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Information Content in Antenna Radiation Patterns KARAN MOHAN, M. AMIR KHAN, AMIN DHARAMSI, Old Dominion University — We discuss the application of Shannon's Information Theory to the quantification of information lost in practical measurements of radiation patterns of antenna arrays. The radiation pattern of a uniform linear one-dimensional phased array of N dipole elements, with inter-element spacing of d and inter-element phase of ψ is given by $P_N(\theta,\phi) = P_{ind}\left[\sum_{n=1}^{N} I_0 \exp(i(kd_n Sin\theta Sin\phi + \psi_n))\right]$, where P_{ind} is the radiation pattern of an individual dipole element, I_0 is the intensity and k is the wavenumber. The probability density function, in space, of emitted photons is therefore given by $\xi_N(\theta,\phi) = P_N(\theta,\phi)/\int P_N(\theta,\phi)d\Omega$. The entropy of this distribution is $H = -\int \xi_N \ln \xi_N d\Omega$. The information obtained about any change in the array is therefore $\Delta H = |H_f - H_i|$ where H_f and H_i correspond to the entropies of the final and initial distributions. This expression leads to a quantitative formulation for the information lost due to imprecision in detectors used to measure radiation patterns. The theoretical approach developed allows one to measure any changes in the antenna array that may occur in an optimal manner, given limitations such as noise, a finite number of detectors of finite precision, or access only to a limited section of the surrounding space.

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