Planar Leaky-Wave Antennas

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Leaky-wave antennas use a traveling wave to radiate continuously along a radiating aperture in order to produce a focused beam of radiation. Planar leaky-wave antennas are particularly attractive since they use simple dielectric layers and/or metallic screens over a grounded substrate layer. A simple source such as a dipole or slot inside the substrate or on the ground plane excites the leaky waves, which propagate radially outward on the structure, producing a beam. The beam may be either a pencil beam at broadside, or a conical beam, depending on the desired scan angle. In this talk several examples of planar leaky-wave antennas will be given, including those composed of high-permittivity dielectric layers, planar metallic patches or slots, and metallic strips. The performance characteristics will be examined in some detail and it will be shown how the basic properties of all such antennas may be examined in a general manner by studying a canonical structure that consists of a "partially reflecting surface" over a grounded dielectric layer. The case of a metamaterial substrate will also be examined to explore if advantages can be realized with such materials. Finally, the interesting optical phenomenon of directive beaming will be explored, and it will be shown that this is also due to a leaky wave propagating on the planar structure.