

Development of Reconfigurable Analog and Digital Circuits for Plasma Diagnostics Measurement Systems

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In long pulse discharge tokamak, a large number of diagnostic channels are being used to understand the complex behavior of plasma. Different diagnostics demand different types of analog and digital processing for plasma parameters measurement. This leads to variable requirements of signal processing for diagnostic measurement. For such types of requirements, we have developed hardware with reconfigurable electronic devices, which provide flexible solution for rapid development of measurement system. Here the analog processing is achieved by Field Programmable Analog Array (FPAA) integrated circuit while reconfigurable digital devices (CPLD/FPGA) achieve digital processing. FPAA's provide an ideal integrated platform for implementing low to medium complexity analog signal processing. With dynamic reconfigurability, the functionality of the FPAA can be reconfigured in-system by the designer or on the fly by a microprocessor. This feature is quite useful to manipulate the tuning or the construction of any part of the analog circuit without interrupting operation of the FPAA, thus maintaining system integrity.

The hardware operation control logic circuits are configured in the reconfigurable digital devices (CPLD/FPGA) to control proper hardware functioning. These reconfigurable devices provide the design flexibility and save the component space on the board. It also provides the flexibility for various setting through software. The circuit controlling commands are either issued by computer/processor or generated by circuit itself.

This paper describes the development of hardware for signal processing, implementation of various analog functions with dynamic reconfigurability for a truly flexible analog solution, development of VHDL code for hardware logic, Graphical User Interface (GUI), various design issues and important features of developed hardware from application point of view.