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Development of lightweight loop antenna for future space missions

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In space plasma physics, the polarization and wave normal direction provide key information to identify the modes and origins of plasma turbulences. Such broad-band measurements have been made by loop antennas, from 0.1 to 1000 kHz. *Okada et al.* developed a loop antenna system aboard the Akebono satellite (EXOS-D) launched in 1989. The loop was square-shaped with an area of 0.36 m² (0.6 x 0.6 m) and the mass of about 2 kg. The major part of its mass was due to antenna frames.

We have examined lighter loop antennas with CFRP technologies since 2007. It has an area of 0.36 m², which is the same as that of the Akebono antenna. The TWF-CFRP tubes are used as antenna frames. Since the CFRP tube is conductive, it is also used as an electrostatic shield of the loop element. The antenna element is rectangular (0.6 x 0.6 m) open coil with 10 turns each. The weight of the loop antenna was 438 g (frame: 72 g, wire element: 135 g, joint parts: 231g), 1/4 of the original Akebono design. As the next step, we will use CFRP joint parts. In that case, the mass will become half. The folding method of the loop antenna was examined in parallel. Then it will be tested by a model with realistic size. We expect to adopt the new loop antenna system to small-sized space missions for magnetospheric and ionospheric studies. It is also expected in landing missions, as a light sensor to detect radio waves from atmospheric discharges, subsurface radar echo, etc.

Reference

Okada et al., *Tras. IEICE*, Vol. E70, No. 6, 550-561, 1987

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