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The Residue Resulting from the Earth's Magnetic Field Cancellation Using Spherical Coils

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Current carrying spherical coils are used to generate the magnetic field to cancel the Earth's Magnetic Field (EMF) on an interesting spherical surface. The currents in the spherical coils, which minimize the residue from the EMF cancellation, are determined by the steepest descent optimization method. In this study, two configurations of the spherical coils are considered. Considering the separation between each plane of the current wires, one has equal spacing and the other has equal polar angle separation. Our primary goal is to achieve the maximum residue less than 5% of the EMF. We also compare the residue and power consumption between various number of wires ranging from 26 to 36 wires for the two configurations. Our results show that the maximum residue from the equal polar angle configuration is less than that from the equal spacing one for every number of current wires. However, the power consumption and the current variation among the wires are less for the equal spacing one (52 - 89 A) as opposed to the equal polar angle configuration (8 - 134 A). This allows us to group the currents distributed to the wires and thus requires less amount of power supplies.

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