A Novel Visualization of Radiation Patterns

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Abstract
This paper will introduce an alternate way of presenting three dimensional radiation patterns to the students in a class room to help them better understand this abstract concept.

Summary
Traditionally in the textbooks and publications, the far field radiation patterns are presented as a polar diagram with principal plane cuts. The readers are then left to visualize the three dimensional picture. The recent trend, with the availability of graphical interfaces is to show a solid three dimensional picture of the pattern.

In an attempt to better understand the radiation in a physical context, Miller and Deadrick [IEEE Antennas and Propagation Magazine, 42, 46-54, December 2000] presented two dimensional vector plots of near field and far field energy flow as a function of time. This is certainly helpful in understanding the development of radiation fields from a source but would still need abstraction to visualize this three dimensional phenomenon.

Since the radiation pattern is three dimensional and that it is a plot of the measure of the electric field strength or power density on the surface of a sphere surrounding the radiating structure, it may be better understood by the readers (in particular by the students in an introductory antenna course) if this was plotted on the surface of a sphere. The pervasive availability of MATLAB makes this quite effortless and it will provide more descriptive presentation and visualization of the radiation. The figures below show the radiation from several assumed pattern functions; Figure 1 shows $abs[\cos(\pi \sin\theta)]$, Figure 2 plots $[\cos\theta \cos(0.5\phi)]^2$, and Figure 3 is a plot of $abs[\cos(3\pi \sin\theta \cos\phi)]$. The paper will present patterns from more realistic radiation sources and include the near field as well as far field patterns.

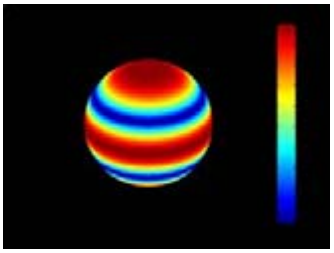
Figure 1

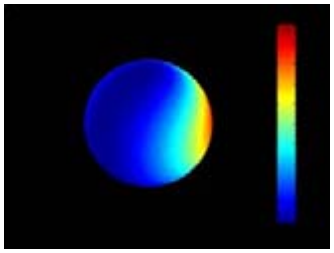
Figure 2

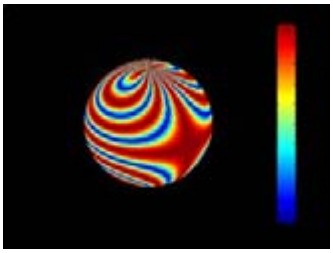
Figure 3