World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:17, No:11, 2023

Coils and Antennas Fabricated with Sewing Litz Wire for Wireless Power Transfer

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Abstract : Recently, wireless power transfer has been developed in various fields. Magnetic coupling is popular for feeding power at a relatively short distance and at a lower frequency. Electro-magnetic wave coupling at a high frequency is used for long-distance power transfer. The wireless power transfer has attracted attention in e-textile fields. Rigid batteries are required for many body-worn electric systems at the present time. The technology enables such batteries to be removed from the systems. Flexible coils have been studied for such applications. Coils with a high Q factor are required in the magnetic-coupling power transfer. Antennas with low return loss are needed for the electro-magnetic coupling. Litz wire is so flexible to fabricate coils and antennas sewn on fabric and has low resistivity. In this study, the electric characteristics of some coils and antennas fabricated with the Litz wire by using two sewing techniques are investigated. As examples, a coil and an antenna are described. Both were fabricated with 330/0.04 mm Litz wire. The coil was a planar coil with a square shape. The outer side was 150 mm, the number of turns was 15, and the pitch interval between each turn was 5 mm. The Litz wire of the coil was overstitched with a sewing machine. The coil was fabricated as a receiver coil for a magnetic coupled wireless power transfer. The Q factor was 200 at a frequency of 800 kHz. A wireless power system was constructed by using the coil. A power oscillator was used in the system. The resonant frequency of the circuit was set to 123 kHz, where the switching loss of power FETs was small. The power efficiencies were 0.44 – 0.99, depending on the distance between the transmitter and receiver coils. As an example of an antenna with a sewing technique, a fractal pattern antenna was stitched on a 500 mm x 500 mm fabric by using a needle punch method. The pattern was the 2nd-oder Vicsec fractal. The return loss of the antenna was -28 dB at a frequency of 144 MHz.

Keywords : e-textile, flexible coils and antennas, Litz wire, wireless power transfer
Conference Title : ICSTT 2023 : International Conference on Smart Textiles and Technology
Conference Location : Tokyo, Japan
Conference Dates : November 13-14, 2023