URN etd-0407109-183705-371
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Statistics This thesis had been viewed 36 times. Download 0 times.
Department
Year 2003
Semester 2
Degree Master
Type of Document Master's Thesis
Language zh-TW.Big5 Chinese
Title Design and Implementation of an Automatic Measurement System for Neuron-Microelectrode Interface
Date of Defense 0000-00-00
Page Count 74
Keyword
Microelectrode
Impedance Measurement
Stimulation
Potential Recording

Abstract
The goal of this paper is to develop an automatic measurement and analysis system of neuron-microelectrode interface by LabVIEW. The interfacing platform is constructed by a commercial 60-channel microelectrode array (MEAs) (made by Multichannel Systems Co) connecting with a self-developed connection mount. The selected neurons are the differentiated PC-12 cell, which are used after culturing with nerve growth factor (NGF). This system contains four units: (1) Interface impedance measurement unit: It uses an Agilent 4284A LCR meter and a connected GPIB card to complete the measurement and display. (2) Neuron stimulation unit: This unit has multiple stimulation waveform generations, which includes bi- or mono- phasic pulse waveforms. According to the results of impedance measurement, we can calculate the necessary threshold voltage of stimulation for activating neuronal spike. (3) Neuron potential recording unit: The recorded neuronal signals passing through the connections of the MEAs are amplified sufficiently by a self-developed analog front-end. Then, these signals are digitalized by NI DAQ card for further analysis and storage. (4) Off-line signal analysis unit: Its functions include wavelet de-noising, stimulus artifact suppression, and spike detection. By way of the completeness of the systematic setup and the neuronal culturing technology, we have well finished the systematic functional verifications such as the impedance properties of interfaces of microelectrode-microelectrode, microelectrode-medium, and microelectrode-neuron, the spontaneous and spike potential detections, and the pre-described neuronal signal analysis. Meanwhile, related signal database is also developed.
Advisory Committee Chih-Kuo Liang - advisor

Files No Any Full Text File.
Date of Submission 2004-07-08