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Tue-Af-Po2.24-08 [107]: The Modeling and Numerical Simulation for Spherical Vector-Potential Coil

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We propose a model of the spherical vector-potential coil, and we investigate the properties of the coil especially the uniform distribution of vector potential. The model is designed base on a spherical winding which made by the long flexible thin solenoid. When we apply a current to a very long solenoid coil, it creates a magnetic field within the coil only; there is no magnetic field outside the spherical vector-potential coil. On the other hand, outside of the loop, a vector potential is generated in the same direction parallel to a current-carrying conductor. The direction of vector potential is parallel to the spherical axis. In this manner, it points out the equation of similarity of the magnetic flux density and the vector potential. We have the motivation to create a uniform distribution of vector potential along the z-axis. The potential benefits of the uniform vector potential distribution can be applied to high-precision electronic measurements. Especially, the excellent properties of the vector potential, it generates an electric field without an electrode and no magnetic field. For detection, it can penetrate the conductive material to produce the desired secondary voltage and an electric field, and it can work well with a media such as corrosive blood. We numerically simulated the distribution of the vector potential in the sphere coil using MATLAB. The simulation method is based on Ampere's circuital law and analogy equations of the magnetic flux density and the vector potential. We also show the properties of the coil, such as secondary voltage, and transimpedance. The simulation result confirms that the vector potential is a uniform distribution.

Index Terms- Vector potential, Magnetic coil, Uniform distribution, Analogy method.

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