

Antennas & RF Components on Novel Materials

Metamaterials for Enhanced Antennas

Previous antenna design efforts have focused primarily on shape enhancements to improve bandwidth and functionality. New capabilities in manufacturing low loss materials such as ceramics, polymers, and periodic crystal structures, however, are motivating interest to incorporate such materials into antenna designs. These novel materials (often referred to as metamaterials) allow for new degrees of freedom in radio frequency design, including the use of volumetric variations in material properties to improve bandwidth and impedance matching performance even at very low frequencies.

Design of New Antennas

The possibilities for introducing new classes of antennas, microwave filters and frequency-selective volume designs truly abound with increased ability to modify material properties. ESL researchers have developed formal design algorithms, and are working with materials science and solid state faculty to realize the resulting designs. Several prototype designs (shown below) have been fabricated to demonstrate the potential of the new materials and their associated fabrication techniques. Incorporation of a metamaterial in one design was shown to make a standard narrowband antenna suitable for broadband applications. Antenna miniaturizations by a factor of five or more have also been achieved without compromising gain. These are exciting results that illustrate the great potential of metamaterials in RF engineering today.

