

SYMMETRY IN LOW-IMPEDANCE MAGNETIC ANTENNAS

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A previous related paper [C.E. Baum, Compact, Low-Impedance Magnetic Antennas, Sensor and Simulation Note 470, 2002] gives the basic geometry of the segmented-loop antenna. Several possible geometries were considered, including the case of a four-loop array fitting in a rectangular parallelepiped. The symmetry provides equal currents (at low frequencies) in the four loops.

Not considering the connection near the coordinate origin to the source, this loop structure has three symmetry planes: $x=0$, $y=0$, $z=0$. We can also note that the three coordinate axes are also two-fold rotation axes. If we constrain $a = b$ then there are two additional symmetry places: $x = y$. Also the z axis becomes a 4-fold rotation axis and we now have four two-fold axes; x , y , and bisectors of those two axes. In the present paper we extend the previous results to include the geometry near the coordinate origin. This is followed by the inclusion of some of the pulse-power equipment.

Now let us introduce other conductors in the loop geometry. This will aid in the inclusion of the pulse-power equipment. An interesting possibility considers the loop bisectors. Except for the small region near the coordinate origin, the 4-loop array has three symmetry planes, as discussed previously. The currents are symmetric with respect to the $z = 0$ plane, making the magnetic field perpendicular to this plane on the plane (except near the origin). Thin conductors on this plane which carry no net current do not interfere with the loops. For there to be no current (net) the voltages between the plus junction and neutral, and minus junction and neutral must balance.

A differential Marx generator is appropriate for inclusion with the neutral conductors. Taking such conductors as a metal tube we have the two halves (+ and -) parts on opposite sides of the tube. Each represents a source connected to the junctions. Note that the Marx columns are approximately parallel to the neutral tube, and connect to this tube at some distance away from the junctions. They also have a source impedance to be included in the calculations.

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