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Design of a reconfigurable, modular and multi-channel bioimpedance spectroscopy system (Article)

Al-Hashimi, A., Nordin, A.N., Azman, A.W.

Department of Electrical and Computer Engineering, Kulliyah of Engineering, International Islamic University Malaysia, Jalan Gombak, Kuala Lumpur, Malaysia

Abstract

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This paper presents the design and implementation of a multichannel bio-impedance spectroscopy system on field programmable gate arrays (FPGA). The proposed system is capable of acquiring multiple signals from multiple bio-impedance sensors, process the data on the FPGA and store the final data in the on-board Memory. The system employs the Digital Automatic Balance Bridge (DABB) method to acquire data from biosensors. The DABB measures initial data of a known impedance to extrapolate the value of the impedance for the device under test. This method offers a simpler design because the balancing of the circuit is done digitally in the FPGA rather than using an external circuit. Calculations of the impedance values for the device under test were done in the processor. The final data is sent to an onboard Flash Memory to be stored for later access. The control unit handles the interfacing and the scheduling between these different modules (Processor, Flash Memory) as well as interfacing to multiple Balance Bridge and multiple biosensors. The system has been simulated successfully and has comparable performance to other FPGA based solutions. The system has a robust design that is capable of handling and interfacing input from multiple biosensors. Data processing and storage is also performed with minimal resources on the FPGA.

Author keywords

Bioimpedance spectroscopy (BIS) Digital auto balance bridge (DABB) Field Programmable Gate Array (FPGA) Multichannel data acquisition

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