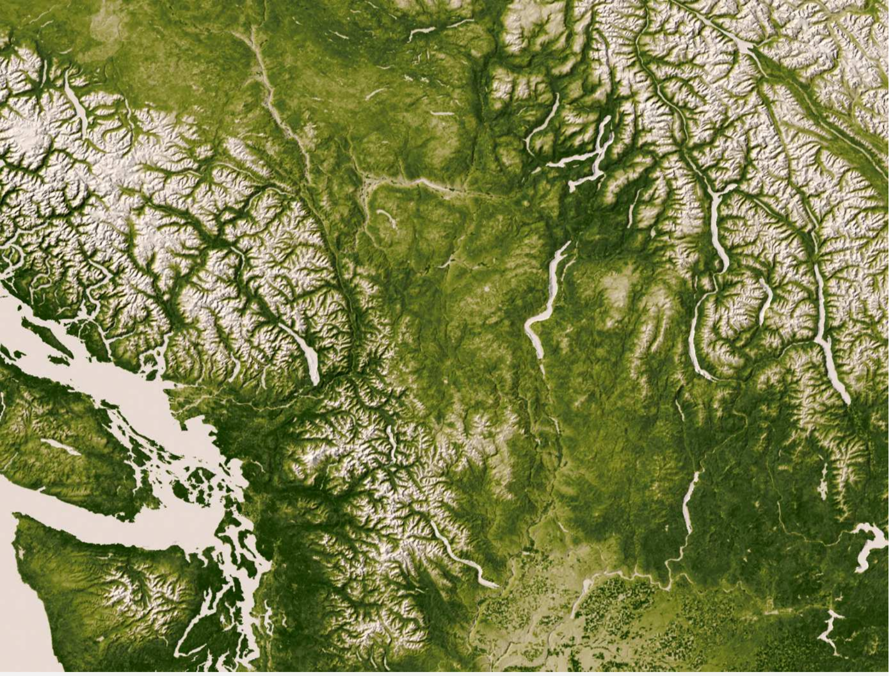

National Aeronautics and
Space Administration

Optics

Photonic Waveguide Choke Joint

Provides a tenfold improvement in out-of-band radiation leakage suppression compared to prior art

NASA Goddard Space Flight Center has developed the Photonic Waveguide Choke Joint with Absorptive Loading, a low-loss non-contact waveguide interface that suppresses out-of-band radiation leakage while preserving in-band performance. This technology is designed to serve as the port of a low-noise cryogenic detector system. It can be used for loss measurement of a flat surface at microwave and millimeter-wave frequencies. The technology enables near-ideal transmission and reflection. It is simple to fabricate and can operate over a wide temperature range. Applications include low-noise detector systems in which any leakage from the waveguide joint can interfere with performance.

BENEFITS

- Suppresses out-of-band radiation (up to 10x compared to typical non-contacting waveguide flange joints) without degrading the in-band response of the waveguide flange
- Accurate over a broad range of frequencies
- Can operate over a wide temperature range, from room temperature to cryogenic temperatures
- Simple to fabricate and maintain

technology solution

THE TECHNOLOGY

The technology is a flat metalized surface waveguide flange (either standard or dual polarization). This flange consists of periodic metal tiling coated with dissipative dielectric material. For in-band operation, the waveguide photonic choke structure acts as a highly reflective filter for the plane wave traveling inside the flange. Due to its high reflectivity, the structure directs plane wave energy back to the waveguide. The lossy dielectric material at the bottom of the metallic posts produces insignificant loss to the in-band response. The thickness of the dielectric can be tuned to dissipate minimum power in the operating frequency bandwidth. In the out-of-band response, the wave inside the photonic choke structure propagates more into the lossy dielectric material producing power dissipation. This power dissipation becomes higher as a function of frequencies as more signal propagates into the lossy dielectric per wavelength.

The technology can operate in a single-mode excitation in the waveguide for minimum loss. It can also be scaled to support any waveguide band. The technology is safe to operate at low-level microwave power (less than one milliWatt). In addition, it has no moving parts and requires little maintenance.

APPLICATIONS

The technology has several potential applications:

- Cryogenic detectors
- Non-contact measurement of material properties at microwave or millimeter-wave frequencies
- Interface for a waveguide feed horn array

PUBLICATIONS

Patent No: 9419319

More Information

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