Electronics/Computers

Evaluation of the Reflection Coefficient of Microstrip Elements for Reflectarray Antennas

NASA's Jet Propulsion Laboratory, Pasadena, California

Basis functions were studied and identified that provide efficient and accurate solutions for the induced patch currents and the reflection phase in microstrip reflectarrays. The integral equation of an infinite array of microstrip elements in the form of patches or crossed dipoles excited by a uniform plane wave is solved by the method-of-moments. Efficient choices of entire domain basis functions that yield accurate results have been described.

The results showed that an optimum choice would be a sinusoidal basis function with a built-in edge condition along the current flow direction, and uniform current across the current flow direction for a rectangular or square patch. For a dipole, the optimum choice is a sinusoidal basis function without the edge condition along the dipole, and uniform with the edge condition across. The code employing these basis functions was substantially faster than the commercial code HFSS, and it was significantly more accurate than previously developed method-of-moments code.

It was determined that the optimum choice is one basis function for each of the two induced currents in a square or rectangular patch, and one basis function for each dipole. For very thin substrates, there was a need to have 32 basis functions to produce accurate solutions.

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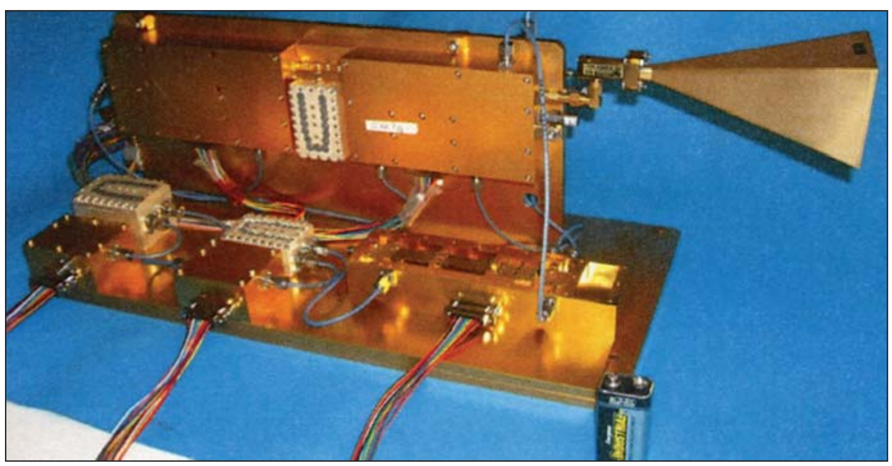
Miniaturized Ka-Band Dual-Channel Radar

This smaller, higher-bandwidth system can be used for interferometry, ocean surface height monitoring, and various military applications.

NASA's Jet Propulsion Laboratory, Pasadena, California

Smaller (volume, mass, power) electronics for a Ka-band (36 GHz) radar interferometer were required. To reduce size and achieve better control over RF-phase versus temperature, fully hybrid electronics were developed for the RF portion of the radar's two-channel receiver and single-channel transmitter. In this context, fully hybrid means that every active RF device was an open die, and all passives were directly attached to the subcarrier. Attachments were made using wire and ribbon bonding. In this way, every component, even small passives, was selected for the fabrication of the two radar receivers, and the devices were mounted relative to each other in order to make complementary components isothermal and to isolate other components from potential temperature gradients. This is critical for developing receivers that can track each other's phase over temperature, which is a key mission driver for obtaining ocean surface height.



The fully integrated **Ka-Band Dual-Channel Radar** with horn antenna. The transmitter electronics are shown along the baseplate, while the dual receivers are mounted on the vertical plate. The last stage of the transmitter is left open to show the subcarriers.

Fully hybrid, Ka-band (36 GHz) radar transmitter and dual-channel receiver were developed for spaceborne radar interferometry. The fully hybrid fabrication enables control over every aspect of the component selection, placement, and connection. Since the two receiver channels must track each other to better than 100 millidegrees of RF phase over several minutes, the hardware in the two receivers must be "identical," routed the same (same line lengths), and as isothermal as possible. This level of design freedom is not possible with packaged components, which include many internal passive, unknown internal connection lengths/types, and often a single orientation of inputs and outputs.

The last item is key to fabricating a dual-channel receiver, where one wants components from the two channels to be isothermal, and therefore mounted back-to-back, while also having the routing as similar as possible. This