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Low-cost novel designed receiver heat exchanger for household solarized cooking system: development and operationalization

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Abstract

Solar energy is widely regarded as the most promising renewable energy source available, and it is used for a variety of purposes. Out of various applications of solar energy, it has predominantly been suggested for cooking in the last three to four decades. High cost and non-customer focus design of the solar cooker is predominantly suggested as it acts as a barrier to actualization of solar cooking as a usual cooking practice. To keep in mind, this paper presents a proposed part design of a custo

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Study on some aspects of adoption of Solar Cooking System: A review

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Abstract

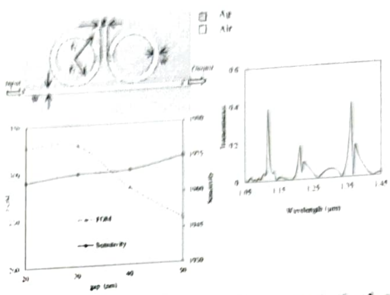
In developing and under-developed nations, the cooking industry is one of the most energy-intensive industries. Although cooking methods have been vastly improved, society has depended heavily on biomass for its kitchen needs since the dawn of civilization. Innovative cooking technology (methods) is now becoming progressively common because of the negative effects and energy wastages in traditional biomass cooking systems. Because of our reliance on rapidly depleting fossil fuels, we have been pressured to turn to alternative energy sources, and solar energy is often the best solution due to its

FEEDBACK

Split Ring Resonators-Based Plasmonics Sensor With Dual Fano Resonances

Yazusha Sharma, Rukhsar Zafar, Sanjeev Kumar Metya, *Member, IEEE*, and Vinay Kanungo, *Member, IEEE*

Abstract—**Plasmonics is garnering the attention in the field of optical sensing due to the unique interaction of light with noble metals which enables sub-wavelength confinement. Here in this paper, a Plasmonic sensor based on coupled split ring resonators is proposed. The interaction between split resonators is theoretically studied and numerically investigated using Finite Difference Time Domain method. Dual Fano resonances are observed in the transmission spectrum with an ultra-narrow line width ($\Delta\lambda$ = 7 nm) and large Quality factor (Q = 185). The resonant wavelength demonstrates a linear dependence with the refractive index of the sensing region. An intriguing feature of the designed sensor is that both the Fano peaks exhibit different value of sensitivities i.e. S_I = 1050 nm/RIU and S_{II} = 1965 nm/RIU for peak I and II respectively which is beneficial in terms of optical sensing. The performance of sensor is also studied for variation in geometrical parameters such as the gap between the split ring resonators. High Figure of Merit (FOM) of 328 RIU^{-1} is obtained from the structure with a gap of 20 nm. Sensitivity is stable with respect to fabrication tolerances (±10%) of gap (g). The proposed structure can be useful in designing optical glucometer with better sensitivity and resolution. The structure can be modified to finds its applicability in chemical sensing and different biological applications.**



Index Terms—**Plasmonics sensor, split ring resonators, dual-fano resonance, figure of merit, sensitivity.**

I. Introduction

OPTICAL sensing methods are highly acclaimed across the globe for medical diagnostic, environmental monitoring and pollution control based applications due to its unique feature of immunity against electromagnetic interference [1]–[3]. Specifically, optical sensors are dominating in remote sensing which is preferred in chemical and biological applications [3], [4]. A new milestone is added in it after the evolution of nano scale technology. Owing to the merits of nanotechnology, researchers and scientists are leading towards new branch of nano-photonics named "Plasmonics" to design on-chip optical sensors which can be utilized in different sensing applications [5]–[7]. Plasmonics is a quantum electromagnetic phenomena which emerges at the interface of metal-dielectric due to the resonant interaction of electromagnetic waves (photons) and collective excitation of free electrons (plasmons) [8]–[11]. Plasmons are densely available at the surface of the metal [10]. The resonant interaction takes place when the momentum of the photons and plasmons matches [10]–[12]. The energy transfer from photons to plasmons is carried out during this interaction and surface waves known as surface plasmons (SPs) are excited at metal-dielectric interface [9]–[11]. According to propagation characteristics of SPs, it can be classified as propagating [9]–[12] and localized plasmons [13], [14]. Both the SPs are equally important due to its unique feature of confining the optical signal far beyond the diffraction limit [11]. This intriguing property of SPPs finds great potential applications in on-chip sensors [15]. Moreover, recently it has been found that Fano resonance in propagating plasmons adds an extra degree of functionality in sensing applications [16], [17]. Fano resonance supports an asymmetric resonance profile

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Photonic Crystal-Based All-Optical Half Adder with High Contrast Ratio

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Abstract: Photonic crystal waveguides provide a way to manipulate the performance of an optical signal in an ultra-small volume and are quite viable in designing chip-based components that will work all-optically. Here, in this article an all-optical half adder is proposed. It is based on a square lattice photonic crystal waveguide in which silicon rods are arranged periodically. The photonic crystal offers a wide photonic band-gap in the desired region of telecommunication wavelength (i. e. near $\lambda = 1550$ nm. The performance of half Adder is measured using the contrast ratio and response time. The contrast ratio for sum and carry is 5.2 dB and 16.7 dB, respectively. The proposed half adder is miniaturized in size and having a footprint of 49 μm^2 only. The total response time of the proposed adder is 1.4 picoseconds only. So, the device offers a high bit rate of 0.714 Tb/sec. The proposed half adder is an optimum choice for its application in on-chip optical integrated circuits.

Keywords: photonic crystal, Half Adder, photonic band-gap, contrast ratio

1 Introduction

The speed of optical signals enables us to see deep into the universe. Optical fibers-based communication possesses the same phenomenon to globally connect us with ultra-fast speed. But the end transmitter and receiver links of an optical communication unit are prone to O-E-O (optical–electronic-optical) conversion [1–3]. This conversion is the stumbling block in high speed optical communication system because an optical signal needs to be converted before (after) transmission (reception). The high latency incurred during conversion is directly related to increased complexity. This latency can be combat if all-optical devices are designed [4]. In this regard, photonics and related devices have emerged as a key technology to facilitate the optical/photonics on-chip integrated circuits [5]. The photonic crystal-based technique is emerging as a key technology to manipulate the flow of photons at an ultra-small dimension. Thus, photonic crystal-based devices can help in realizing the dream of optical integrated circuits. A photonic crystal is an artificially structured material in which combination of two different dielectric materials are periodically arranged in a manner such that it offers a photonic band gap(PBG) in a similar way as the semiconductor material shows electronic bandgap. The PBG is the range of frequency in which signal of specific frequency range is not allowed to propagate and is reflected back [6–8]. These ranges of frequencies are allowed to propagate through the crystal if the line defect is created in the perfect crystal. The signal propagates tightly along the defect region and thus, offering minimum losses at tight corners as compared to its counterpart (optical fiber). Optical signal is confined by the phenomenon of TIR (Total internal interference) in fiber while Photonic crystal uses both the phenomenon of TIR and PBG [9]. Thus, the photonic crystal helps to mould the flow of light at nano-scale dimension.

Photonic crystals-based devices are optimum for designing optical ICs. It offers an ultra-small mode volume for optical signal confinement. Several researchers had worked on the photonic crystal for designing adders because adders are also an important component of any optical ICs [10–12]. Banaei et. al. proposes two nonlinear ring resonator based optical full adder using photonic crystal [12]. Half adder can be easily realized using AND and XOR gate. Ghadrdan et. al. had used the same concept and proposed an half adder by realizing a combination of XOR and AND gate [13].

In this proposed work, we have also investigated an all-optical half adder. This adder is controlled by the presence of reference input. The desired output at Sum and Carry port is obtained with controlling the phase of

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Toluene–filled photonic crystal fiber with flat dispersion

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ABSTRACT

In this paper the proposed PCF core is filled with toluene (R.I. = 1.497) for designing a refractive index sensor. The proposed photonic crystal fiber (PCF) core is filled with toluene to get a flat dispersion and near zero loss characteristics. A metallic gold layer is deposited in the inner wall of two large holes, of the first ring of cladding to achieve the flat dispersion. The remaining air holes are filled with different type of liquid having different different refractive index. The various properties like guiding properties of proposed PCF are normally investigated by OPTI-FDTD. This PCF exhibits flat dispersion of 205.19 at refractive index N = 1.4 at 1.87 μm with low confinement loss which can be used for non-linear technologies as well as in bio-medical diagnosis.

Selection and Peer-review under responsibility of the scientific committee of the International Conference on Advancement in Nanoelectronics and Communication Technologies.

1. Introduction

An excellent control of fiber parameter through robust engineering technique mode photonic crystal fiber on great demand for wide range of application (bio-medical diagnosis, non-linear optical communication). Photonic crystal fiber (PCF) is an excellent upsurge fiber technology was backbone of communication system as it provides reliable and flexible optical communication channel as compared to that of free space medium. Depending on guiding mechanism, PCF can be characterized as step index fiber and hollow core fiber. PCF have numerous unique properties such as low confinement loss, high linearity, flat dispersion high birefringes. Flat dispersion PCF is eminent in numerous practical applications because of having low losses [1-3].

The demand of photonics has drastically increased in the recent years and extensive research work is carried out on photonic crystal fiber (PCF). In recent era, LIPCF has achieved a great demand in the field of optoelectronics. Optoelectronics is that branch of photonics in which micro-fluidics and photonics are combined together, to enhance new research and advancements. When tiny holes in cladding or may be in core in PCF are filled with selective liquids, then characteristics of PCF are changed to large extent [9]. Hence with such kind of liquid infiltrated fibres we are able to achieve reconfigurable and dynamic optical properties.

In PCF, there are broadly two types of transmission possible in PCF: Solid core PCFs in which the guiding is done by Total Internal Reflection phenomenon and hollow core PCFs, in which the light is guided by photonic band gap. In the solid core PCFs, light is guided by total internal reflection phenomenon with the properties of broadband, single mode and low loss. The light can confine in hollow core PCFs in low refractive index and sub-wavelength air hole. The propagation mechanism of the hole is studied by evanescent field coupling and electromagnetic theory of optical transmission.

In 2019, Hai Lui presented a methane sensor based on liquid filled photonic crystal fiber. It provides high sensitivity and temperature compensation with high degree of accuracy in results. In 2015, Y. E. Monfared presented a survey based on nonlinear liquid infiltrated fibers. Six nonlinear liquids of different refractive index were used under his investigation. These include methanol, chloroform, benzene, toluene, nitrobenzene and carbon disulphide with refractive index values of 1.317, 1.433, 1.476, 1.477, 1.524 and 1.59. Obtained results reveal that highest nonlinear properties are recorded for carbon disulphide filled photonic fibre with tighter mode confinement [4]. Few years later liquid infiltrated fiber with toluene liquid was investigated by him to design a sagnac interferometer with higher values of sensitivity and temperature compensated applications [5]. He could achieve a polarization maintaining photonic crystal fiber with a value of approx 26%

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