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Development of highly sensitive micro-magnetic sensor for bio-magnetic field measurement utilizing magneto-impedance element

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Magnetization dynamics by pulse excitation in amorphous wire is limited in the surface layer by skin effect due to magnetic rotation. We have constituted highly sensitive linear micro-magnetic field sensors utilizing Off-diagonal Magneto-Impedance (MI) effect. Recently, we have succeeded in producing pico-Tesla (10^{-8} Oe) resolution MI sensors due to ultra-low intrinsic magnetic noise of amorphous wire. Superconducting Quantum Interference Device (SQUID) are ultrasensitive, which have been utilized for producing bio-magnetic signals. For example, Magnetocardiography (MCG) is a non-invasive technology that measures the magnetic field of the heart. It was developed for general-purpose use as a non-invasive, non-contact diagnostic tool for detecting obstructive Coronary Artery Disease (CAD). The SQUID has been also used to measure the human brain signals. The application of brain signals detection was developed in various fields. In medicine, it could be implemented for brain injury inspection, diagnosis of neocortical epilepsy, telemedicine or cognitive functions research. And with advances in sensing technology, neuro-prosthetics applications based on Brain Computer Interfacing (BCI) could be improved and used to restore damaged hearing, sight or movement. In comparison to the SQUIDs, MI sensors are smaller, are of lower cost and there is no need for low temperature operation. The brainwaves of mean N100 and P300 ERP elicited by audio stimuli have been measured by MI sensors. Brainwave measurement results of MI sensor are presented and the results are compared with SQUID's or EEG's results. The measurement results for MCG by MI sensors are also presented.

Biography

Tsuyoshi Uchiyama has completed his PhD in Engineering from Nagoya University. Currently, he is working as an Associate Professor of Intelligent Devices, Department of Electrical Engineering and Computer Science, Graduate School of Engineering, Nagoya University, Japan.

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