Two-dimensional rhombic-lattice grating coupler for oblique incidence in the integrated photonic crystal waveguide slab

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Grating couplers are a very attractive solution for (near) vertical coupling between optical fiber and photonic wires or 2D photonic crystal (PC) waveguides (WGs). The polarisation sensitivity of 1D-gratings can be overcome by implementing 2D-gratings in a polarization diversity configuration. By using a 2D-grating and two orthogonal waveguides, a coupling efficiency of 20% was achieved in [1], for vertical coupling. The orthogonal polarization states of the random polarized light in the fiber are coupled to the TE-modes of the orthogonal waveguides.

However, vertical coupling suffers from large second order reflections. Therefore, the fiber should be tilted while preserving the symmetry, but this induces unwanted coupling to higher order modes. This can be compensated for by slightly rotating the waveguides, as mentioned in [2]. Another solution is using a rhombic-lattice grating in stead of a rectangular-lattice grating.

We have simulated this 2D rhombic-lattice grating that consists of a superposition of two 1D planar-focusing lens gratings (P-FLGs) for oblique coupling between fiber and PC WG, as shown in Fig. 1. K-vector in the figure is rotated at 2º in order to orthogonalize each PC WG. For p- and s-polarized 10º incidence with wavelength of 1.37μm, both calculated coupling efficiencies to each PC WG are ~14%.

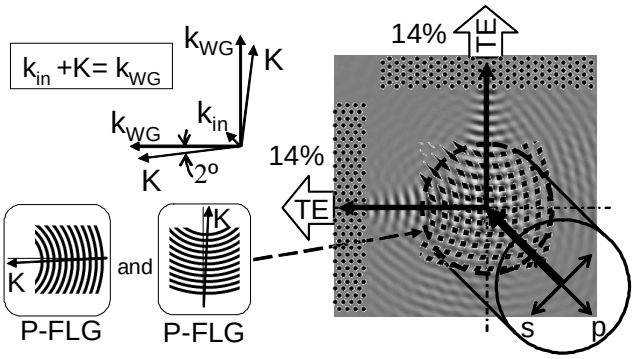

Fig. 1. Snapshot of two TE-modes coupled by 2D rhombic-lattice grating

[1] D. Taillaert et al, *IEEE Phot. Tech. Lett.*, **15**, 1249 (2003).
[2] W. Bogaerts et al, *Optics Express,* **15,** 1567 (2007)