ISSTIN 2012

PROCEEDING

INTERNATIONAL SEMINAR ON SCIENCE AND TECHNOLOGY INNOVATIONS 2012

Green Technology Innovations for A Sustainable Society

University of Al Azhar Indonesia
2-4 October 2012

Organized by:
Faculty of Science and Technology
University of Al Azhar Indonesia

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Seminar on Science Technology and Innovation 2012

Prof. Dr. Ir. Zuhal, M.Sc.E.E.
Rector
University of Al Azhar Indonesia

Assalaamu'alaikum warahmatullahi wabarakatuh,

Distinguished guest,

All praises and glory to Allah Subhanahu wa Ta'ala, The Almighty, for allowing us to gather for this distinguished Forum at the University of Al Azhar Indonesia. First of all I would like to express my deep satisfaction to the committee for their efforts to make this program happen, also to the Islamic Development Bank for their support and other sponsors as well.

This International Seminar is organized by the Faculty of Science and Technology. In essence, this Seminar is a manifestation of concerns by the faculty members on the continuing destructions of our environment, and an expression of this faculty to promote the use of green technology in the society. It is hoped that this seminar could help promoting green lifestyle through the use of green technology in this country, and to raise public awareness on the need to be innovative and to produce climate smart processes and products.

I wish all of you the best of luck and much courage as you presenting and be presented in this international seminar with new ways of creating a world that works for everyone with no one left out, and of acquiring mutual knowledge that enable us to build a better future - a sustainable society.
Thank you very much.

Wassalaamu'alaikum wa Rahmatullahi wa Barakatuh

Dr. Ary Syahriar, DIC
Dean of Faculty of Science and Technology
University of Al Azhar Indonesia

Assalaamu'alaikum warahmatullahi wabarakatuh,

Welcome to the 1st International Seminar on Science and Technology Innovation 2012 (ISSTIN 2012). Additionally, the aim of ISSTIN 2012 is to facilitate the communication of academic between domestic and foreign, to construct international platform and also to exhibit the new fruits on science and technology innovation.

We are honored to have the State Minister of Research and Technology Republic of Indonesia to convey his keynote speech. Apart of it, we will also have plenary sessions with six speakers in the first and second day with various backgrounds to share about state of the art of green technology innovation such as green technology, green computing, green building, etc.

ISSTIN 2012 is supported primarily by The International Development Bank (IDB) Jeddah, and also PT Pembangunan Jaya Ancol, PT Agung Podomoro Land, PT Solusi247 and our media partners Republika and JakTV.

Finally, it is both our duty and pleasure to express our gratitude for the work done by the referees as well as the hardworking team to make this seminar successful. Without their efforts many of the papers in this volume would not have been improved.

We hope and believe that everybody will have an academic enjoyment during this seminar and pleasant stay in Jakarta.

Wassalaamu'alaikum wa Rahmatullahi wa Barakatuh

Nunung Nurhasanah, ST., MSi.
Chairperson
Organizing Committee of ISSTIN 2012

Assalaamu'alaikum warahmatullahi wabarakatuh,

Dear Colleagues,

On behalf of the Organizing Committee, I am honored to welcome you to the International Seminar on Science and Technology Innovations 2012 (ISSTIN2012). This seminar is organized by the Faculty of Science and Technology, University of Al Azhar Indonesia (UAI), Jakarta.

This year we received 77 paper submissions from various universities, research centers, and its affiliations. The Technical Program Committee accepted 70 selected papers that will be presented in this seminar. The accepted papers are categorized into four groups; Biotechnology, Electrical Engineering, Industrial Engineering, and Information Technology.

And finally, the success of this seminar is due to the hard efforts of many people who we gratefully acknowledge. We also thank the authors whose papers are presented, invited keynote speakers, and all parties that we are not able to mention here.

We hope you all will enjoy the two days of discussion through this seminar and enjoy the beauty of Jakarta and the UAI campus. We hope to see you again next year, in the Seminar on Science and Technology Innovations 2013.

Wassalaamu'alaikum wa Rahmatullahi wa Barakatuh

Proceeding of Seminar on Science and Technology Innovation 2012

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Jakarta 12110

Phone: +62-21-727 92753
Fax: +62-21-724 4767

Email: ISSTIN2012@uai.ac.id
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(Information Technology, University Indonesia)

KEY NOTE SPEAKER

Prof.Dr.Ir.H. Gusti Muhammad Hatta, MSc (State Minister of Research and Technology Republic of Indonesia).

Graduated from UNLAM, Banjarmasin, Faculty of Forestry, affiliated with Institut Pertanian Bogor. Master degree from Universitas Gadjah Mada, and doctoral degree from Wageningen University, The Netherlands.

Experience, among others:

- 2003-2005 – Head of Research Department UNLAM, Banjarmasin.
- 2006-2009 – Vice Rector, UNLAM, Banjarmasin.
- 2009-2011 – Minister of Environment.
- 2011-present – State Minister of Research and Technology, Kabinet Indonesia Bersatu II.

Speaker I of Plenary Session

Datuk Dr. Tengku Mohd. Azman Shariffadeen (IDB Consultant, Malaysia)

He served as an academic at the Faculty of Engineering, University of Malaya, for eleven years and spent the next 21 years as the founding Director General and CEO of the Malaysian Institute of Microelectronic Systems (MIMOS). He served for nine years as the ex-officio secretary of the National Information Technology Council, chaired by the Prime Minister of Malaysia. In this capacity he was closely involved with the formulation and implementation of national ICT policies and strategies, in particular, the Multimedia Super Corridor (MSC) and the National IT Agenda (NITA).

Currently shares his experience in knowledge and innovation for development, particularly in projects in the Middle-East and the Asia Pacific Region. He is a Fellow, Academy of Sciences, Malaysia; Member, National Science and Research Council, Malaysia; Adjunct Professor, International Islamic University, Malaysia; Member, High-Level Advisory Panel, Global Alliance for ICT and Development, United Nations; Advisor, Al Aghar Group, Kingdom of Saudi Arabia and Member, New Club of Paris. He is a director of Pernec Corporation Berhad, an IT company.

Abstract:

INNOVATING FOR
A GREENER FUTURE THROUGH SCIENCE AND TECHNOLOGY –
FRAMEWORKS FOR EFFECTIVE ANALYSIS, PLANNING AND MANAGEMENT

This presentation introduces several frameworks which enable effective analysis, planning and management of innovation that is based on science and technology. A value chain of the innovation process flow reveals a major difference between a producer nation and a consumer nation. While a producer is able to implement a seamless flow from science and technology development to its eventual application to realise value, the consumer suffers an "innovation chasm" that separates the production of knowledge from the production of goods or services.This chasm has to be bridged if consumer nations are to become producers. The collaboration of key actors in the public sector, private sector and the community sector is crucial. In particular the role of entrepreneurs in the incubation of technologies and businesses that arise from them is prominent. The value chain analysis provides an effective description of the components of a national innovation eco-system and how they are linked.

A core bridging function is the process of diffusion and adoption of innovations, which is explained using Rogers' model. From this analysis it becomes clear that the act of inventing is insufficient to innovate. Diffusion and adoption involves acceptance and actual use of inventions by potential users and consumers. This often overlooked fact is a major challenge, with almost total emphasis normally given to the creation and invention phases of innovation.

The World Economic Forum's Growth Competitiveness Index is another framework that facilitates analysis and planning. Examples are provided of country ranking that reveal key areas of policy and strategy intervention that may help to accelerate innovation-driven competitiveness.

Finally the 7i framework (Nair 2007) to measure innovation capacity and rank countries is introduced. By way of examples it is demonstrated how the framework may be applied to identify areas of improvement so that a country may be able to plan and undergo rapid increase in innovation capacity.

Speaker II of Plenary Session

Ir. Rana Yusuf Nasir (Director Rating & Technology of Green Building Council Indonesia, President Director of PT Airkon Pratama, Indonesia)

Graduated from Institut Teknologi Bandung, on Applied Physics. Expert in Building Engineering Services & HVAC System.

Affiliations:

- Member of U.S. Green Building Council - New York Chapter
- Core Founder Green Building Council Indonesia
- Director of Rating & Technology GBCI and responsible for developing Greenship Rating System Tools
- President 2009-2010 - ASHRAE: American Society for Heating, Refrigeration & Airconditioning Engineer: Indonesia Chapter
- Member of IAFBI (Ikatan Ahli Fisika Bangunan Indonesia)
- Member of Technical Team - Komite Nasional Perlindungan Lapisan Ozon
- AC Working Group Leader for HCFC Phase-out Management Plan for Ministry Office of Environment

Experience/Achievements:

- Specializing on Operation & Maintenance for Building Utilities and M&E Contracting
- Supplying HVAC Central System, Install & Maintenance
- Energy Saving & Upgrading Performance of Building Utility
- Supporting Ozone Layer Protection activity for Ministry Office of Environment since 1992
- Receiving 2 (two) Awards for Active Role in Environment Program from Ministry of Environment: Year of 1998 and 2008.

Abstract:

GLOBAL TREND FOR BUILDING :
GREEN AND HIGH PERFORMANCE BUILDING

As global population significant growth for the last century reaching about more 7 billion people, makes a significant growth also an increasing number of building for live space, for working and for other activity.

The building industry sector have contributed up to 17% in water use from the use of water consumption worldwide, 35% use wood from forests, 40% of energy use, and it contributed 33% of CO2 emissions which is one of the biggest contribution of greenhouse gas. Building sector also consumed one third of earth natural resources. In other words, the building industry gives impact to and contribute to environmental damage, the symptoms of global warming and climate change.

Buildings have a surprisingly profound impact on our natural environment, economy, health, and productivity. Building should be designed for not spoiling the environment, better indoor quality to reduce health risk, comfortable space to increase working spirit to boost the productivity and in from economy aspect, has a better life cycle cost. From this perspective, green building concept and as well as high performance building concept was created.

For evaluation and assessment a building to be certified as Green Building, it needs a rating tools which had been developed by Green Building Council Indonesia. In developing rating tools, Green Building Council Indonesia (GBCI) set a corridor for the tools as :

a. Simplicity and not a complex one.
b. Applicable
c. The availability of product and technology.
d. The required additional investment as low as possible.

Recently, GBCI already launched 2 (two) rating tools : Greenship Rating Tools NB (New Building) version 1.1 and Greenshiip Rating Tools EB (Existing Building) version 1.0. Until end of 2012, there are 77 building have sent their intention to apply for certification, 25 project already registered and in the process of certification, the other is still in registration process. 54% of the numbers are for New Building Certification, 73% oh the numbers located in DKI Jakarta, and the others are in West Jawa, Central Jawa, and Bali.GBCI has awarded a Certification based on Greenship Rating Tools for 3 (two) building : Kantor Pusat Management PT Dahana, Subang for New Building Criteria, Menara BCA, Jakarta for Existing Building, both achieved Platinum Level. The third is Sampoerna Strategic Building for Existing Building and achieved Gold Level.

For new building, there is a one step before completed assessment that if the building owners aimed to evaluate their building on design stage, and GBCI will do assessment based on tender drawing and the result called as “Design Recognition. For this stage, GBCI has awarded a “Design Recognition” to :

- Gedung Utama Kementerian Pekerjaan Umum, Jakarta expected to achieve a Platinum Level.
- Institut Teknik & Science Bandung, Cikarang expected to Gold Level
- Rasuna Tower, Jakarta expected to Gold Level.
- Bank Indonesia Solo expected for Platinum Level

Speaker III of Plenary Session

Ir. Budi Karya Sumadi (President Director of PT. Pembangunan Jaya Ancol, Indonesia).

Graduated from Universitas Gajah Mada, Yogyakarta, Department of Architecture.

Job Experience

2001 – 2004 Finance Director, PT Pembangunan Jaya Ancol Tbk.
2001 – 2004 Finance Director, PT Taman Impian Jaya Ancol
2001 – now Commissioner, PT Philindo
2004 – now President Director, PT Pembangunan Jaya Ancol Tbk
2004 – now President Director, PT Taman Impian Jaya Ancol

Organizations

2003 – now Chairman Assistant, Independent Golf Club Indonesia
2005 – now Head of Education & Training Department, Indonesian Public Listed Companies Association
2005 – now Board of management, KONI DKI Jakarta
2005 – now Chairman, Jaya Raya Utama Foundation

Abstract:

MANAGING DREAMS

The Ancol amusement park, is one of the most visited destination in Asia. Recently Ancol tries to contribute the best for the environment by introducing the Ocean Ecopark. The area is reinvented on three concepts; of green, for open area utilization; blue, for water management; and red for the activities. The locale is developed with four area of themes: Eco Energy, Eco Care, Eco Nature and Eco Art. Ancol promotes initiatives in education and green living style to be a green company applying environment friendly corporate culture.

Speaker IV of Plenary Session

Ir. Jusman Syafii Djamal (Chairman of Matsushita Gobel Foundation, Indonesia).

Graduated from Institut Teknologi Bandung, Mechanical Engineering.

Experience, among others:

- 2000-2003 – President Director of PT Dirgantara Indonesia.
- 2005-present – Chairman of Matsushita Gobel Foundation.
- 2007-2009 – Minister of Transportation, Kabinet Indonesia Bersatu I.
- 2011-present – Member of Komite Inovasi Nasional, lead by Prof. Dr. Ir. Muhammad Zuhal, M.Sc.EE.

Abstract:

FOR FUTURE GENERATIONS, PANASONIC AIMS TO BECOME
THE NO. 1 GREEN INNOVATION COMPANY
IN THE ELECTRONICS INDUSTRY

Panasonic was founded based on the philosophy of contributing to progress in society and to enriching people's lives through business activities. By offering products that help people lead better, greener lives, Panasonic has made close ties with people worldwide.

Panasonic believes that they can integrate contribution to the environment with business growth, by driving green innovation in all aspects of our business practices such as product development firmly rooted in people's everyday lives and production activities.

The 'eco ideas' mark symbolizes Panasonic's strong commitment to continuous environmental sustainability management.

Speaker V of Plenary Session

Prof.Dr. Rosnah Mohd.Yusuff (Department of Mechanical and Manufacturing Engineering, Universiti Putra Malaysia, Serdang, Malaysia).

Graduated Bachelor degree on Chemistry, Master degree on Industrial Engineering and Management from University of Iowa, USA, and Doctoral degree on Manufacturing System from Universiti Putra Malaysia (UPM), Malaysia.

Professional Qualification/Membership/Affiliation:

- Past Secretary, Engineering Education and Training Committee (EETC) of the Federation of Engineering
- Institutions in Islamic Countries, FEIIC
- Past Secretary, EETC news bulletin, ENTIC, FEIIC
- Member, Editorial board of Inderscience publishers
- Executive Council Member, of Pan Pacific Council on Occupational Ergonomics
- Member, International Ergonomics Association Technical Committee Member on Primary Industries
- Member, International Ergonomics Association Technical Committee Member on Musculoskeletal Disorders
- Protem Committee Member, Human Factors and Ergonomics Society of Malaysia
- Founding Member, Malaysian Society of Engineers and Technologists
- Member, Executive Board Member and IEM-FEIIC National Monitoring Committee (2007-2009)
- Member, FEIIC- Kuala Lumpur Regional Office (2007-2009)
- Member, EQAPS-FEIIC (2007-2009)
- Chief Editor, FEIIC Bulletin and Publication (2007-2009)
- Member, Standing Committee on Innovation Foresight (FEIIC, 2007-2009)

Abstract:

ENVIRONMENTAL CONSCIOUS MANUFACTURING
FOR SUSTAINABLE GROWTH

Companies must be more environmentally conscious, focus on sustainable practices and materials, and become more socially responsible corporations. Current manufacturing activities have caused the degradation of the environment, the depletion of resources at an accelerated rate, global warming, and affected the quality of life. New technologies, the short life cycle of products consumed more resources that hinder sustainable growth. Thus, companies have to transform their manufacturing activities, not only to increase competitiveness but to consider the impact of their activities on the environment in a socially responsible manner. Environmental conscious manufacturing when practiced addressed the environmental necessity and provide the means of managing the depletion of resources. Enhancing the understanding of the practices of ECM and their impacts on the environment will enable companies to develop their manufacturing strategies.

Keywords - Environmental conscious manufacturing (ECM), Reverse logistics, 6Rs, sustainable growth

Speaker VI of Plenary Session

Dr. Ade Jamal (Head of Department of Informatics Engineering).

PhD degree from Delft University of Technology, The Netherlands. He serves as a researcher in Badan Pengkajian dan Penerapan Teknologi (BPPT) and Head of Korea-Indonesia ICT Training Center, Ministry of Communication and Information in 2010-2011.

Abstract:

GREEN COMPUTING,
JUST ANOTHER BUZZWORD OR REALLY CAN MAKE WORLD CLEANER?

Nowadays, green computing is attracting more attention from IT people whether they are designers, manufacturers, organization or even just end-users of information technology who have environmental awareness. However, just like most of environmental issues in other fields, many people still consider green computing as just a “nice to have” technology or justanother buzzword from the environmental activist.

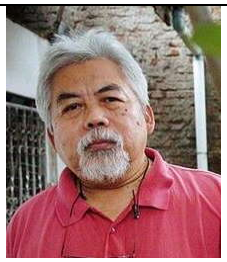
By definition green computing is the study and practice of designing, manufacturing, using and disposing of computers, servers and associated subsystems efficiently and effectively with minimal or no impact on the environment. In the early ninety, environmental awareness was started by Energy Star Label which is a seal approval from regulator to reduce energy consumption by using energy efficient hardware. This Energy Star Label disappeared when the power efficient LCD monitors came into the market replacing the CRT monitor. This is one example of successful green computing movement from computer designer and manufacturer to enhance better environment.
Reducing energy is always the first priority but using energy efficient product is not the only approach in the green computing. This paper will present various issues in the green computing from practical issue to the state of the art technology such as virtualization and cloud technology.

Keywords: green computing, energy saving, Cloud Technology

List of Invited Speakers

Prof. Dr. Saiyed I. Ahmed
HEC Foreign Professor and
Coordinator, Dengue Research Program
Institute of Microbiology,
University of Agriculture, Faisalabad

Prof.Dr. Johan Iskandar
Professor of Etnobiology Biological Department University Padjajaran
Institute of Ecology, University Padjajaran, Bandung, Indonesia



Dr. Anjum Suhail
Chairman of Dept. of Agri. Entomology, University of Agriculture, Faisalabad-Pakistan

Dr. Lisman Suryanegara, M.Agr
Researcher at Indonesian Institute of Science, LIPI
Centre of Biomaterial

Associate Professor Alyani Ismail
Centre of Excellence for Wireless and Photonic Networks
Department of Computer and Communication Systems Engineering Faculty of Engineering, Universiti Putra Malaysia,

Assoc. Prof. Dr. Raja Syamsul Azmir B Raja Abdullah
Department of Computer & Communication Systems
Engineering,
Universiti Putra Malaysia

Rini Akmeliawati, PhD
Chairperson of Intelligent Mechatronics System Research Unit (IMSRU-IIUM)
International Islamic University Malaysia

Assoc. Prof. Dr. Chuvej Chansa-ngavej
Director, Shinawatra University Research Center
Shinawatra University, Thailand

Dana Sulistiyo Kusumo
School of Computer and Engineering
UNSW, New South Wales, Australia

Moch. Arif Bijaksana
Research member of e-Discovery Lab
School of Electrical Engineering and Computer Science
Faculty of Science and Engineering, Queensland University of Technology (QUT)
Brisbane, Australia

Lecturer at Institut Teknologi Telkom, Bandung.

EVENT SCHEDULE
INTERNATIONAL SEMINAR ON SCIENCE AND TECHNOLOGY INNOVATION 2012 (ISSTIN2012)
UNIVERSITY AL AZHAR INDONESIA, JAKARTA, 2-4 OCTOBER 2012

DAY 1

TIME	TUESDAY, OCTOBER 2nd, 2012		
08.00-08.30	Registration		
08.30-09.00	Opening Exhibition		
09.00-10.15	Opening		
	Key Note Speech by Prof.Dr.Ir.H. Gusti Muhammad Hatta, MSc State Minister of Research and Technology		
10.15-10.35	Coffee Break		
10.35-12.15	Plenary Seminar		
	Moderator: Dr. YS Hidayat		
	1. Datuk Dr. Tengku Azman Sharifadeen (IDB Consultant)		
	2. Rana Yusuf Nasir (Director for Rating & Technology, Green Building Council Indonesia)		
	3. Budi Karya Sumadi (President Director of PT. Pembangunan Jaya Ancol)		
	4. Jusman Syafii Djamal (Chairman of Matsushita Gobel Foundation)		
12.15-13.30	Lunch Break		
13.30-15.00	Parallel Seminar 1		
	Decision Analysis R. 317 A Moderator: Syarif Hidayat	Eco Devices R. 317 C Moderator: Suci Rahmatia	Ecology R. 317 C Moderator: Nita Noriko
	1. Invited Speaker Assoc. Prof. Dr. Chuvej Chansangavej	1. Invited Speaker Assoc. Prof. Dr. Alyani Ismail	1. Invited Speaker Prof. Dr. Johan Iskandar
	2. IE-02	2. Invited Speaker Dr. Lisman Suryanegara	2. Invited Speaker Dr. Anjum Suhail
	3. IE-06	3. EE-07	3. BIO-07
	4. IE-12	4. EE-23	4. BIO-09
15.00-15.20	Coffee Break		
15.20-16.50	Parallel Seminar 2		
	Software Engineering R. 317 A Moderator: Winangsari P	Biodiversity R. 317 B Moderator: Vanny Narita	Bio & Eco Instrumentation R. 317 C Moderator: Yaya Suryana
	1. Invited Speaker Dana Kusumo	1. Invited Speaker Prof. Dr. Saiyed Ahmed	1. Invited Speaker Rini Akmeliawati, PhD
	2. IF-08	2. BIO-01	2. EE-01
	3. IF-09	3. BIO-05	3. EE-02
	4. IF-14	4. BIO-14	4. EE-08
16.50-19.00	Free		
19.00-21.00	Honorary Dinner		

DAY 2

TIME	WEDNESDAY, OCTOBER 3rd, 2012		
09.00-10.30	Parallel Seminar 3		
	Image Processing & Intelligent Systems R. 317 A Moderator: Nida'ul H	Good Manufacturing Process R. 317 B Moderator: Niken Parwati	Communication Development R. 317 C Moderator: Octarina NS
	1. Invited Speaker Moh. Arif Bijaksana	1. IE-03	1. Invited Speaker Assoc.Prof.Dr. Raja Syamsul Azmir B Raja Abdullah
	2. IF-01	2. IE-10	2. EE-03
	3. IF-06	3. IE-14	3. EE-05
	4. IF-15	4. IE-16	4. EE-14
		5. IE-17	5. EE-15
10.30-10.45	Coffee Break		
10.45-12.00	Plenary Seminar 2 317a + 317b		
	Moderator: Dr. Syarif Hidayat		
	1. Prof.Dr.Rosnah Mohd.Yusuff (UPM)		
	2. Dr. Ade Jamal (UAI)		
12.00-13.30	Lunch Break		
13.30-15.00	Parallel Seminar 4		
	Microbiology R. 317 A Moderator: Riris Lindawati	IT Utilization R. 317 B Moderator: Endang Ripmiatin	Supply Chain & Product Development R. 317 C Moderator: Ahmad Juang
	1. BIO-02	1. IF-02	1. IE-08
	2. BIO-03	2. IF-03	2. IE-09
	3. BIO-08	3. IF-05	3. IE-11
	4. BIO-10	4. IF-13	4. IE-13
			5. IE-18
15.00-15.20	Coffee Break		
15.20-16.50	Parallel Seminar 5		
	Optical Communication R. 317 A Moderator: Octarina NS	Biotechnology R. 317 B Moderator: Riris Lindawati	Mobile Application and DBMS R. 317 C Moderator: Ade Jamal
	1. EE-11	1. BIO-06	1. IF-04
	2. EE-13	2. BIO-11	2. IF-10
	3. EE-17	3. BIO-12	3. IF-11
	4. EE-18	4. BIO-16	4. IF-16
	5. EE-19		

DAY 3

TIME	THURSDAY, OCTOBER 4th, 2012
08.30-12.00	Old Jakarta Tour

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Industrial Engineering

EFFECT OF DEFECT FRACTION AND REFRACTIVE INDEX IN UNIFORM FIBER BRAGG

Nasrulloh[1], Octarina Nur Samijayani[1], Ary Syahriar[1]

[1]Department of Electrical of Engineering Faculty of Science and Technology
University of Al Azhar Indonesia, Jl. Sisingamangaraja, Jakarta 12110

Email : arul.ste@gmail.com, octarina.ns@gmail.com, ary@uai.ac.id

Abstract -**This paper explain about defect fraction and refractive index due to change of reflection power and transmission power in uniform fiber Bragg grating. Defect fraction and refractive index as properties of fiber Bragg grating need to observe to know their effect in reflection and transmission power in optical telecommunication system. Couple mode theory was used to describe the parameter of uniform fiber Bragg grating then integrated numerically with transfer matrix method to get the formula for uniform fiber Bragg grating. Here, reflection power and transmission power were demonstrated and the simulation will be limited to single-mode silica-based fiber that operate at a central wavelength of 1550 nm. By simulating the effect of defect fraction and change in refractive index between core and cladding, we are expect better understanding about the characteristics of fiber Bragg grating for further application in telecommunication, lasers and sensor field.**

Keywords *- fiber Bragg grating, defect fraction, refractive index, transfer matrix method*.

Abbreviation

FBG (Fiber Bragg Grating)
p.u (power unit)

I. INTRODUCTION

Nowadays, optical telecommunications is the newest technology that growth rapidly in our telecommunication system. Optic is the branch of physic that describes the behavior and properties of light and the interaction of light with matter. Optic explains and is colored by an optical phenomenon. The field of optic usually describes the properties of visible light, infrared and ultraviolet, but because light is an electromagnetic wave, a similar phenomenon also occurs in X-ray, microwave, radio wave, and other forms of electromagnetic radiation.

Optic is the most useful and powerful tool that used in telecommunication system to switch the old technology with new technology. Since the invention of fiber Bragg grating is attributed to the work of Hill et al. at the Communication Research Centre in Canada in 1978, the fiber Bragg grating has become a very attractive optical device in high-performance optical communication system. Fiber Bragg grating has emerged as important components in the wide applications. Their unique filtering properties and versatility, as in-fiber devices, has revolutionized the telecommunications, the lasers and the sensors fields.

II. BASIC THEORY

A "Bragg grating" is a periodic or aperiodic perturbation of the effective absorption coefficient and/or the effective refractive index of an optical waveguide formed by exposure of the core and intense optical interferences pattern. In the periodic structure of the FBG the coupling of energy between different co-propagating and counter-propagating modes of the fiber takes place. The mode coupling phenomenon is a strong function of wavelength. A Bragg Grating can reflect a predetermined narrow or broad range of

wavelengths of light incident on the grating, while passing all other wavelengths of the light.

The capability to photo-imprint gratings in optical fibers requires that the glass be photosensitive. By irradiating the fiber with an intensive pattern that has a periodic or aperiodic distribution, a corresponding index perturbation is permanently induced in the core of the waveguide. The result is an index grating that is photo-imprinted in the optical waveguide. As a result, the Bragg grating becomes a very selective spatial reflector in the core of the fiber.

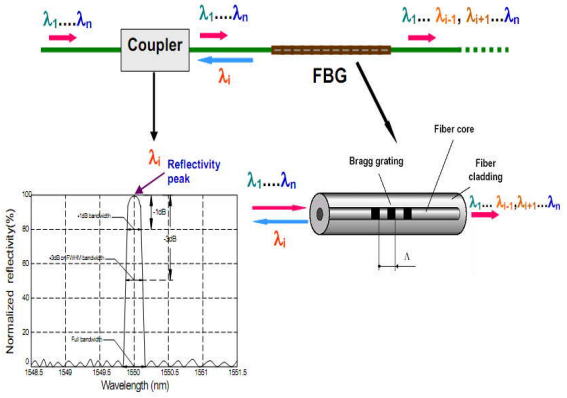

Figure 1 Fiber Bragg Gratings

Figure 1 shows the grating functionality of period in FBG, and how Bragg grating work in optical fiber communication.

The photosensitivity in Bragg grating refers to a permanent modification of the refractive index following a specific light exposure. This effect enables an index grating to be written in an optical fiber. The amount of the saturated refractive index change and the initial change rate of this index are the two parameters characterizing the photosensitivity. This phenomenon provides a new approach for studying the properties of defects in glasses and also a practical method for writing permanent gratings in glass fibers. These gratings are useful for the fabrication of fiber based devices for optical telecommunications and optical sensing applications.

III. MATERIALS AND METHODS

To get the formulation in fiber Bragg grating, couple mode theory is such an important tool to describe this phenomenon. As a result the transverse electric field can be expressed as a combination of forward and backward travelling waves as

$$\vec{E}_t(r,\theta,z,t) = \sum_{vm}[A_{vm}(z)e^{j\beta_{vm}z} + B_{vm}(z)e^{-j\beta_{vm}z}]\vec{b}_{vm}(r,\theta)e^{-j\omega t} \quad (1)$$

Where $A_{vm}(z)$ and $B_{vm}(z)$ are the slowly varying amplitudes of the vm_{th} mode travelling in the forward and backward direction respectively. ω is the angular frequency of propagation and β is the propagation constant defined as

$$\beta = 2\pi n_{eff}/2 \quad (2)$$

where n_{eff} is the effective refractive index of a particular mode.

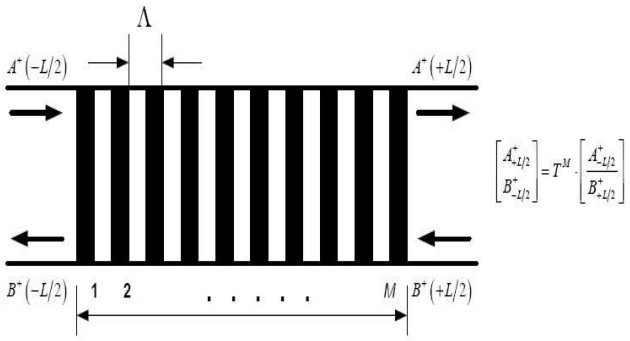

Figure 2 Illustration of grating simulation using the transfer matrix method

The propagation each of the sections k is described by a transfer matrix T_k expressed as follows

$$\begin{pmatrix} A_k^+ \\ B_k^+ \end{pmatrix} = T_k \begin{pmatrix} A_{k-1}^- \\ B_{k-1}^- \end{pmatrix} \quad (3)$$

where the transfer matrix T_k is given by

$$T_k = \begin{pmatrix} \cosh(\gamma_B dz) - j\frac{\sigma}{\gamma_B}\sinh(\gamma_B dz) & -j\frac{\kappa}{\gamma_B}\sinh(\gamma_B dz) \\ j\frac{\kappa}{\gamma_B}\sinh(\gamma_B dz) & \cosh(\gamma_B dz) + j\frac{\sigma'}{\gamma_B}\sinh(\gamma_B dz) \end{pmatrix}$$

The reflectivity of a grating with constant modulation amplitude and period is given by the following expression:

$$R = \frac{k^2 \sinh^2(sl)}{\delta^2 \sinh^2(sl) + s^2 \cosh^2(sl)} \quad (4)$$

The power transmission coefficient is related to the reflection coefficient through the law of conservation of energy which states

$$R(\lambda) + T(\lambda) = 1 \qquad (5)$$

IV. RESULTS AND DISCUSSION

Now, we will executed the simulation to calculate reflection and transmission spectrum with initial parameter:

Parameter	Value
λ_B (Bragg wavelength)	1550 nm
λ (wavelength range)	1520 – 1580 nm
c (light velocity)	3 x 10^8 m/s
M (number of elementary cells)	50
F (defect fraction)	2
γ_B (gamma)	0
n_1 (index of first layer)	1.44
n_2 (index of second layer)	1.47
d_1 (length of first layer)	0.7 µm
d_2 (length of second layer)	0.35 µm
L (elementary cell period length)	1.05 µm
L_{defect}	0.7 µm

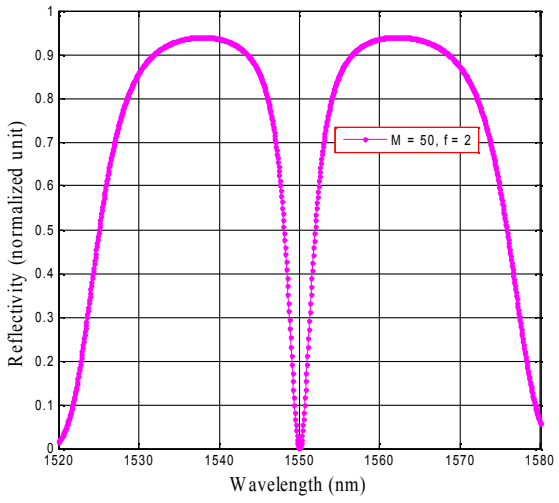

Figure 3 Reflection power spectrum with length of the L_{defect} = 0.7 µm in the central of the gratings and $\gamma_B = 0$

In Figure 3, the defect on the structure of fiber Bragg gratings with $L_{defect} = f \times d_2$ and $\gamma_B = 0$, produce two bandpass filters that separated by a narrow transmission cavity. The peak value of this two reflection areas is 0.93 p.u.

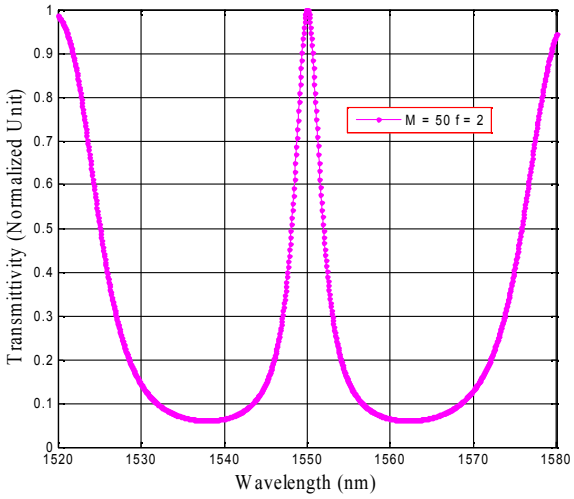

Figure 4 Transmission power spectrum with length of the L_{defect} = 0.7µm in the central of the gratings and $\gamma_B = 0$

Figure 4 represents transmission power in central of the grating. The transmission power separated by a narrow transmission which is reach maximum power, 1 p.u. the minimum value of transmission power is 0.06 p.u.

When reflection power reach minimum value, 0 p.u, the transmission power reach maximum power, 1 p.u. it means the equations R(λ)+ T(λ)= 1 can be proved in this simulation.

4.1 Effect of defect fraction in defect structure of fiber Bragg grating

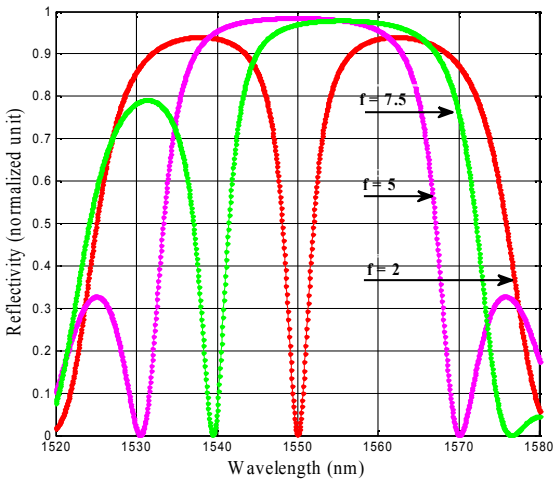

Figure 5 Relation of Reflection power and Wavelenght with different defect fraction.

Defect structure in center of wavelength happen with smaller defect fraction and even value. With bigger and odd value, there is no defect in center of wavelength.

$$R(\lambda) = |\rho|^2 = \frac{\sinh^2(\gamma_B L)}{\cosh^2(\gamma_B L) - \frac{\sigma^2}{\kappa^2}}$$

This equation also tell us the effect of defect fraction on fiber Bragg grating. Where $L_{defect} = f \times d_2$. L_{defect} is defect on grating length, f is defect fraction and d_2 length of second layer in fiber Bragg grating.

Figure 5 represents the defect structure in fiber Bragg grating if we tunned the value of defect fraction in grating. With defect fraction f = 5, the band pass filter have a good performance in central wavelength of 1550 nm. With f = 5 and f = 7.5, the reflection power is 0.97 p.u. by changing defect fraction from 2 become 5 and 7.5 the reflection power is higher. With f = 5 and f = 7.5, there is no defect in 1550 nm. With bigger and odd f, the wavelength can be shifted.

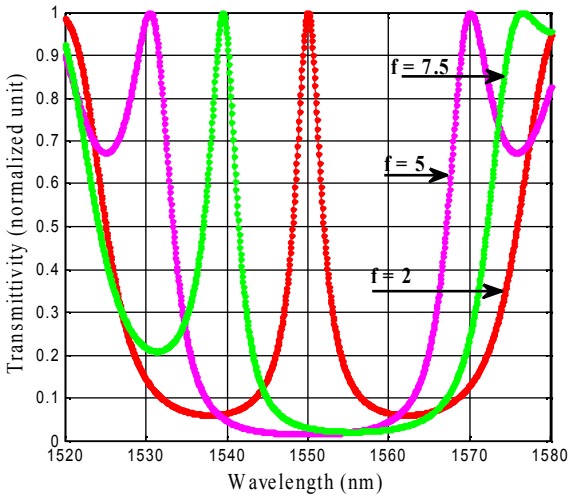

Figure 6 Relation of Transmission power and Wavelenght with different defect fraction

Figure 6 represents the defect structure in fiber Bragg grating if we tunned the value of defect fraction in grating. With defect fraction f = 5, the band pass filter have a good performance in central wavelength of 1550 nm. With f = 5 and f = 7.5, the transmission power is 0.01 p.u. by changing defect fraction from 2 become 5 and 7.5 the transmission power is smaller. With f = 5 and f = 7.5, there is no defect in 1550 nm. With bigger and odd f, the wavelength can be shifted.

4.2 Effect of refractive index in defect structure of fiber Bragg grating

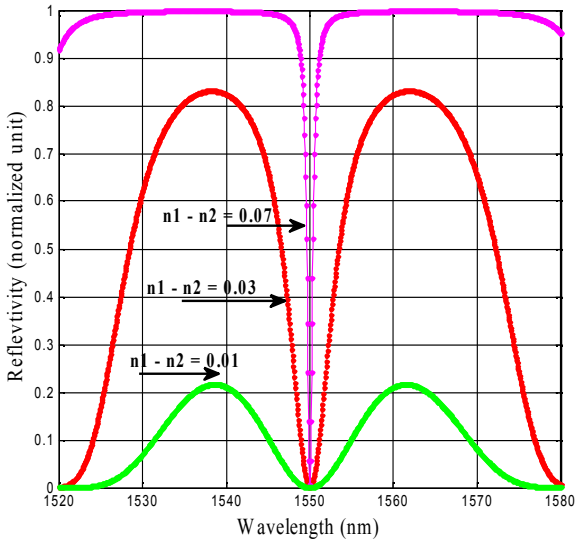

Figure 7 Relation of reflection power and wavelenght with different Refractive Index Δn

Figure 7 represents the reflection power with different refractive index in core and cladding. By using different refractive index n_1 = 1.42 and n_2 = 1.49, so Δn = 0.07, the maximum reflection power is 1 p.u. With the value of refractive index n_1 = 1.44 and n_2 = 1.47, the maximum power reflection is 0.84 p.u. change of Δn from Δn = 0.07 to Δn = 0.03 will produce samller reflection power. The smallest power produced by using Δn = 0.01, the reflection power is 0.22 p.u. The relation of reflection power with different refractive index in core and cladding are describe in equation as follow:

$$R(\lambda) = |\rho|^2 = \frac{\sinh^2(\gamma_B L)}{\cosh^2(\gamma_B L) - \frac{\sigma^2}{\kappa^2}}$$

Where

$$\kappa = \kappa^* = \frac{\pi}{\lambda}\overline{s\delta n_{eff}}$$

$$\sigma = \frac{2\pi}{\lambda}\overline{\delta n_{eff}}$$

With different between refractive index in core and cladding $\Delta n = 0.01$, there is any significant change in reflection power transmission. The power reflection is only 0.22 p.u. Figure 7 shows us that smaller different between refractive index in core and cladding can produce more losses reflection power, however with larger different between refractive index in core and cladding, reflection power will be better.

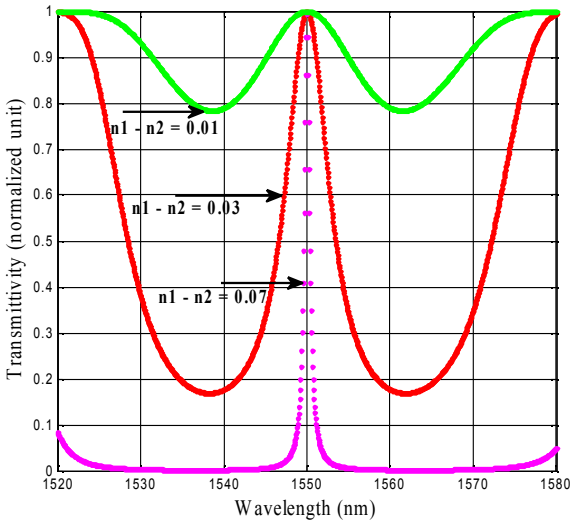

Figure 8 Relation of transmission power and wavelenght with different Refractive Index Δn

Changing the difference of refractive index is change the value of transmittivity and reflectivity to, by changing difference of refractive index from $\Delta n = 0.03$ become $\Delta n = 0.01$ the peak transmission power change from 0.83 p.u to 0.22 pu. Then the difference of refractive index is change to $\Delta n = 0.07$, transmission power is about 1 p.u at 1550 nm. By using different refractive index n1 = 1.42 and n2 = 1.49, the transmission power is 0 p.u. Change the value of refractive index by n1 = 1.44 and n2 = 1.47, the maximum transmission power is 0.83 p.u.

V. CONCLUSION

In fiber Bragg grating, couple mode theory then integrated numerically with transfer matrix method can used to observe the parameter and characteristics of uniform fiber Bragg grating. Based on the simulation result and analysis, we can conclude that from the characteristic of defect strusture in fiber Bragg grating we can conclude that:

- Defect fraction with the same number of

elementary cells can produce the shifting wavelength. Greater defect fraction produce a shifting wavelength to the wider wavelength. Defect structure in center wavelength is occurred with smaller defect fraction. With bigger value, there is no defect in center of wavelength. With bigger defect fraction, the maximum power can be shifted to any wavelength.

- The adjusting of refractive index value in core and cladding is also necessary to produce better filter in fiber Bragg grating.With the more difference value of refractive index between core and cladding FBG will produce higher transmission and reflection power with very narrow cavity in the center of wavelength. The different refractive index between core and cladding is also affecting to the defect structure. The greater difference refractive index produce narrower filter in band pass and band stop.

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