

ANTENNA AND TOPOLOGY CHOICES FOR A LARGE N
ARRAY FOR LEO SATELLITE DOWNLINK

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The ever increasing volume and importance of data provided by low earth orbiting (LEO) satellites necessitate developing downlink systems that are more cost efficient than those presently in use. A popular alternative is to replace the costly high-gain dish antennas with phased arrays of many wide-beam and inexpensive elements. A prototype array of this type is presently in development at the Georgia Institute of Technology. Some design choices and analyses will be presented in the areas of antenna design, volumetric array layout, and thinned linear array (TLA) optimization. Genetic algorithms have been used extensively in the design and optimization processes.

A design for a novel type of elementary antenna was explored, in which the beam pattern is matched to the inverse of the propagation loss of the satellite link. Using this antenna will significantly reduce the required number of elements as compared to other antenna choices. It is possible to construct this elementary antenna as a fixed array of simple antennas of varying position, size, and stimulation. Results will be presented for array-factor and method-of-moments simulations for active and parasitic designs.

It was found that an array based on the radials of a platonic solid has advantages in resolution, sidelobe, and optimization complexity when compared to the popular geodesic design. Sidelobes and pseudo-grating lobes of a platonic array can be reduced by optimizing a similar TLA. Although the optimization of TLAs has been a subject of previous research, novel applications and conditions have been explored and improvements have been made to the results of other methods. Results will be presented for arrays in which combinations of average spacing, minimum spacing, and quantized spacing are enforced.

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2. B - Fields and Waves
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5. This paper has been submitted to the student paper competition for this conference.