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DESIGN AN OPERATIONAL AMPLIFIER FOR NEUTRO CHEMICAL SENSOR

BY

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ABSTRACT

This project needs to design an operational amplifier (op-amp) for neutron chemical sensor. The op-amp is amplifying the input current in nanoampere (-800nA to 800nA) and converts the signal into voltage. This low power amplifier designed with high gain and high sensitivity because output current from neutron chemical sensor very small. The designed consists combination of current amplifier, differential amplifier, voltage amplifier, class AB power amplifier and high sensitivity current-to-voltage converter. The low power amplifier output should capable to drive the voltage-to-frequency converter (VFC). This op-amp is a part of the main project the wireless voltammetry recording in unaesthetized behaving rats. Vivo voltammetry is a valuable technique for rapid measurement of dopamine in the brain of freely behaving rats. Using a conventional voltammetry system, however, behavioral freedom is restricted by cables connecting the head assembly to the measurement system. This system consisted of a potentiostat and transmitter system activation pulse to a carbon fiber recording electrode where the process would produce the signal and then the op-amp converts the signal into voltage before convert the signal into frequency by VFC. The Multisim8 design tool software is used to design and simulate the op-amp circuit.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The design used a low power operational amplifier as one of sub components in the voltammetry system. Low power means that the voltage and current supplies to the op-amp is very low to make it operate. The op-amp is apart of the voltammetry system. The op-amp is use to convert current into voltage where the current produced by neutron chemical sensor. The neutron chemical sensor build of three electrodes, recording electrode, reference electrode and auxiliary electrode where it function to measure concentration of the chemical in the brain.

The project used the dopamine as the reference chemical for analysis. Dopamine is one of the chemical in the human brain to detect Parkinson disease. The neutron chemical sensor is the measurement part of the voltammetry system. The project focuses on design the vivo voltammetry system that uses to measure dopamine in the brain of the freely moving rats. In history, the system is not the new system. There are several teams have created the system but still bulky and need to be improve. In vivo voltammetry system is where considering the real conditions and environment.

In vivo voltammetry has become a powerful method of recording changes in extracellular transmitter concentration in unrestrained animals [4], allowing examination of amounts of extracellular transmitter similar to microdialysis, but with higher time resolution, recent increase in time resolution and demonstration of stable recording over very long-term studies [5]. One of the remaining limitations with both conventional voltammetry and microdialysis is the presence of cables connecting the head assembly to the measuring system [1].