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Advanced Integrator System for KSTAR Magnetic Fusion Device

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The drift self-compensating type analog integrator and impedance buffering pre-amplifier (integrator system) have been installed and characteristics tests of them have been successfully performed for initial magnetic diagnostics (MD) of the first plasma operation in the Korea Superconducting Tokamak Advanced Research (KSTAR) device [1].

The MD has been based on inductive coil sensor in the most magnetic confinement device and tokamk [2, 3]. The 77 MD sensors have been installed and in-situ calibrated for the first plasma operation in the KSTAR device which includes Rogowski coil, five flux loops, one pair of diamagnetic loops, three vessel current monitors and sixty four magnetic field probes.

Figure 1 shows schematic diagram of installed total of measurement system for plasma operation. The measured data through the MD sensor saved in main server after drift of the integrator was subtracted using linear fitting formula. However, drift of the integrator system has about 2 % non-linear. Hence, integrator system should be improved for real time plasma control in next campaign.

The results of drift measurement from the first plasma generation will be presented and discussed.

This work was supported by the Korea Ministry of Science and technology under the KSTAR project contracts.

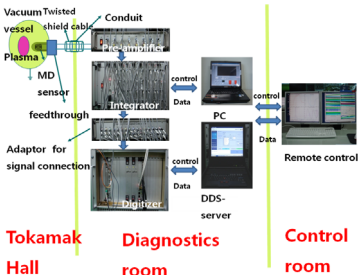

Fig. 1. Schematic diagram of the integrator system with local and remote data acquisition system.

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Sensitivity and Noise of Coaxial Transmission Line Type Magnetic Field Sensor Constructed with Co Base Amorphous Wire

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Co-based amorphous wire with 125 μm in the diameter and 40 mm long was used as an inner conductor of the coaxial transmission line type magnetic field sensor. Complex input impedance of the transmission line was measured up to 3 GHz with longitudinal magnetic field. The first frequency corresponding to 1/4 wavelength of this transmission line length was dependent to applied magnetic field around 250 MHz. The sensitivity, $\triangle Z/(Z0> \cdot \triangle H)$ was over 200 in several tens MHz. Analysis of noise spectrums measured with/without outer conductor was representative of that the proposed sensor was extremely insensitive to external electrical noise due to shielding effect of the outer conductor and confining the field inside the transmission line. Capacitively coupled electrical noise [1] of the transmission line was about 7 % of the bare amorphous wire. Circuit parameters of the transmission line were extracted to explain the sensitivity quantitatively from the measured input impedance, and compared with the numerically computed ones.

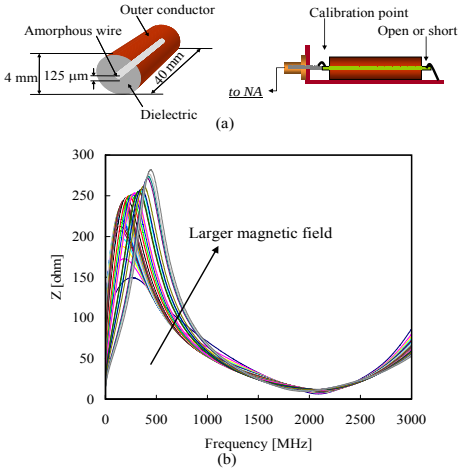

Fig. 1. (a) Schematic view of coaxial transmission line constructed with Co base amorphous wire; (b) Frequency dependency of input.

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