ECTI President Message:

In the year 2015, the editorial team works harder and harder to make e-Magazine very attractive and useful for ECTI members. I would like to express sincere appreciation to the team and also to all authors for their excellent contributions and great efforts. We are now moving toward to achieve higher quality magazine in order to bring our member satisfactions. Therefore, I would like to ask for reader comments, so that we can improve quality of the magazine.

Also, this year the ECTI committees work very hard to make all conferences organised by ECTI association very interesting. The ECTI-CON 2015 will be held at Novotel Hotel, Hau-Hin, on June 24-27 and the ECTI-CARD 2015 will be held at Thumrin Thana Hotel, Trang on July 8-10. These major conferences will acquaint you up-to-date technology related to electrical engineering research and development. All participants will not only learn research details from speakers and keynotes but also create a new research network while attending these conferences. I, therefore, would like to invite you all to attend both conferences due to not only the conference programs are very interesting but also the conference sites are worth to visit for relaxing yourself and your families.

I look forward to seeing you at both conferences.

Prayoot Akkaraekthalin, KMUTNB

In this issue:

วารสารอิเล็กทรอนิกส์ ECTI
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On the Side Coupling to Optical Fiber Using Zinc Oxide Nanorods

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Abstract

This paper presents an analytical for the side coupling calculations due to scattering of Zinc oxide (ZnO) nanorods. Nano-rods grown on the fiber scatters the light at large angles inside the guiding regions: cladding or core. At angles larger than the critical angles, the scattered light is guided and portion of the incident light reaches the detection side of the fiber link. The model is a first considers the forward scattering only.

1. Introduction

Zinc oxide (ZnO) nanostructures are commonly used for realization of different shapes and sizes of nano-structures such as nanowires, nanorods, nanocombs, nanobelts, nanorings and nanocages [1]. Nanorod structures have high surface to volume ratio and anisotropy. They can be grown in liquid phase or gas phases [2-3]. Solution based hydrothermal process of fabricating ZnO nanorods is simple and environmental friendly [3,4] and due to the pre-seeding step the process becomes substrate independent [1]. Hence, growth on glass [5], silicon [6] and sapphire [7] has been reported. This encouraged the implementation of this process on several waveguide strucutres [8,9].

Light guided inside a waveguide such as an optical fiber leaks outside due to scattering from the nano-rods grown on the surface. This leakage has been used for humidity sensing [9]. To reach the guided mode region and to ensure interaction between the evanescent wave and the rods mechanically polished D-shaped fiber was used where the nanorods were grown on flat surface for ammonia detection [10]. Another approach to enhance the evanescent wave interaction is to thermally taper the fiber before the growth process [11]. Alternatively, wet etching using hydrofluoric acid (HF) can be used to expose the core region [12].

In previous publications, the author and the group have introduced the use of the growth of ZnO nanorods on optical fiber for side coupling to guided modes; both cladding [13] and core [14] modes. In this scheme, light is launched from the side of the fiber eliminating the need of butt-coupling and the need for mechanical alignment. The coupling efficiency is however low compared to butt-coupling. Though the total coupled power can be low, with high enough signal

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

to noise ratio this scheme can be practical for several applications. For example, the author with the group have demonstrated alcohol vapor sensing [15]. It was also used to illustrate the feasibility of application as wide field of view optical receiver for visible light communication [14].

In this paper we focus on studying the practical limitation of the proposed scheme and its feasibility for application in visible light wireless communication. The structure of interest is shown in figure 1 below. Here, the fiber is etched to expose the core region. The ZnO nanorods are grown on part of the un-etched multimode fiber (on the cladding region), the transient region and the core region directly as depicted in the graphs.

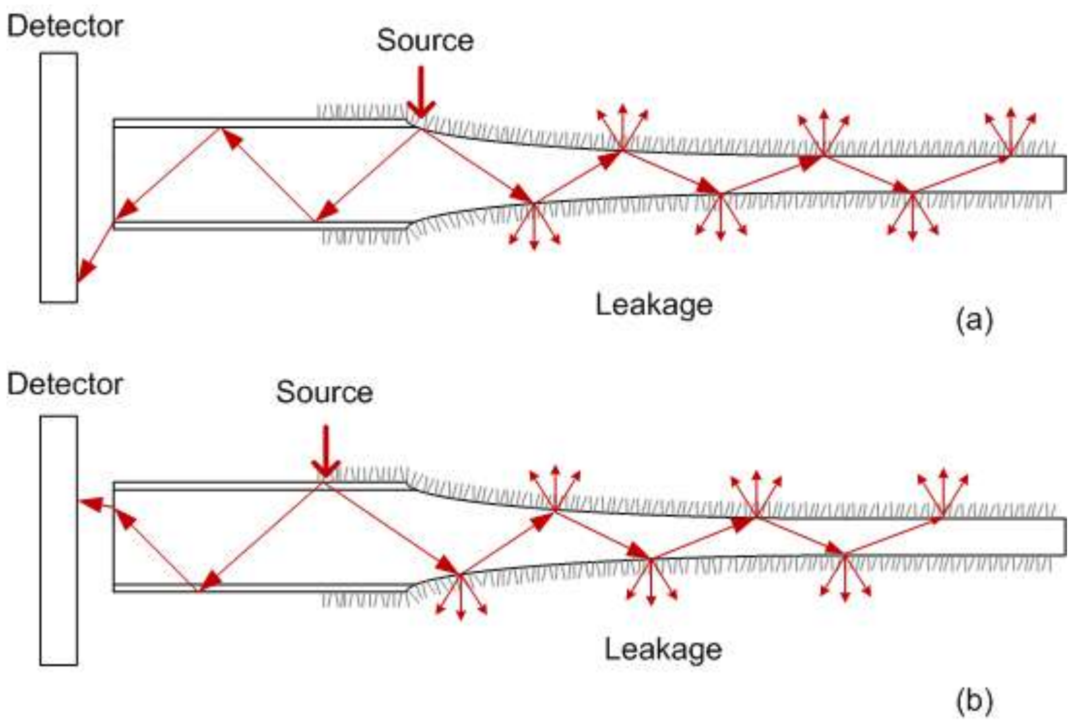

Figure. The proposed ZnO nanorods coated fiber for side coupling two excitation schemes (a) Core mode excitation and (b) Cladding modes excitation.

1. Modeling the optical excitation inside the optical fiber

In the scheme above, a point light source is assumed to shine on a specific location on the fiber with nano-rods grown on the top of the surface. The rods scatter the light at different directions according. Maximum coupled power to core or cladding mode is defined as [16]

$$P_o = P_{source} 2\pi C_{sc} \rho_a \psi,$$
$$\psi = \int_{\theta_c}^{\pi} p(\theta - \theta_{inc}) \sin\theta \, d\theta \qquad (1)$$

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

$$\alpha_z = C_{sc}\rho_a / \mathrm{L} \tag{2}$$

In equation 1, P_{source}, is the power of the source excitation. The constants C_{sc} and ρ_a are the scattering cross section of one rod and rods density respectively. The function $p(\theta - \theta_{inc})$ is the phase function which is the probability distribution function or the scattered power as a function of the scattering angles θ. The function is assumed to vary linearly with the incident angle θ_{inc}. The critical angle, θ_c, is the one between the core (or cladding) and air. The scattering coefficient is defined in equation (2).

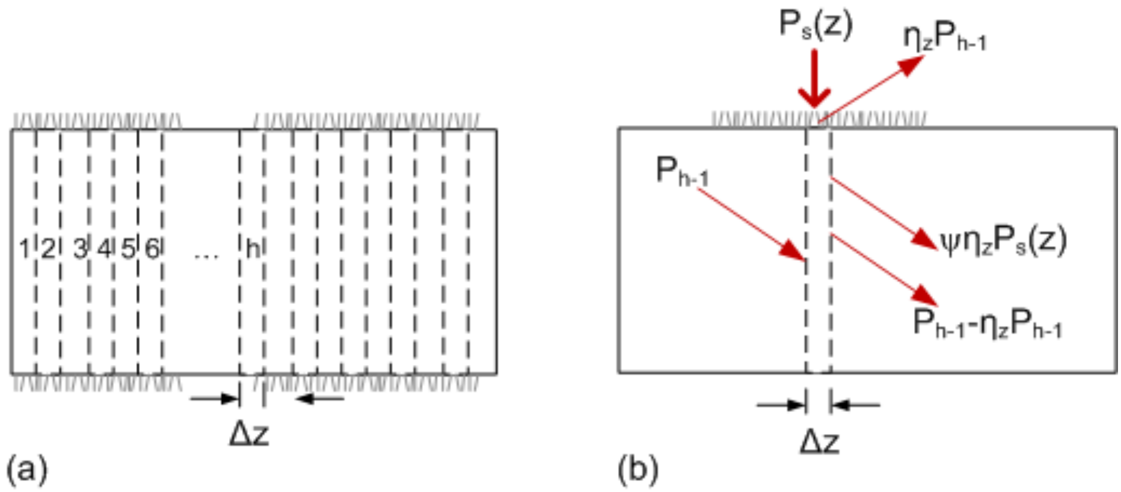

Figure 2. (a) Dividing the fiber region coated with ZnO nanorods into discrete sections of width Dz. (b) Optical Intensity components around a segment of the coated fibe.

To study the coupling and source distribution effect, the fiber coated with ZnO nanorods is divided into segments of width Δz. The width is assumed to be very small that the source distribution is assumed constant within that width as shown in figure 2a. At any segment, h, within the fiber with an extended excitation source that has an arbitrary intensity profile $P_s(z)$ causes a portion of $\psi\eta P_s(z)$ to couple to the guided modes. The constant ψ is the portion of the scattered light that couples into the guided modes of the fiber as defined in equation 1. In addition to the excitation, a portion of the previously coupled light (coming from segment P_{h-1}) adds to the amount of light coming out of segment h as shown in Figure 2b. Notice that, in the figure the coupling coefficient from segment h is indicated as η_z. The power coupled out of segment h can be then written as

$$P_h = \psi\eta_{z,h}P_s + P_{h-1} - \eta_{z,h}P_{h-1} \tag{3}$$

For a segment of width Δz, the coefficient η_z can be expressed as $\eta_{z,h}=\Delta z\alpha_{s,h}$. Hence, equation 3 can be written as

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

1.1.Gaussian beam excitation

In this section a Gaussian beam is considered to be launched on the fiber coated with ZnO nanorods at a location. The beam waist is set σ. Under these assumptions, the solution in equation 8 can be re-written as

$$p(z) = \left\{\psi \frac{\alpha_s}{\sqrt{\pi}} \int^{z} \exp\,(\alpha_s z') exp(-(z'-z_o)^2/\sigma^2) dz' + c\right\} \exp\,(-\alpha_s z) \qquad (12)$$

The equation above is reduced to

$$p(z) = \left\{-\psi \frac{\alpha_s \sigma}{2} \exp\left(\frac{(\alpha_s\sigma)^2}{4} + \alpha_s z_o\right) erf\left(\frac{\alpha_s\sigma^2 + 2z_o - 2z}{2\sigma}\right) + c\right\} \exp\,(-\alpha_s z) \qquad (13)$$

Applying the boundary condition p(0)=0, the constant c can be extracted

$$c = \psi \alpha_s \sigma \exp\left(\frac{(\alpha_s\sigma)^2}{4} + \alpha_s z_o\right) erf\left(\frac{\alpha_s\sigma^2 + 2z_o}{2\sigma}\right) \qquad (14)$$

Using this value, equation 13 is re-written as

$$p(z) = \psi \alpha_s \sigma \exp\left(\frac{(\alpha_s\sigma)^2}{4}\right) \left\{erf\left(\frac{\alpha_s\sigma^2 + 2z_o}{2\sigma}\right) - erf\left(\frac{\alpha_s\sigma^2 + 2z_o - 2z}{2\sigma}\right)\right\} \exp\,(-\alpha_s(z - z_o)) \qquad (15)$$

To simplify the expression in equation 15, few unitless coefficients are introduced: normalized scattering coefficient ϕ_s, normalized distance ζ and normalized excitation location ζ_o. These coefficients are defining as follows

$$\varphi_s = \alpha_s\sigma/2, \quad \xi = z/\sigma \; and \quad \xi_o = z_o/\sigma \qquad (16)$$

Equation 15 is now reduced to

$$p(\xi) = \psi\varphi_s \exp({\varphi_s}^2)\,\{erf(\varphi_s + \xi_o - \xi) - erf(\varphi_s + \xi_o)\} \exp\,(-\varphi_s(\xi - \xi_o)) \qquad (17)$$

Using the model in equation 17, the calculated coupling power as a function of the normalized distance ζ is calculated versus different excitation locations ζ_o. Here the normalized scattering coefficient ϕ_s is set to 0.05.

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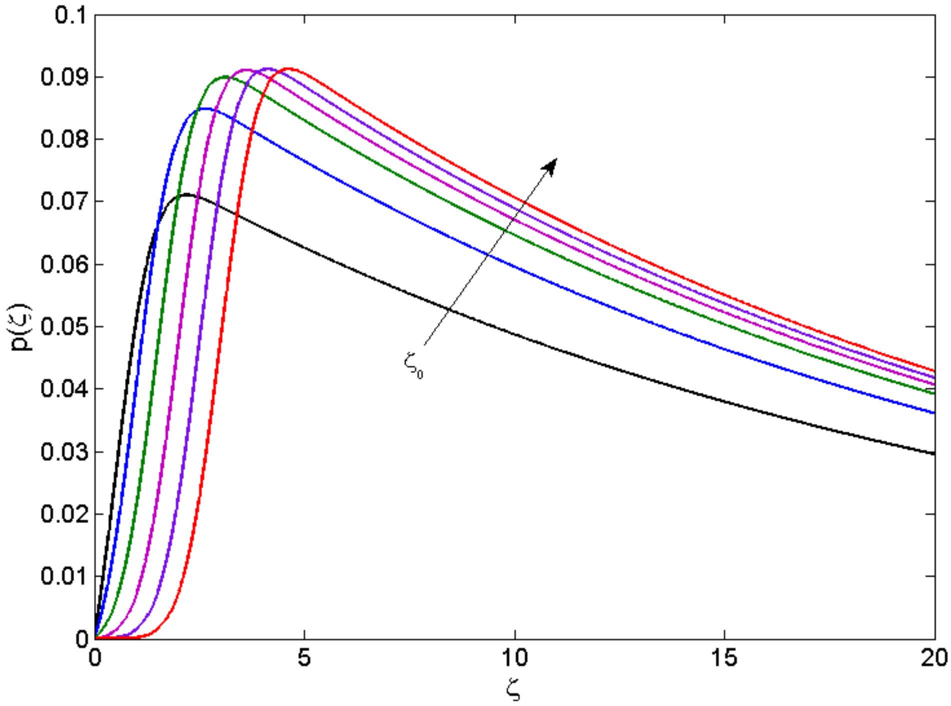

Figure 3. Coupled power as a function of the normalized location inside the fiber for different normalized excitation locations (ζ_o).

Notice in the all the derivations above the location z=0 is assumed to be the interface where ZnO nanorods start to exist abruptly. The model calculates the forward coupled light. Figure 3 illustrates the change of the forward coupled light with Gaussian beam at different excitation locations ζ_o. The graphs above show that maximum coupling is achieved at a distance of 1.5 from the excitation location ζ_o or $\zeta_{max} = \zeta_o+1.5$. The power then drops in an exponential form. The value of the maximum coupling power reaches its highest value (then saturated) at ζ_o=1.5. Hence, maximum power coupling is achieved from a section of the ZnO coated optical fiber with section width of 3σ.

1. Practical analysis

In a previous publication, the structure in Figure 1 was experimentally characterized by scanning a finite beam along multimode optical fiber coated with ZnO nanorods. The coupled power is measured from the clear end of the fiber as shown in Figure 4 [15]

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

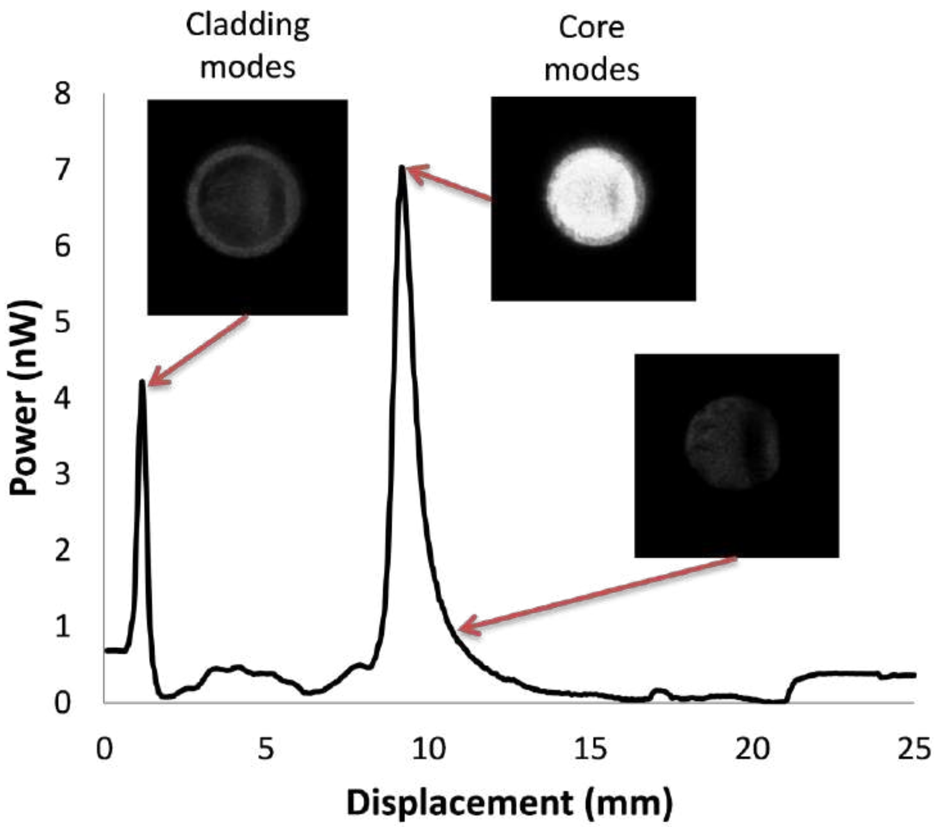

Figure 4. Experimental measurement of a finite beam along the fiber coated with nano-rods depicted in figure 1.

The graph shows two peaks one due to exitation of cladding modes at the region where ZnO nanorods grow and the other due excitation of core modes from the region where the core is exposed. The finite beam is produced by a single mode optical fiber placed in close proximety to the coated multimode fiber. The profile of the fundamental mode is assumed to be Gaussian. The estimated beam width from the experiment was 540 μm and normalized scattering coefficient ϕs=0.78.

To model the coupling to semi-infinitely coated fiber where the ZnO coating starts at location z=0 and scanning a Gaussian beam of waist σ over the fiber, the detection is fixed at location ζ_L which is large enough to ensure that $p(\zeta_L) \rightarrow 0$) in order to approximate this model to infinitely long coated fiber. Fixing ζ_L to 20 and plotting the graph versus $\zeta_L - \zeta_o$ the following results are obtained for different values of ϕ_s.

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine

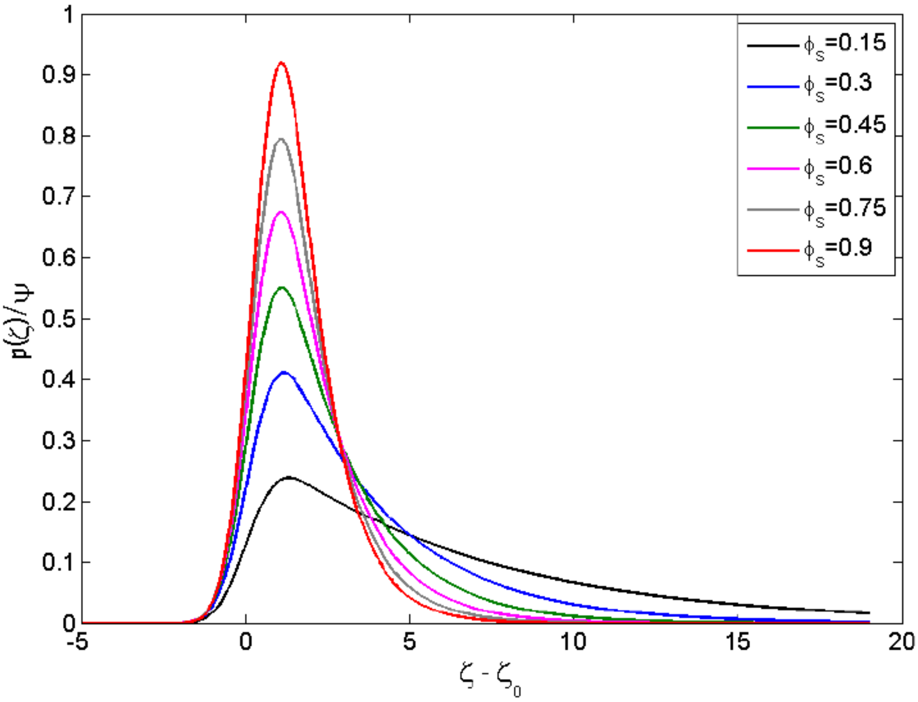

Figure 5. Calculating the coupled power to semi-infinitely coated fiber for different scattering coefficients.

For smaller normalized scattering coefficient, the decay is slower compared to the higher coefficients. For the considered ϕ_s value of 0.78 the calculated coupling power versus zo forms a pronounced peak with width of approximately $\Delta\zeta_o = 3$. From the experiment the two peaks for cladding and core modes excitations have widths of $\Delta\zeta_o = 1.55$ and $\Delta\zeta_o = 4.5$ respectively. The two peaks show different values for coupling powers. This can be attributed to the difference in the critical angle between cladding and air for cladding modes and core and air for the core modes. The critical angle for the core modes is smaller than that of the cladding modes. Hence, ψ for the cladding modes is less than that of the core modes. To model two peaks due to two regions of excitation, a general form of the coupled power can be written as

$$p(\xi) = p_1(\xi) + p_2(\xi + \Delta\xi) \tag{18}$$

In the experiment, the difference between the two peaks is 9 mm which corresponds to $\Delta\zeta \sim 33$. The portion of the phase function ψ_1 and ψ_2 for the cladding and core modes are assumed to be 0.1 and .17 respectively.

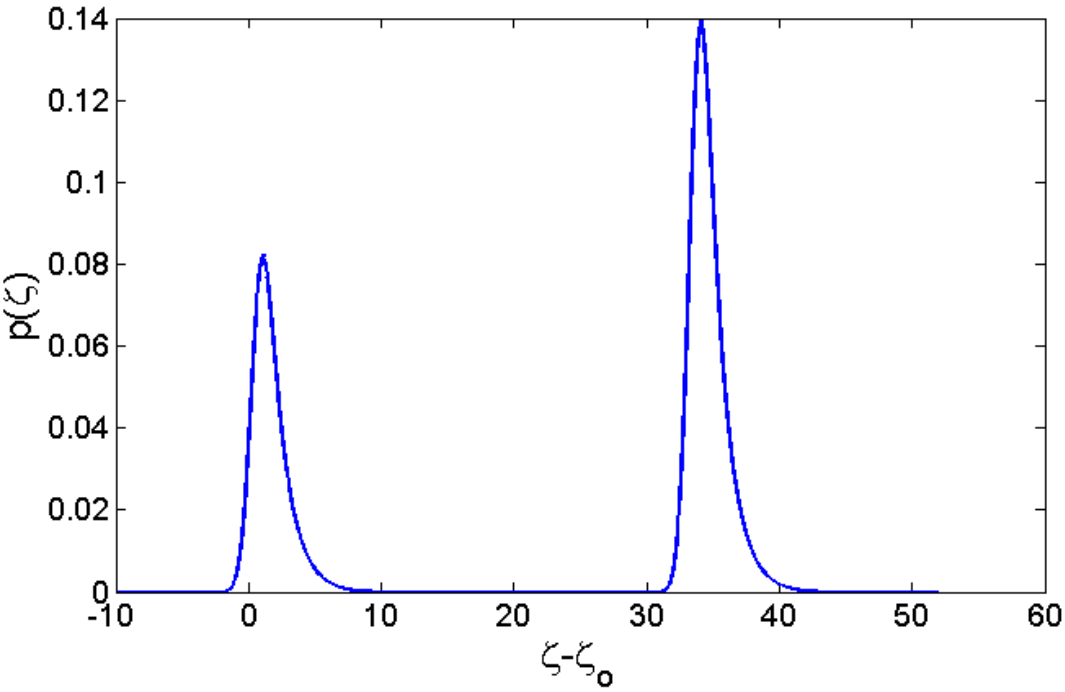

Figure 6. Calculated general coupling power due to two excitation locations for cladding and core modes separated by a distance of $\Delta\zeta$=33.

In conclusion, the paper presents a first order analytical model for the side coupled power inside optical fiber through scattering from nano-rods grown on the fiber. The model includes only forward scattering neglecting the effect of back scattering. The model can be used to optimize the design of the zinc oxide nanorods on the fiber for different applications.

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ISSN: 2286-7074
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วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

[Article]

Dr. Waleed S. Mohammed graduated from the department of electronics and electrical communications, Cairo University, Egypt in 1996 with a major in control systems. He worked in the Lasers institute (NILES), Cairo University for three years and received his M.sc. degree from the Department of Computer Engineering, Cairo University in 1999. In 2001 he received his 2nd M.Sc. from the College of optics and photonics/CREOL, University of Central Florida, Orlando, FL, USA. He completed his Ph.D. work in 2004 and his thesis was titled "nano/micro optical elements for mode coupling applications. In 2004, he joined Prof. P. W. E. Smith's ultra-fast photonics laboratory (UPL), Electrical and Computer Engineering department, University of Toronto, as a postdoctoral fellow. In 2005, he joined Prof. Li Qian's group at the same University. In 2007 Dr. Mohammed joined the International school of engineering, Chulalongkorn University, Bangkok, Thailand as an instructor in the nano-engineering department. He taught optoelectronics, fundamental of optics, numerical modelling, nano-electronics and research methodology. As of September 2010, he joined the school of Engineering, Bangkok University as a research scholar. His primary research areas are Optical wireless communications, Fiber optics devices, Nano-photonics, Numerical modelling, Integrated optics and Optical sensing.

ISSN: 2286-7074
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ECTI e-magazine

Paper List of ECTI-EEC Trans., Vol.13 , No. 1, Feb-2015 issue

http://www.ecti-thailand.org/paper/journal/ECTI-EEC

ECTI-CON 2014 Special Issue

1. Tadchanon Chuman, Suchin Arunsawatwong, "Criterion of Approximation for Designing 2 × 2 Feedback Systems with Inputs Satisfying Bounding Conditions"

2. Atitaya Sirirungsakulwong, NATTAKAN PUTTARAK, Pornchai Supnithi, "Reduced-Nonlinear Effect on Magnetic Recording Channels Using MMSE Equalizers"

3. Sakorn Po-Ngam, "The Simplified Control of Three-Phase Four-Leg Shunt Active Power Filter for Harmonics Mitigation, Load Balancing and Reactive Power Compensation"

APCC 2014 Special Issue

4. Patrick Seiler, Bernhard Klein, Dirk Plettemeier, "Analytical and Experimental Investigation of Substrate Permittivity and Loss up to 67 GHz"

5. Meriem Salhi, Sihem Trabelsi, Noureddine Boudriga, "Mobility-Assisted and OoS-Aware Resource Allocation for Video Streaming over LTE Femtocell Networks"

6. Nikorn Hen-ngam, Jirayuth Mahattanakul, "A Simple and Accurate Formula for Oscillating Amplitude of CMOS LC Differential Oscillator"

Report from Conferences and Workshops
1. Professor Roadshow, reported by Kosin Chamnongthai (KMUTT)

ECTI association has set up a program to encourage Thai lecturers to plan forward professor position by speakers; Prof. Monai Krairiksh (KMITL), Prof. Prayoot Akkaraekthalin (KMUTNB), and Prof. Kosin Chamnongthai (KMUTT) launching in the beginning of 2014 at CMU, following at BU, and PSU.
In 2015, we started the project at Mahasarakham University (MSU) on Jan 20, 2015, following at Ubon Ratchathani Rajabhat University (URRU) on Feb 17, 2015, and at the Sirindhorn International Thai-German Graduate School of Engineering (TGGS), King Mongkut's University of Technology North Bangkok on March 17, 2015

@ MSU on Jan 20, 2015

@ URRU on Feb 17, 2015

@ TGGS, KMUTNB on Mar 17, 2015

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

2. KST 2015 (reported by K.Chinnasarn, Faculty of Informatics, Burapha University)

KST 2015

The 2015 – 7th International Conference on Knowledge and Smart Technology

KST international conference has been established with the aim in mind that a sustainable community will be achieved through continuous studies and share resources. The conference will be held annually in Burapha University which located in the Eastern part of Thailand. It provides a central forum for experts and developers to promote, share, and discuss various issues and developments in the broad field of Computational Intelligence, Intelligent Application, Intelligent Computer Networks and Systems, and Emerging Intelligent Technologies. KST international conference will provide an opportunity for young researchers to demonstrate their talent and interesting research ideas. The conference will benefit people who are actively involved in research related to computational intelligence and its applications. The 7th KST was held at the Tao-Thong Hotel, Burapha University, Thailand on January 28 – 31, 2015. Visit the official website at http://kst.buu.ac.th/

KST 2015 was organized by 9 departments from 8 institutes including Burapha University, Chulalongkorn University, Sripatum University at Chonburi, Khon Kaen University, King Mongkut's University of Technology Thonburi, Assumption University, Prince of Songkla University and Rajmangala University of Technology Tawan-Ok, Chantaburi Campus

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

In addition, the KST 2015 was also technically supported by the Institute of Electrical and Electronics Engineers (IEEE), the Institute of Electrical and Electronics Engineers Thailand Section (IEEE Thailand Section), and Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology Association of Thailand (ECTI Thailand). Moreover, KST 2015 conference had been sponsored by Software Industry Promotion Agency (Public Organization) or SIPA, Office of The National Broadcasting and Telecommunications Commission, and TOT Public Company Limited, for sponsoring the conference.

KST 2015 Statistics

- 84 papers submitted from 15 countries
- 28 papers accepted (acceptance rate of 33.33%)
- 10 Thai papers submitted and no paper accepted (acceptance rate of 0%)
- 9 oral sessions (2 parallel sessions)
- 1 Special Session in “Recent Advances in Cognitive Science"
- 3 keynote speakers (2 Sessions)
- 250 participants from 8 countries attended to the conference

Prof. Sompol Phongthai
President of Burapha University

in KST 2015 opening ceremony

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ECTI e-magazine
ISSN: 2286-7074

KST 2015 **Events**

KST 2015 keynote speech was given by **Professor Dr. Roberto Caldara** from Department of Psychology, University of Fribourg, Switzerland, on the topic " Mapping the impact of culture and race in visual processing", and **Professor Dr. Hanmin Jung** from Department of Computer Intelligence Research, Korea Institute of Science and Technology Information Daejeon, Korea and **Professor Dr. Young-guk Ha** from Department of Computer Science and Engineering, Konkuk University, Seoul, Korea, on the topic “InSciTe Advisory: Prescriptive Analytics Service for Enhancing Research Performance”

Special Session on " Recent advances in Cognitive Sciences" organized by **Professor Dr.Katsumi Watanabe** from University of Tokyo, Japan.

Matlab Workshop on Computer Vision by **Assist. Prof. Dr. Parinya Sanguansat** from Panyapiwat Institute of Management, Thailand

Meeting of International Consortium in Informatics (ICI Meeting) organized by **Professor Dr. Kosin Chamnongthai** from Faculty of Engineering, King Mongkut's University of Technology Thonburi, Assumption University and **Assist. Prof. Dr.Suwanna Rasmequan** from Faculty of Informatics, Burapha University.

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

KST 2015 Banquet was held at The Tide Resort Hotel, Bangsaen Beach, Chonburi, on Jan 29, 2015

Meeting of International Consortium in Informatics (ICI Meeting) and Best Paper Award

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

3. ICSEC 2014 (reported by Sartra Wongthanavasu, KKU)

ICSEC 2014

The 2014 – 18th International Computer Science and Engineering Conference

July 30 – August 1, 2014

Pullman Khon Kaen Raja Orchid, Khon Kaen, Thailand

Statistics

- ICSEC2014 was organized by Dept of Computer Science, Khon Kaen University
- 196 papers submitted from 19 countries
- 122 papers accepted (acceptance ration for int'l track is 58 %)
- 28 sessions in 7 parallel tracks
- Two tutorials, one workshop, and one special session
- 4 keynote speakers (2 Sessions)
- Approx. 300 participants from 16 countries

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
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A) Paper submission

Tracks	Paper submission	Paper acceptance	Percentage
i) International track	135	85	64.6%
- Invited papers	7	7	
- iTAG workshop	8	5	
ii) Thai track	46	25	54.3%
Total	196	122	62.2%

B) Authors by Country and Region (All Papers)

All authors of submitted paper are counted. Authors are counted once for each paper.

Countries	Authors	%	Papers (1st author)	%
Thailand	305	70.4	151	71.6
India	30	6.9	17	8.1
Taiwan	19	4.4	8	3.8
P.R.China	17	3.9	7	3.3
Malaysia	14	3.2	6	2.8
Saudi Arabia	11	2.5	5	2.4
Iran	9	2.1	3	1.4
Pakistan	7	1.6	5	2.4
Other	21	4.8	9	4.4
Total	433			

Authors classified by region

Region	Authors	%
Asia/Pacific	400	92.4
Europe, Middle East,	32	7.4
Other	1	0.2

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C) Authors by Country and Region (Accepted Papers)

All authors of accepted papers are counted, regardless of whether they are.

Countries	Authors	%	Papers (1st author)	%
Thailand	185	75.2	84	77.1
Taiwan	16	6.5	6	5.5
India	12	4.9	4	3.7
Saudi Arabia	6	2.4	3	2.8
Malaysia	6	2.4	2	1.8
Other	21	8.4	10	9.1
Total	246			

Authors classified by region

Region	Authors	%
Asia/Pacific	228	92.7
Europe, Middle East, Africa	17	6.9
Other	1	0.4

D) Two tutorial sessions

Session 1: Distributed Simulation in the Cloud
Professor Stephen John Turner
Division of Networks & Distributed Systems,
School of Computer Engineering, College of Engineering,
Nanyang Technological University, Singapore

Session 2: Mobile Cloud Computing
Associate Professor Dusit Niyato
Division of Networks & Distributed Systems,
School of Computer Engineering, College of Engineering,
Nanyang Technological University, Singapore

E) Workshop on iTAG

Theories and Applications of Graphs: Toward the Big Data Era
Professor Sheng-Lung Peng, National Dong Hwa University, Taiwan

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Future Computer Science and Engineering Education (FCSEE)
Professor Prabhas Chongstitvatana and Asst.Prof.Dr.Putchong Uthayopas

Keynote speakers

1. Professor Mitsunori Makino, Chuo University, Vice President of Engineering Sciences Society and IEICE
   Topic: *Computer Graphics and Visualization Technology in Big Data and Cloud Computing*
2. Professor THAM Chen Khong, Department of Electrical & Computer Engineering (ECE), National University of Singapore
   Topic: *Internet of Things using Cognitive Radio: Promises and Challenges*
3. Dr.Waleed S Mohammed, School of Engineering, Bangkok University
   Topic: *Growth Optimization of Zinc Oxide Nano-rods on Optical Fibers Towards Sensing and Communication Applications*
4. Dr.Thanachart Numnonda, IMC Institute, Thailand
   Topic: *Cloud Computing Status and Trend in Thailand*




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ECTI-CON 2015

Hua Hin, Thailand June 24 – 26, 2015

ECTI-CON 2015 is the twelfth annual international conference organized by Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI) Association, Thailand. The conference aims to provide an international platform to present technological advances, launch new ideas and showcase research work in the field of electrical engineering, electronics, computer, telecommunications and information technology. Accepted papers will be published in the Proceedings of ECTI-CON 2015 and will be submitted for inclusion into IEEE Xplore. Acceptance will be based on quality, relevance and originality.

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Special sessions:
The aim of special sessions is to provide researchers with an opportunity to present their their latest, cutting-edge research within specific fields relevant to the theme of the conference. Prospective organizers should submit proposals to the General Secretary via

Paper submission:
- Prospective authors are invited to submit original full papers **without author's names and affiliations, in English**, of 4-6 pages in standard IEEE two-column format only, reporting their original work and results, applications, and/or implementation in one or more of the listed topics.
- Papers must be submitted only by internet through the submission system of the conference website.
- At least one author of each accepted paper **MUST** register and present paper at the conference in order for the paper to be included in the program. The program will be submitted for inclusion into IEEE Xplore.

Important dates:
- Full paper submission: Jan 31, 2015
- Notification of acceptance: Apr 30, 2015
- Camera-ready paper submission: May 15, 2015
- Authors and Early-bird registration: May 15, 2015

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ECTI Who's Who