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A fast measuring device for impedance spectrum of lithium-ion battery based on FPGA

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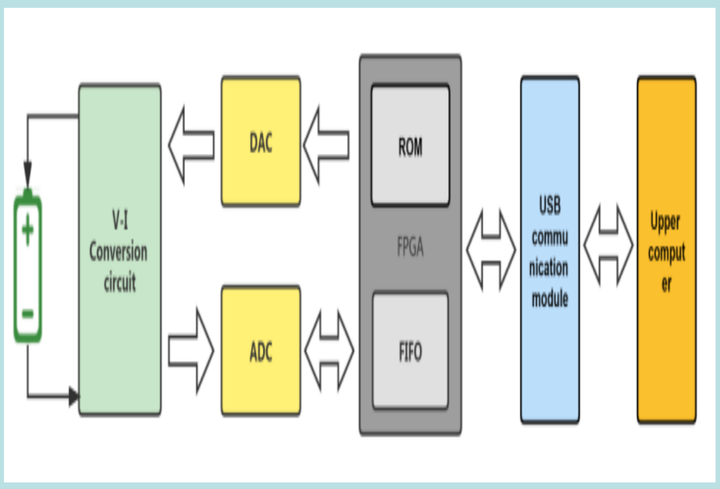
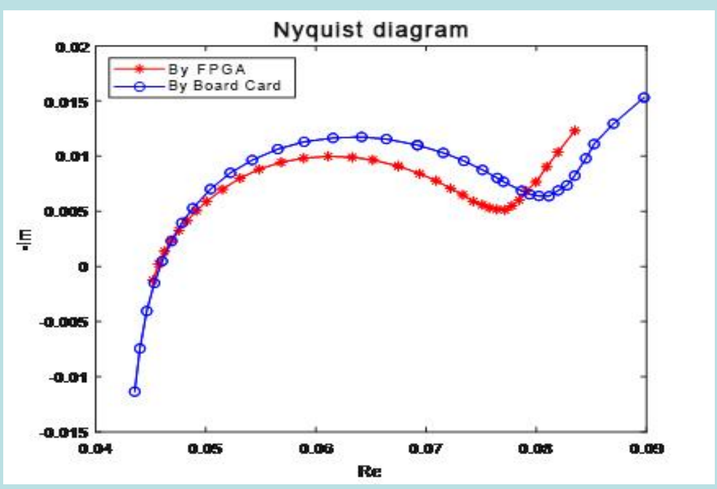
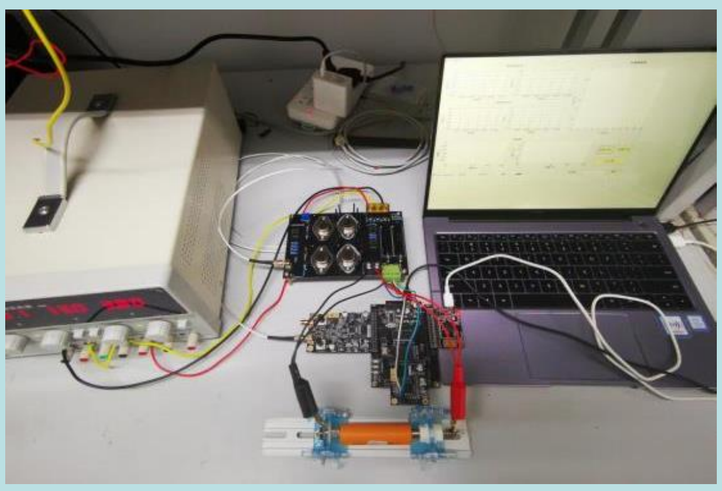
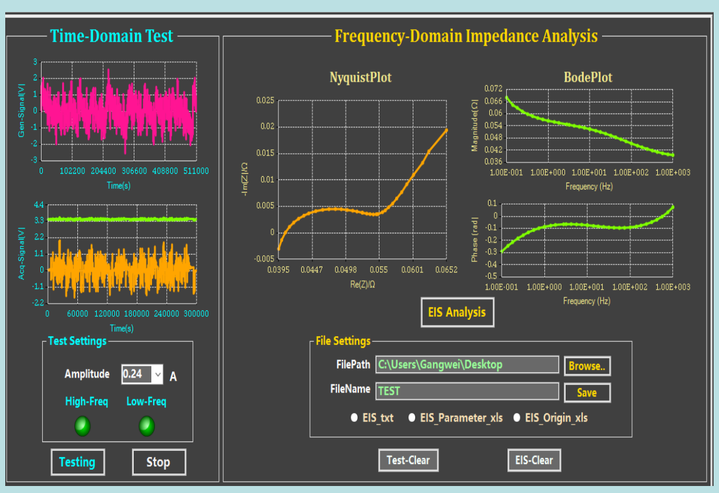
FPGA control logic modular design & Software upper computer development









Overall system process & Experimental setup & System measurement results

Aiming at the application of EIS in lithium-ion battery measurement, this project designs a FPGA-based time-domain test device using a fast Fourier transform method to achieve fast and low-cost impedance spectroscopy measurement:

• System design

The FPGA control logic consists of instruction resolution module, system control module, clock and frequency division module, waveform generating module, data acquisition module, cache module and communication module.

• Experimental design and verification

The measurement system designed consists of FPGA control system, D/A chip, A/D chip, USB communication chip, software and V-I conversion circuit. The FPGA control system provides a superimposed sine voltage signal for the V-I conversion circuit by controlling the D/A chip, and collects the voltage excitation and current excitation signal of the battery by controlling the A/D chip; the computer software transmits and the FPGA control system through the USB communication chip; the V-I circuit converts the superimposed sine voltage signal into a current signal to provide current excitation for the battery.

Summary

This paper proposed a design of FPGA-based fast measurement device for lithium-ion battery, which meets the function of impedance spectrum measurement, and has the advantages of low cost and fast measurement compared with the existing measurement device. The design can be further used for health and safety state monitoring of batteries.