Abstracts

Microwave phase conjugation using antenna arrays

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A technique has been developed and tested for achieving phase conjugation in the microwave and millimeter-wave regime. The effective nonlinearity required for this phase-conjugation process is provided by electronic mixing elements feeding an array of antennas. Using these balanced mixing circuits in conjunction with a one-dimensional array antenna, we have demonstrated two-dimensional free-space phase conjugation at 10.24 GHz. A critical factor of this technique is the delivery of a 2/spl omega/ pump signal to each array element with the same phase. Two types of interconnects, electrical and a more versatile optical technique, have been implemented to distribute the pump signal in our demonstrations. In both systems, two-dimensional free-space phase conjugation was observed and verified by directly measuring the electric-field amplitude and phase distribution under various conditions. The electric-field wave-fronts exhibited retro-directivity and the auto-correction characteristics of phase conjugation. Furthermore, these experiments have shown amplified conjugate-wave power up to ten times of that of the incoming wave. This amplifying ability demonstrates the potential of such arrays to be used in novel communications applications.

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