Abstract: Metasurfaces (MTS) are constituted by sub-wavelength size patches printed on a thin, possibly grounded dielectric substrate. MTS has the appealing characteristics of low profile, manufacturing simplicity, combined with the capability of control of the EM field. The BCs perceived by an EM field can be modified at will by spatially changing the characteristics of the sub-wavelength patches in a gradual manner. We identify three main design of MTSs, in which the objective is to control: (i) space-wave; (ii) leaky-wave, and (iii) surface wave. The first type of MTSs control impinging spatial waves by refracting, deflecting, focusing or controlling the polarization of an impinging space wave. The second class of MTS is designed in order to convert a bounded surface wave (SW) into a curvilinear wavefront leaky-wave (LW), where impedance BCs are modulated in a locally-periodic fashion. MTSs for SWs manipulation control their propagation path, changing the SW wavefront. Combining these different design into microwave devices leads to high-gain, low cross-pol antennas, Gaussian horns, multibeams, lenses, deflector, metaradomes. Adaptive MTSs, composed of dynamically reconfigurable materials, would allow to explore new reconfigurable-beam antennas.

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