Reflectarray Antenna Design for X-Band Applications Using Flexible Substrates

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Introduction

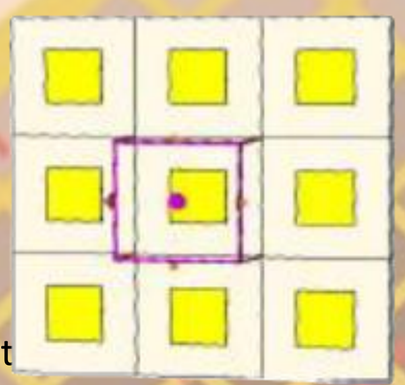
Reflectarray antennas have piqued interest in recent years due to a number of advantages, including low profile thickness and weight, ease of manufacture via the printed circuit approach, high gain through the use of several elements, and simple feeding mechanisms.

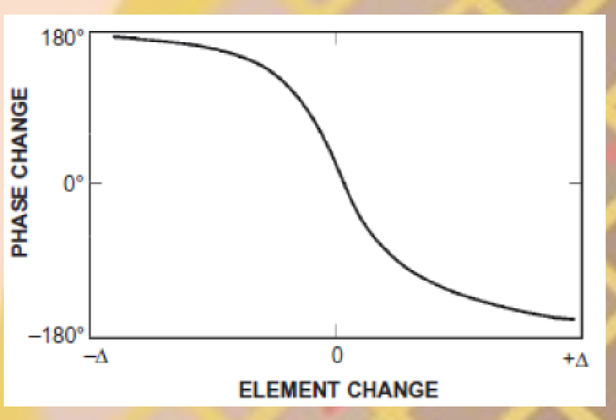
Methodology

Reflective array antenna consists of unit cells, dielectric substrate and substrate thickness.

❖ Unit Cell

Any potential value of phase-shift in the reflectarray must be achieved by changing one parameter in the unit cell, such as the patch size, stub length, or patch rotation angle. It is also important to make sure that the element selected will have enough element variation to yield at least a phase change of ± 180 ° .





❖ Dielectic Substrate

Flexible materials need to be chosen carefully to withstand the physical deformation conditions such as bending, stretching, and even twisting while maintaining its functionality. The flexible antenna substrate material must have low dielectric loss, low relative permittivity, low coefficient of thermal expansion, and good thermal conductivity.

❖ Substrate Thickness

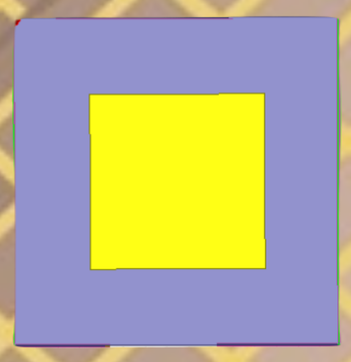
Substrate thickness is of great importance in reflective array antenna design. The thickness of the designed unit cells affects the measurements. As the substrate thickness changes, the changes in the graphs are clearly seen.

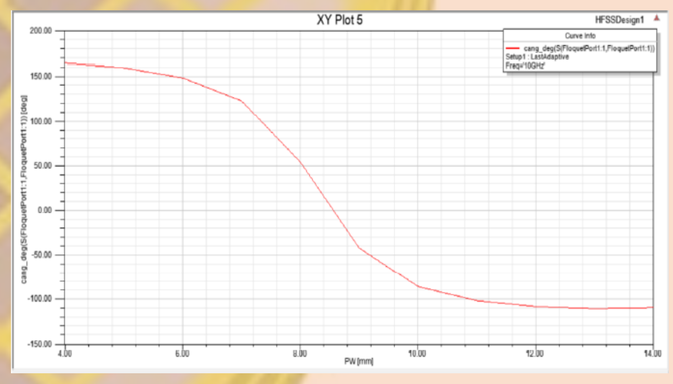
Application Areas

In space and distant sensing applications, a reflectarray antenna can be utilized instead of a parabolic reflector. The use of a multi-panel folding mechanism makes it easy to transfer and deploy the reflectarray in the satellite because it is flat and compact in nature. Satellites with high throughput have evolved to meet the needs of next-generation ultra-high-speed internet and high-definition television services.

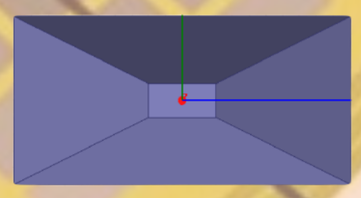
Designed Antenna Simulation Results

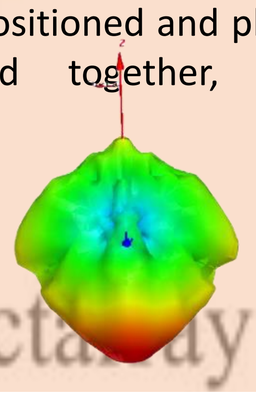
The reflectarray antenna is formed as a result of unit cell design, antenna design and simulation with horn antenna. First, the unit cell is designed and measurements are made.

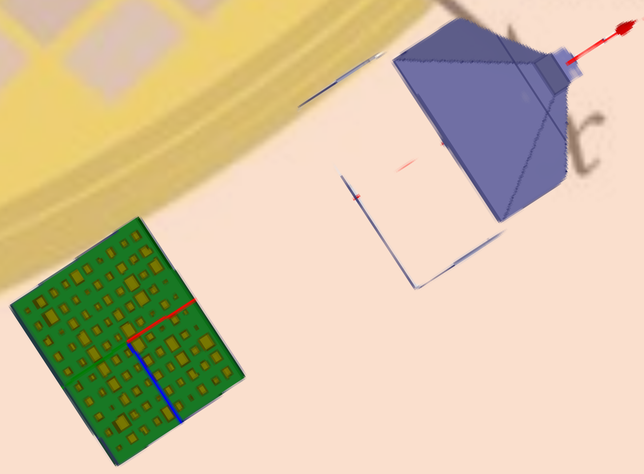


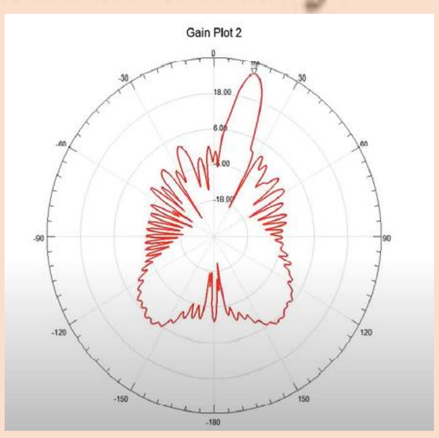


After the horn antenna is designed, it is positioned and phase adjusted. Finally, they are simulated together, and measurements are taken.









References

❖J. Huang and J. A. Encinar. *Reflectarray Antennas*. Piscataway, N.J.; Hoboken, N.J.: IEEE Press; Wiley-Interscience, 2007.

❖ Öztürk,Ender, MinkowskiReflectarray Analysis And Design AtXband,Phd. Thesis at HacettepeUnviersity Electrical and ElectronicsEngineering, December 2018.

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