Photonic biosensor in the angular spectrum

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I. Introduction

Reliable and cost effective biosensors play an important role in medical and biological sectors (e.g. pathogenic diagnosis). Most of these sensors operate using electronics but in recent years there has been a lot of research on photonics based biosensors [1]. In this field alone already a lot of different sensor concepts have been demonstrated. There is however still room for innovation as in this paper we present a novel photonics based biosensor [2]. The basic idea behind photonic biosensors is that the binding of biomolecules to the sensor induces a refractive index change which can in turn be quantitatively measured.

II. Sensor concept

The sensor presented here is based on photonic crystals (PhCs). A photonic crystal is defined by a periodic refractive index profile (see Figure 1) and can be used to diffract light under a certain angle as can be seen in Figure 1.

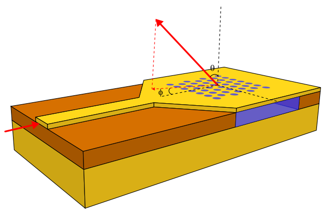

Figure 1. For certain wavelengths the incident light on the photonic crystal will be diffracted out of the plane.

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When we look at the pattern of the diffracted light in the angular spectrum we can distinguish a Lorentzian shape (see Figure 2). The position of this peak is influenced by the refractive index in the PhC and can as a consequence be used for sensing. Simulations have shown that shifts of 65 degrees per refractive index unit and more are possible. A major advantage of this sensor over others is that it is able to operate at a single wavelength where other sensors usually require a wavelength range to operate.

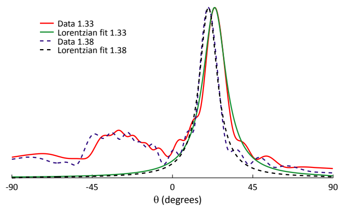

Figure 2. The Lorentzian peak in the angular spectrum shifts under influence of the refractive index.

III. Conclusions

We have demonstrated a novel photonic crystal based sensor that can achieve sensitivities of 65 degrees per refractive index unit and more. Furhtermore, this sensor only needs a single wavelength source to operate.

References

[1] X. Fan, I. M. White, S. I. Shopova, H. Zhu, J. D. Suter and Y. Sun, *Sensitive optical biosensors for unlabeled targets: A review*, Anal. Chim. Acta 620, 8-26 (2008).

[2] E. Hallynck and P. Bienstman, *Photonic crystal biosensor based on angular spectrum analysis*, Optics Express, 18(17), p.18164-18170 (2010).