RETURN LOSS OF SEWN-IN IOOP ANTENNA USING SEWING TECHNIQUE
MASTER THESIS

No.2281241 Soudai Konta
(Supervised by Prof. Shogo Kiryu)

ABSTRACT

One treatment for severe heart disease is the implantation of an assisted artificial heart. Because the ventricular assist device requires a large amount of power for its operation, it is often powered from a power source located outside the body. As a result, the quality of life of the wearer of an artificial heart is restricted by the power source installed outside the body, and the risk of developing infections from skin penetrations is associated with the risk. We thought that this issue could be solved if we could create a wireless power supply system using contactless power transmission. In realizing the wireless power supply system, the system was designed to be used in a hospital room or a room in the home. Therefore, among the many wireless power transmission methods, the radio wave emission type is used, which is relatively stable for transmission over long distances. Another unique feature of this study is the use of Litz wire antennas. Sewn-in antennas are easy to carry and install, and can also be used as auxiliary antennas by sewing them into clothing. However, it has not been demonstrated that a sewn-in antenna with Litz wire can transmit power. Therefore, this study will examine the characteristics of sewn-in loop antennas used to realize wireless power feeding systems and spaces.

We focused on the return loss of the sewn-in loop antenna and evaluated its characteristics.
The electromagnetic simulation software (Femtet) was used to determine the change in frequency response for different shapes of sewn-in loop antennas. The results of the simulation were compared with the frequency response of a sewn-in loop antenna actually fabricated using Litz wire.

In this study, the frequency characteristics of the measured values changed compared to the frequency characteristics of the simulated values. One factor contributing to this is the dielectric constant of the PLA substrate used for antenna fabrication. We considered that the dielectric constant of the PLA substrate affected the frequency response of the loop antenna, resulting in differences from the simulated values performed on free space. This indicates that the ambient environment alters the frequency response of the impedance of the loop antenna. This makes it difficult to use a sewn-in loop antenna of the same shape for the ultimate purpose of installing it in various locations as a transmitting antenna.

The use of a sewn-in loop antenna as a receiving antenna was considered. The results of the study showed that the frequency characteristics of the receiving antenna changed depending on the installed human body, but the change range was small. Therefore, it is possible to use a sewn-in loop antenna as a receiving antenna by considering an antenna shape with a wide bandwidth in which reflection loss is small and by implementing a function to fine-tune the frequency response.