Artificial Dielectric Layers as Surface-Wave-Less Antenna Substrate

W. H. Syed, A. Neto, D. Cavallo

Surface waves issue in planar printed antenna

Dense dielectric, e.g. silicon
- Increase front to back ratio
- More power in surface waves

GOALS:
- Maximize front-to-back ratio
- No excitation of surface waves

Solution: Artificial Dielectric Layers (ADL)

Equivalent homogeneous and anisotropic medium

Green's function based analytical equivalent circuit

- Theory based on 'connected array of slots'
- Valid for every plane of incidence
- Finiteness of layers taken into account
- Extension to near source excitation

Angular selectivity is the key!!

Antenna design in X-band

Slab only, \( \varepsilon_r = 3.66 \)
Slab + ADL, \( \varepsilon_r \text{eff} = 24 \)

Angular selectivity is the key!!

Low frequency prototype demonstrator

Radiation patterns

Reflection coefficient

High Frequency Prototype (230 GHz- 325 GHz)

- In-house IC process
- Collaboration with DIMES