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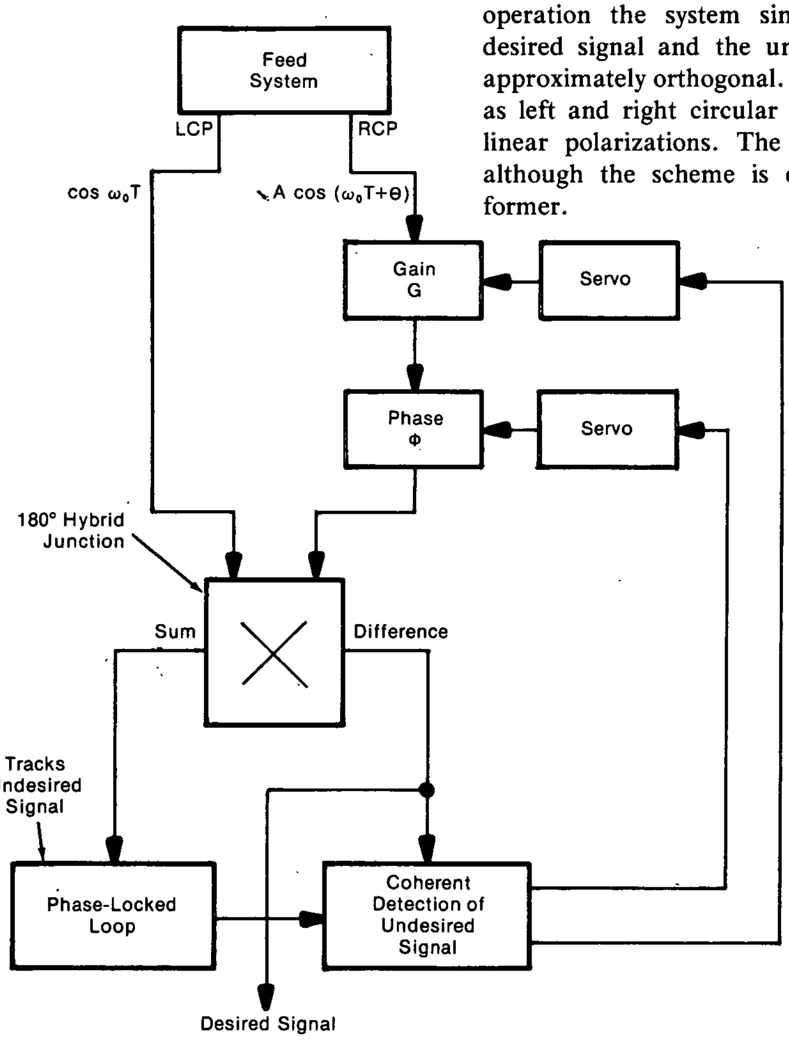
Multibeam-Antenna Feed System to Isolate Orthogonally Polarized Beams

Multibeam antennas require a high degree of isolation between the beams. In one approach, two beams which have nearly the same carrier frequency are orthogonally polarized. As a result, it is possible to place two channels with nearly the same frequency on the same antenna beam and effectively eliminate one of the signals from the receiving system. A new antenna feed system provides this function.

The system is a polarization tracker and comprises a variable polarizer, a polarization control, and a receiver servo loop. The illustration shows the feed system connected to the receiver servo loop. In operation the system simultaneously receives the desired signal and the undesired signal which are approximately orthogonal. They can be either paired as left and right circular polarizations or as cross-linear polarizations. The latter will be discussed, although the scheme is equally applicable to the former.



Polarization Tracker

(continued overleaf)

A feed horn with the nominal capability of receiving left and right circular polarizations (LCP and RCP) gives almost equal-amplitude signals at its ports when a linearly polarized signal is received. The phase difference between the port signals is a linear function of the linear polarization angle. The LCP and RCP components of the undesired signal are thus as shown in the illustration, where the amplitude A and phase Θ represent all gain and ellipticity imperfection in the signal and the receiver system. If the gain G were 1/A and phase angle $\Phi = -\Theta$, then it is clear that there would be no undesired signal component in the difference channel after the 180° hybrid junction.

Since the desired received signal is approximately spatially orthogonal to the undesired signal, its LCP and RCP components will be approximately Θ+180° different in phase rather than just Θ, as is the case for the undesired signal. Hence, the desired signal will appear almost totally in the difference channel and thus will be available for distribution, free of the interfering signal.

There remains the problem of properly determining the values of G and Φ to use in the system. One alternative is manual setting to null out the undesired signal, but this may be unsatisfactory in an operational environment. This scheme utilizes the sum channel output, which is almost entirely the undesired signal, as a frequency and phase reference (via the indicated phase-locked loop), to perform inphase and quadrature coherent detection of the undesired quadrature signal components in the error channel. The servo control of gain G and phase Φ will give automatic polarization nulling capability.

Note:

Requests for further information may be directed to:

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Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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