

Study on miniaturization and acceleration of onboard digital signal processing module for plasma wave instruments

KASAHARA, Yoshiya^{1*} ; MATSUI, Hiroki¹ ; GOTO, Yoshitaka¹

¹Kanazawa University

Measuring plasma wave is one of important clues to understand space plasma physics, and it is necessary to implement intelligent signal data processing techniques into the plasma wave instruments. It is necessary to reduce the weight and size of the instruments to meet the requirements of future missions such as flying formation satellites and planetary exploration spacecraft. In the present study, we developed a FPGA board, which enables us to develop arbitrary digital signal processing applicable for the future missions.

Our FPGA board is designed to evaluate the performance of signal processing module, which is especially used for various kinds of real-time signal processing. The board consists of one CPU connected with a USB port, and two sets of FPGA and DDR2. One set of FPGA and DDR2 is equipped for storing input signal data and sending them to another one, which is used for the evaluation of real-time data processing module and storage of output data. The input and output data stored in the DDRs can be accessed from the onboard CPU, and we can easily control the CPU using Tera Term through a USB port. We also developed a general purpose module for evaluation of a proposed signal processing method. By using this module, a developer can integrate his/her own signal processing module on the FPGA board without any complicated wiring work for the peripheral circuits and evaluate the performance of his/her own module. Finally we implemented a sub-band compression module developed for real-time data compression of waveform measured by the plasma wave instruments. It was demonstrated that the designed module is compact and fast enough to realize real-time processing for 6 channels of waveform data.

Keywords: Waveform capture, Verilog-HDL, Plasma wave instruments, Signal processing