oscillator-based analog-to-digital converter to digitize the input signal utilizing a voltage-to-phase gain. This provides a saturation-free input range that permits the detection and recording of weak signals without having loud recordings saturate the signal.

APPLICATIONS

- Electrophysiological recording device
- Sleep EEG monitoring system
- Neural recording system

ADVANTAGES

- The signal does not saturate in the presence of other loud signal artifacts
- Weak electrophysiological signals can still be detected

STATE OF DEVELOPMENT

An on-chip system has been developed that shows a 20x improvement for saturation tolerance over existing systems of similar power, noise, and area. Performance improvements are underway, as well as the development of a complete system-on-a-chip for remote healthcare sensing applications.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,925,503	02/23/2021	2014-404
Japan	Issued Patent	6567518	08/09/2019	2014-404

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

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OTHER INFORMATION

KEYWORDS

electrophysiology, EEG, ECG, EMG, digital, signal, analog, ADC, voltage, phase, saturation, biosensor, remote, wireless, halthcare, emergency, sensitivity

CATEGORIZED AS

- **Medical**
  - Devices
  - Research Tools
- **Sensors & Instrumentation**
  - Biosensors
  - Medical
- **Engineering**
  - Other

RELATED CASES

2014-404-0

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- Electrode Agnostic, Supply Variant Stimulation Engine For Implantable Neural Stimulation
- A Simple, Area-Efficient Ripple-Rejection Technique for Chopped Bio-Signal Amplifiers
- A Distance-Immune Low-Power Inductively-Coupled Bidirectional Data Link

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