MASTER OF SCIENCE
IN
SYSTEMS ENGINEERING

REFINEMENTS IN A DISCRET COSINE TRANSFORMATION BASED NON-UNIFORM EMBEDDING WATERMARKING SCHEME

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Perceptual watermarking is a promising technique towards the goal of producing invisible watermarks. It involves the integration of formal perceptual models in the watermarking process, with the purpose of determining those portions of an image that can better tolerate the distortion imposed by the embedding, and ensuring that the watermarking will inflict the least possible degradation on the original image. In a previous study, the Discrete Cosine Transform (DCT) was used, and the watermark embedding was done in a non-uniform manner with criteria based on both the host image and the watermark. The decoder model employed made use of apriori access to unmarked and marked images, as well as to the watermark. A fair level of success was achieved in this effort. This research refines this scheme by integrating a perceptual model and by proposing a modification to the decoder model that makes possible the successful recovery of the watermark without apriori access. The proposed perceptual scheme improves the watermark's transparency, while maintaining sufficient robustness to quantization and cropping. The proposed semi-blind variation offers adequate transparency and robustness to quantization, but its performance against cropping is considerably degraded.

KEYWORDS: Digital Image Watermarking, JPEG Compression, Discrete Cosine Transform, Perceptual Models, Human Visual System

REDUCTION OF MUTUAL COUPLING IN SMALL DIPOLE ARRAY ANTENNAS

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The mutual coupling in phased array is a well-known phenomenon. It affects the active element pattern of the array as the phase of the individual element is altered. In an array that has many elements, the effect is identical for all the elements that are nearer to the center of the antenna, thus allowing a more predictable scan performance with respect to the phase of the elements. However, in a small array that has only three elements, the active element pattern for the elements at the end can be significantly different from the center element, and this affects the predictability of operations such as direction finding.

The thesis investigates two ways that can potentially reduce, or at least control, the mutual coupling in small arrays. The first method simply adds a dummy element with a special load condition to each end of the array to make the edge element "feel" as if there are more elements next to it. The second method uses a passive feedback circuit to both monitor and correct the magnitude and phase of the mutual coupling at the input of each array element. A hybrid ring is attached to each of the elements to monitor the amount of interference received by that element.

Simulation results for the dummy element method shows that some reduction in phase error can be achieved if the spacing and length of the element are selected properly. The compensation network approach relies on an efficient two-port array element. The research has focused on the design of a two-port printed circuit dipole that could be used in such an array. The dipole was designed, simulated, and fabricated. Future research will use this element in a compensation network.

KEYWORDS: Phased Array Antenna, Mutual Coupling Compensation, Dummy Element Compensation Method, Network Compensation Method