**Controlling Light in a Metasurface-Perturbed Dielectric Waveguide**

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Photonic integrated circuits offer an attractive platform for various devices and applications such as on-chip information processing, chemical and biological sensors. However, a reliable, large-scale system integration of such a device still presents many challenges. These challenges include miniaturizing device footprints, increasing device operation bandwidth and robustness, and reducing device losses. Integration of optical waveguides and subwavelength dielectric structures may help address some of these challenges.

Metamaterials have been a significant topic of research over the last decade, mainly focused on controlling light propagating in free space. Metasurfaces offer a great potential in controlling guided waves by assembling arrays of miniature, anisotropic light scatterers. As a result, the metasurfaces are able to mould optical response of the device by introducing spatial variations in the optical response of the light scatterers. Consequently, modifying the wavefront of light by altering its phase, amplitude and polarization in a desired manner.

Here, we show that metasurface structures consisting of silicon nanoantennas on the Si3N4 waveguide with SiO2 substrate are able to interact with the guided modes. The nanoantennas are designed to introduce a dielectric perturbation which affects the coupling between the supported modes. This enables design of integrated devices with novel functionalities. We present designs for efficient mode conversion devices as well as unidirectional power transmission waveguides.