Wavefront Correction for Large, Flexible Antenna Reflector

NASA's Jet Propulsion Laboratory, Pasadena, California

A wavefront-correction system has been proposed as part of an outer-space radio communication system that would include a large, somewhat flexible main reflector antenna, a smaller subreflector antenna, and a small array feed at the focal plane of these two reflector antennas. Part of the wavefront-correction system would reside in the subreflector, which would be a planar patch-element reflectarray antenna in which the phase shifts of the patch antenna elements would be controlled via microelectromechanical systems (MEMS) radio-frequency (RF) switches. The system would include the following sensing-and-computing subsystems:

- An optical photogrammetric subsystem built around two cameras would estimate geometric distortions of the main reflector;
- A second subsystem would estimate wavefront distortions from amplitudes and phases of signals received by the array feed elements; and
- A third subsystem, built around small probes on the subreflector plane, would estimate wavefront distortions from differences among phases of signals received by the probes.

The distortion estimates from the three subsystems would be processed to generate control signals to be fed to the MEMS RF switches to correct for the distortions, thereby enabling collimation and aiming of the received or transmitted radio beam to the required precision.

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Novel Microstrip-to-Waveguide Feed Employing a Double-Y Junction

This feed is useful for low-cost measurements involving waveguides up to X-band.

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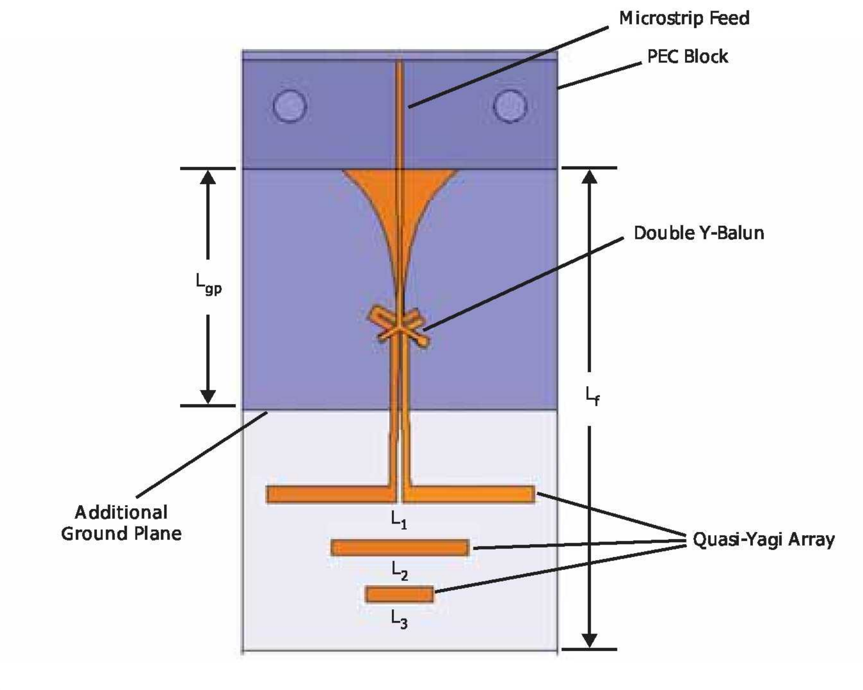
Previous microstrip-to-waveguide transitions either required a hermetically sealed waveguide configuration, or a balun that needed to be tuned according to the frequency band of interest. In this design, the balun is realized using a double-Y junction to transition from microstrip to coplanar strip feeding a quasi-Yagi dipole array (see figure). The length of the feed (L_f) extending into the waveguide is 15.54 mm. The length of the ground plane below the ULTRALAM substrate is 7.75 mm. The lengths L_1, L_2, and L_3 are 8.50 mm, 4.38 mm, and 2.14 mm, respectively. These lengths were computed via a preliminary optimization aimed at improving the return loss at the band edges.

The waveguide feed was designed to excite the TE10 mode in a WR-90 waveguide, and to operate over the recommended frequencies of 8.2 to 12.4 GHz. The feed employs a Rogers 6010 substrate (dielectric constant $\varepsilon_r \approx 10.2$) bonded with a Rogers ULTRALAM substrate ($\varepsilon_r \approx 2.5$). The ULTRALAM substrate serves to provide mechanical strength for 6010 substrate, and to miti-



The **Microstrip-to-Waveguide (WR-90) Transition** employing double-Y balun and modeled in HFSS.