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Error Field Measurement and Processing with FPGA in KTX Active Control System

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In the Keda Torus for eXperiment (KTX) device, it is necessary to suppress error field of slit zone and flange which can improve the quality and stability of plasma discharge. This paper introduced an new active control system which can reduce error field of vertical gap in KTX. The advantage of the active control system was to implement the matrix algorithm calculation using FPGA in real time which has lower latency than implementing it in the software on computer. The system contained 16 Rogowski coils to detect dynamic eddy current signals of copper shells near the vertical gap. The 16-channel signal was digitalized by high-speed ADCs after passing through two-stage amplifiers and high-frequency filtering parts. Then we conducted matrix algorithm calculation in FPGA to get the feedback voltage value from the output of ADCs and stored the results in the DDR2. Finally, the FPGA sends the calculation results to the coil control module through RS-485 or network in real time. Additionally, the matrix parameters of FPGA calculating program were adjusted by the computer through USB or Ethernet. Under the operation of active control system, we made comparison between the measurement result and the magnitude of error field of the original system. Result indicated that the error field of vertical gap in KTX device was reduced, and the system could successfully achieve fast matrix calculation in real time within a few latency.

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