

ACADEMIC PROGRAMS & RESEARCH GROUPS 2006 - 2008



Faculty of

Mathematics and Natural Sciences

Institut Teknologi Bandung

Foreword

Dean of Faculty of Mathematics and Natural Sciences
Institut Teknologi Bandung



The Faculty of Mathematics and Natural Sciences was established in 1947, and now is one of 12 faculties or schools at Institut Teknologi Bandung (ITB). Today Faculty of Mathematics and Natural Sciences has some 164 permanent academic staffs, which are consisted of about 80% PhD holder, including 9 professors in several research groups. Having ITB's vision as a leading educational institution in Indonesia, the faculty is running 15 Study Programs consisting Astronomy, Chemistry, Physics and Mathematics, which are respectively in Bachelor, Magister/Master and Doctoral degrees, and Master degree in Actuarial Science, Physics Teaching and Chemistry Teaching. All of these programs achieved the highest rank in the national accreditation board and they become favorite study programs for students aiming mathematics and natural sciences as their major.

Research conducting by the faculty's members is carried out in 15 Research Groups, publishing reviewed articles and technical reports with national and international reputation. By collaboration with other institutions, the faculty maintains the continuation of research in fundamental sciences, mainly consisting of aspects below :

1. Information technology, especially in computational sciences.
2. Biotechnology, where can be rooted from different research paths. For instance, Biochemistry, Organic Chemistry, Biophysics, and Bio mathematics.
3. Nano sciences, which needs more invention, especially from chemists or physicists, on new materials, natural or synthetic ones.

Details of works being carried out by the research groups can be found in this booklet.

Akhmaloka, Ph.D



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Institut Teknologi Bandung

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Astronomy

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The Scientific Description of Various Celestial Phenomena and The Large Scale Universe

Astronomy

Astronomy is a branch of science wherein physics and mathematics find their utmost application and challenge, to give a scientific description of various celestial phenomena and objects and of the large scale universe itself. Astronomy is a very active field of science and is progressing rapidly worldwide. The Astronomy Study Program-FMIPA-ITB, through its Undergraduate and Graduate Programs, prepares human resources who will be able to play a role in the development of astronomy in Indonesia by actively contributing in the development of astronomy body of knowledge.

Undergraduate Program

The Undergraduate Program (or Bachelor Degree Program), supported by adequate facility and infrastructure, produces graduates who have strong basic knowledge of natural science, a progressive and adaptive outlook towards relevant applied fields, and who are responsive to the development of science and technology in general. Fifty years of experience in the astronomy education has shown that astronomy graduates are able not only to pursue higher degree in astronomy or closely related fields, but also to smoothly adapt in the working arena, regardless of the field of work, with good performance. This has been made possible primarily by the curriculum and its implementation process which build in each student a thinking/reasoning pattern and working methodology which are logical, structured, progressive, and adaptive.

Master Program

At the master level, the Study Program branches into two: Master in Astrophysics and Master in Astronomy Education and Development. The former deals with more in-depth study of astrophysical subjects and is a direct continuation of the bachelor program, whereas the latter concerns more with the development of astronomy subject matter in the field of education. The latter also has the aim of building a support system for the development of astronomy by undergoing exploration of the progress in worldwide astronomy and thorough study on the requirements for the progress and impact on the astronomical community and public in general.





Doctoral Program

The doctoral level is based on the astronomical research. Doctor candidates conduct researches which are converging to their dissertation. The results, being original research works, are contribution to the 'proper' astronomy. At the frontier, astronomy is progressing due to its research works and its own nature as a science, and its interaction with various elements which have contributed in the development of astronomy as a field of science, as well as its participation in human civilization and culture which are globalizing in trend.

Facilities

Most astronomy classes meet at the Astronomy Study Program on the fourth floor of the LabTek IV Building in the main campus of ITB, which also houses the offices of all academic staff members, a good size library, and computer with internet facility. The library and the computer facility are well maintained and regularly updated.

The Bosscha Observatory in Lembang, approximately 13 km north of Bandung on top of a beautiful 1300 m high hill, accommodates a great number of learning and research activities for Indonesian astronomical community as well as public service related to astronomy. Together with Astronomy Study Program and Astronomy Research Division, Bosscha Observatory organizes programs for professional scientists and public throughout the year, with a lot of students' involvement.

Main facilities at the Bosscha Observatory:

- Telescopes: Zeiss double refractor, Bamberg refractor, Unitron refractor, Schmidt reflector, Goto reflector, and a number of small portable telescopes
- Accessories: CCD cameras, spectrograph, etc. Computer facilities for data storage, data analysis, computation, and internet
- Library: Bosscha Observatory houses one of the most extensive science libraries in Indonesia with its large collection of books and updated periodicals.

Academic Staffs

Academic Staff Member as of July 2007:

A total of 20 members: 14 doctorates, 3 doctoral candidates, 3 masters, covering 3 main fields of expertise: solar and planetary sciences, stellar physics, galaxy, and cosmology.

Students

With average annual admission of 18 undergraduates, 5 master students, and 1 doctoral student, the Astronomy Study Program has a student body of about 100 each year. The Astronomy Student Association is very active in astronomy-related extracurricular programs and public services.

Alumni

Record shows that more than 40% of graduates pursue higher degree in various fields of study. Tracer study indicates that the profession and employment of alumni of Astronomy Study Program cover a wide range, among others: lecturer and teacher of science, mathematics, computer-based work, and philosophy; social worker; Research and Development personnel in software and hardware industries and in the armed forces; Information Technologist; banker and financial expert; journalist; publisher.



Research Interests

The Astronomy research group is divided into 3 subgroups Galaxy and Cosmology, Stellar Physics and Solar System.

Some of the research topics in the Galaxy and Cosmology subgroups are study of structure and dynamics of the Milky Way, distribution and evolution of galaxies, active galaxies (quasar), search for dark matter, and theoretical and observational cosmology.

Research activities in the Stellar physics subgroup covers three main topics (a) theoretical studies and numerical modeling of stellar evolution, stellar structure and atmosphere, circum stellar envelope and matter, common and peculiar classes of variable stars (close binary, pulsating, accretion disk), light curve and spectral synthesis; (b) Photometry and spectroscopy of variable stars (eclipsing binaries, Be stars, Helium stars, Am stars, cataclysmic binaries), polarimetry of Herbig Ae stars, and astrometry for orbital elements and physical parameters determination of visual double stars; (c) Development of data acquisition and processing systems, i.e. CCD-based astronomical instruments, image and data processing, data archival, knowledge-based classification of digital stellar spectra.

Some of research topics in the Solar System research subgroup are Solar physics (sunspot proper motion and its relation to the solar flare, solar terrestrial relationships, high solar energetic particle), solar system physics (planetary Mars atmosphere, Titan atmosphere), near earth asteroid and dynamics and evolution of asteroids (family asteroids), orbit calculation of hazardous objects and extra solar planets.

Research Group Staffs :

Head :

Suhardja D. Wiramihardja, Dr.

Members:

Iratius Radiman, Dr.

Moedji Raharto, Dr.

Premana Wardayanti Premadi, Ph.D

Yayan Sugianto, M.Si

Ferry M. Simatupang, M.Si

Suryadi Siregar, Dr.

Dhani Herdiwijaya, Dr.

Taufiq Hidayat, Dr.

Budi Dermawan, Dr.

Endang Soegiartini, M.Si

Mahasena Putra, Dr.

Muhamad Irfan Hakim, M.Si

M. Ikbal Arifyanto, Dr. rer. nat.

Chatief Kunjaya, Dr.

Hesti Retno Wulandari, Dr. rer. nat.

Djoni N Dawanas, Dr.

Hakim L Malasan, Dr.

Baju Indradjaja, M.Si

Aprilia, M.Si





Publications

International Journals	: 9
National Journals	: 4
International Proceedings	: 60
National Proceedings	: 7

Astronomy Study Program

International Publications :

1. Wiramihardja, S.D., (2008), "Emission-line Stars in Star-forming Regions", *THAI Journal of Physics*, Serie 3, p. 186
2. Martel, H. and Premadi, P., (2008), "Light Propagation in Inhomogeneous Universes. V. Gravitational Lensing of Distant Supernovae", *The Astrophysical Journal*, Volume **673**, Issue 2, p. 657-663.
3. Kuncarayakti, H., Kristyowati, D. and Kunjaya, C., (2008), "On nova Scorpii 2007 N.1 (V1280 Sco)", *Astrophysics and Space Science*, Volume **314**, Issue 4, p.367-367.
4. Soegiartini, E., Radiman, I. and Mumpuni, E. S., (2008), "Orbital Simulation of Asteroids Located in Special Positions in the Solar System", *THAI Journal of Physics*, Serie 3
5. Dawanas, D.N., Wardana, A., Malasan, H., (2007), "The Evolution of BD+60 2522: with mass loss and overshooting", *Astrophysics SpaceScience*, Vol. **312**, p. 23-25
6. Sasaki, S., Sasaki, T., Watanabe, J., Yoshida, F., Kawakita, H., Takato, N., Dermawan, B., Fuse, T., Ito, T., Sekiguchi, T., (2006), "A Newborn Asteroid 832 Karin with Old and New Surfaces - SUBARU Spectroscopy", *Advances in SpaceResearch*, Vol. **38**, p. 1995-1999.
7. Saito, J., Miyamoto, H., Nakamura, R., Ishiguro, M., Michikami, T., Nakamura, A. M., Demura, H., Sasaki, S., Hirata, N., Honda, C., Yamamoto, A., Yokota, Y., Fuse, T., Yoshida, F., Tholen, D. J., Gaskell, R. W., Hashimoto, T., Kubota, T., Higuchi, Y., Nakamura, T., Smith, P., Hiraoka, K., Honda, T., Kobayashi, S., Furuya, M., Matsumoto, N., Nemoto, E., Yukishita, A., Kitazato, K., Dermawan, B., Sogame, A., Terazono, J., Shinohara, C., Akiyama, H., (2006), "Detailed Images of Asteroid 25143 Itokawa from Hayabusa", *Science*, Vol. **312**, p. 1341-1344

8. Westphal, W., Coppi, C., von Feilitzsch, F., Isaila, C., König, J., Potzel, W., Rau, W., Razeti, M., Stark, M., Wulandari, H., Angloher, G., Bavykina, I., Christ, P., Hauff, D., Ninkovi, J., Pantic, E., Petricca, F., Pröbst, F., Seidel, W., Stodolsky, L., Bauer, M., Jagemann, T., Jochum, J., Rottler, K., Scholl, S., Bucci, C., Cozzini, C., Henry, S., Kraus, H., Majorovits, B., McGowan, R., Mikhailik, V., Tolhurst, A. J. B., Ramachers, Y., (2006), "Dark matter search with CRESST," *Czechoslovak Journal of Physics*, Vol. **56**, Issue 5, p.535-542
9. Petricca, F., Angloher, G., Bucci, C., Christ, P., Cozzini, C., von Feilitzsch, F., Hauff, D., Henry, S., Jagemann, T., Jochum, J., Kraus, H., Majorovits, B., Ninkovi, J., Potzel, W., Proebst, F., Ramachers, Y., Rau, W., Seidel, W., Stark, M., Stodolsky, L., Westphal, W., Wulandari, H., (2006), "CRESST: First results with the phonon-light technique", *Nuclear Instruments and Methods in Physics Research Section A*, Volume **559**, Issue 2, p. 375-377

National journals

1. Wiramihardja, S.D., Arifiyanto, M.I. and Sugianto, Y. (2008), "Astrometric Study of Galactic Clusters I. NGC 3532", *Journal of Mathematics and Sciences* (in press).
2. Soegiartini, E. and Siregar, S., (2008), "Telaah awal Keubahan Setengah Sumbu Panjang Akibat Efek Yarkovsky pada Asteroid 3362 Khufu (1984 QA)", *Jurnal Sains Dirgantara, LAPAN* (in press).
3. Yamani, A. dan Siregar, S., (2006), "Periode –Luminositas Cepheid dan korelasi Bolometrik Bintang Deret Utama", *Jurnal Sains Dirgantara*, Vol. **4**, No.1, p 21-34
4. Siregar, S. and Kuncarayakti, H., (2007) "Recalculating the orbit of Alpha Centauri AB", *Journal Matematika & Sains*, Vol **12**, No.3, p.85-88



GAO-ITB Telescope



Chemistry

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The Fundamental Description of Material and Life Sciences



Chemistry

Chemistry is the scientific study of interaction of chemical substances with one another and energy, and concerned with the composition, structure, and properties of matter, as well as the changes it undergoes during chemical reactions. The Chemistry Study Program-FMIPA-ITB concerns on basic knowledge in 5 major studies: Analytical Chemistry, Inorganic Chemistry, Physical Chemistry, Organic Chemistry and Biochemistry. The Chemistry Study Program-FMIPA-ITB, through its Undergraduate and Graduate Programs, prepares human resources who will be able to play a role in the development of chemistry in Indonesia by actively contributing in the development of chemistry research and development elsewhere.

Undergraduate Program

Chemistry undergraduate study program, Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung, is the oldest Chemistry Study Program in Indonesia, which was founded in 1947 and has more than 1400's Chemist. Chemistry students will strengthen their basic knowledge in 5 major in Chemistry, Analytical Chemistry, Inorganic Chemistry, Physical Chemistry, Organic Chemistry and Biochemistry) Besides, the students can broaden their minds by taking elective lectures provided in ITB and taking internship program in one of the chemical industry or Research Foundation, depends on student's compliance.

Since 2002, Chemistry study Program also runs "Honors" Program, or first class student program as an appreciation to the high performing student in their class by offering an educational process where they can reveal their maximum potentials. At the end of honors educational processes, honors graduates will be ready to study further or to compete in the global market. They are also expected to be an academic leader and highly qualified scientist, or an entrepreneur in chemistry related fields in the incoming future.

Master Program

Chemistry Master Program (S2), Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung was established since 1980's. There are around 700 existing magistrates since it was established and more than 300 scientific journals presented in the scientific meeting and national and international accredited journals. Chemistry Master Study Program consists of 5 sub-programs that are Analytical Chemistry, Physical Chemistry, Inorganic Chemistry, Organic Chemistry and Biochemistry. Each Sub-program has its own characteristic curricula. Postgraduate students in Chemistry are aimed for 4 semesters (36 cu) to be prepared for further study (Doctorate program), in Indonesia or overseas, or to be a qualified researcher in Chemistry related industry that needs research and development to enhance their competitiveness.

Since 2006, Chemistry Master Program has opened new sub-program, namely Master of Chemistry in Teaching, in which the postgraduate student can be prepared as a qualified Senior High School teacher by emphasizing in strengthening the basic knowledge of chemistry.

Doctoral Program

Chemistry Doctorate Study Program (S3), Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung was established since 1980. There are around 100 existing Chemistry Doctor was originated from Chemistry Doctorate Program since it was established and around 200 scientific journals presented in the scientific meeting and national and international accredited journals. As well as its Master Study Program, Doctorate Program in Chemistry consists of 5 Chemistry field of study (subprogram) that are Analytical Chemistry, Physical Chemistry, Inorganic Chemistry, Organic Chemistry and Biochemistry, with various research of interest such as Separation and Speciation of Analytes, Physical Chemistry of Material, Theoretical and Computational Chemistry, Synthesis of Inorganic Materials, Natural Product Chemistry, Bioorganic Chemistry, DNA and Protein Engineering, Bioinformatics, etc. Within 6 semester curricula, 28 Doctoral titled-staff members (graduated from overseas or Indonesia) are dedicated to prepare doctoral post graduate students to achieve an original findings in Chemistry field of interest either in strengthening nation competency in fundamental sciences or applied chemistry, such as material sciences, food sciences, energy, health, environmental sciences, etc.





Facilities

The Department has:

1. A Library, collects more than 6,000 books and sciences magazines (journals),
2. Computers facilities, connect to the internet,
3. Laboratories, for example, the Elementary Chemistry Lab., the Analytic Chemistry Lab. the Separation and Speciation Chemistry Lab., Anorganic Chemistry Lab., Anorganic Synthetics Chemistry Lab., Physic Chemistry Lab., Theoretic Chemistry Lab., Material Chemistry Lab., Organic Chemistry Lab., Natural Organic source Chemistry Lab., Bio-Organic Lab, Bio-Chemistry Lab., Protein and Enzyme Lab., Bio-chemistry, Food, and Plants Lab., Nucleate Acid and Molecule Genetics Lab.
4. Instruments and research facilities, such as: HPLC, AAS, FTIR Spectrophotometer, UV-Vis Spectrophotometer, GC, corrosion test installations, PCR, low temperature chamber.

Academic Staffs

These study programs are totally supported by 42 members in which 30 among them hold PhD degree distributed in 4 research groups : Analytical Chemistry; Inorganic and Physical Chemistry; Organic Chemistry; and Biochemistry.

The Honors Program

The Honors Program in Chemistry is a distinction given for outstanding students who have demonstrated marked competence in course work (GPA >3) and are willingly to take 12 units extra course and to be involved earlier in research project of considerable merit. This program will provide rewards to participating students in form of assistance to get scholarships or related job positions in industry; a fast track for continuing study to master or doctoral courses as well as recommendation for recruitment of new staff member when available.

Alumni

The chemistry alumni can contribute to various carriers as long as there is chemistry involved. It is well known and has become rule of tongue that “chemistry is everywhere”, therefore the chemistry alumni can develop their basic knowledge on chemistry to be applied to many problems in their society and environment. As a matter of fact, more than 60% chemistry alumni pursue their career in various fields and in various industries, such as natural resources explorations, mining and petroleum industry (Pertamina, Total Indonesie, Freeport, etc.), agrochemical industry (PT. Pusri, PT. Chandra Asri, etc.), pharmaceutical industry, cosmetic and households industry, paper industry, textile and garment industry, surfactants industry, polymer industry, health and food industry, manufacturer industry, raw materials industry, telecommunication industry, IT industry. About 30% of chemistry alumni pursue their career as academic staffs and researchers in universities (in Indonesia and Malaysia) and government-owned scientific institutions, such as LIPI, BATAN, BPPT, LAPAN, Forensic Division, BP-POM, etc.; and in education institutions, such as high schools and private educators. The remaining alumni had a carrier as banker, insurance agent, army, politician, journalist, consultant, entertainer and entrepreneur.





Research Interest

• Analytical chemistry is a scientific discipline which develops and applies methods, instruments and strategies to obtain information on the composition and nature of matter in space and time. Our focus is on the development, validation and application of state-of-the-art, integrated and automated analytical methods and instrumentation, for trace analysis and speciation.

Analytical Chemistry Research Group of the Faculty of Mathematics and Natural Sciences has mission statement :

Provide leadership in analytical chemistry research and education at the highest international level capable to make positive impact on the world, as well as provide supporting environment for scientific growth of each group member. The supporting environment will be created by synergy among the individual group member, supervisor, laboratory managers, senior staff and other group members.

The general objectives are :

Develop theories and methods in analytical chemistry.

Prepare human resources in research - from undergraduates to post-docs - emphasizing creativity, cooperation, and interdisciplinary actuation centered in analytical chemistry;

Develop and apply analytical solutions that are more effective and economical in areas like the environment, process and quality control, routine and research laboratories, fitting into the broader goal of advancing analytical science and improving life quality.

Our preferential research activities are:

Invention, development, automation, evaluation and/or application of sensors, devices, methods, techniques and/or systems for sampling, separation, accumulation, speciation and/or measurement of low concentrations of inorganic species (focus : toxic metals) and organic analytes in the laboratory, processes or in the field. Techniques and instrumental approaches usually carried out are: electro analysis, chemical sensors, molecular and atomic spectrometry, chromatography, flow injection analysis, separation/pre concentration/ speciation of analytcs.

Research Group Staffs

Head

Muhammad Bachri Amran, Dr.

Members

Aminudin Sulaeman, Dr.

Buchari, Prof., Dr.

Indra Noviandri, Dr.

Muhammad Ali Zulfikar, Dr.

Saepudin Suwarsa, MS., Drs.

Samitha Dewi Djajanti, Dra.

Suryo Gandasasmita, Dr., MT.

Publication Analytical Chemistry

International Journals : 5

National Journals : 7

International Proceedings : 15

National Proceedings : 8

International Journals :

1. Fitri N., Kastenholz B., Buchari, Amran M.B., and Warganegara F.M., (2008), "Molybdenum Speciation in Raw Phloem Sap of Castor Bean", *Analytical Letters*, **4**(10), 1–12.
2. Zulfikar M.A., Mohammad A.W., Kadhum A.A., (2007), "Synthesis and characterization of poly(methyl methacrylate)/SiO₂ hybrid membrane". *J. Materials Science and Engineering A: Structural, Materials Properties, Microstructure and Processing*, **452**, 422-426.
3. Arcana I.M., Sulaeman A., Pandiangan K.D., (2006). "Synthesis of polyblends from polypropylene and poly(R,S)-beta-hydroxybutyrate, and their characterization". *Polymer International*, **55**(4), 435-440.
4. Zulfikar M.A., Mohammad A.W., Kadhum A.A., (2006). "Poly(methyl methacrylate)/SiO₂ hybrid membranes: Effect of solvents on structural and thermal properties". *J. Applied Polymer Science*, **99**(6), 3163-3171.
5. Zulfikar M.A., Mohammad A.W., Hilal N., (2006), "Preparation and characterization of novel porous PMMA-SiO₂ hybrid membranes". *Desalination*, **192**(1-3), 262-270.





National Journals

1. Santoso I., Buchari, Amran M.B., Sulaeman A. (2007). "The Effect of Concentration of Carrier, pH and Time of Extraction on Separation Factor of Penicillin G-Phenylacetate by Reactive Extraction", *Indo. J. Chem.*, **7**(2), 185-189.
2. Watoni A.H., Gandasasmita S., Noviandri I., and Buchari (2007). "Electrochemical Synthesis & Characterization of Polypyrrole for Dodecylsulfat Sensor Membrane", *Indo. J. Chem.*, **7**(3), 249-253
3. Santoso I., Buchari, Amran M.B., Sulaeman A. (2007). "Ekstraksi dan Pemisahan Penisilin G dari Fenilasetat dengan Teknik Membran Cair Emulsi". *JMS*, **12**(3), 94-101.
4. Panggabean A.S., Amran M.B., Buchari, Achmad S. (2007). "Spesiasi senyawa organotimah dengan Teknik Kromatografi Pasangan Ion-Fasa Terbalik". *JMS*, **12**(4), 140-146.
5. Santoso I., Buchari, Amran M.B., Sulaeman A. (2007). "Penentuan Faktor Daya Pisah Penisillin G-Fenilasetat antara Cara Ekstraksi Reaktif dengan Cara Membran Cair Emulsi". *Alchemy*, **6**(1), 1-8
6. Buchari, Gandasasmita S, Noviandri I. (2007). "Modifikasi Elektroda Kawat Emas dengan Polipirol secara Elektropolimerisasi menggunakan Elektrolit pendukung garam-garam Halida". *J. Alchemy*, Vol. **6**, No. 1, Maret 2007, hal. 50-56, ISSN : 1412-4092
7. Suyanta, Susanto I.R., Buchari, Noviandri I., (2006). "Lanthanaum (III) Selestive Electrode Based 1,10-Diaza-4,7,13,16-Tetraoxacyclooctadecane-N,N'-Diacetic Acid as Ionophore". *JMS*, **11**(1), 32-3.

Vision Mission Target

Inorganic and Physical Chemistry Research Group of the Faculty of Mathematics and Natural Sciences has a vision: to be an excellent research group focusing in new materials encompassing inorganic compounds, polymer, ceramics and composites. Its missions are:

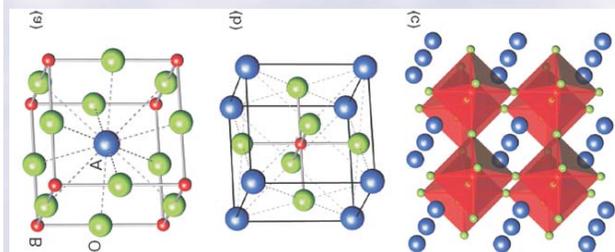
1. to continuously improve Inorganic and Physical Chemistry teaching and learning;
2. to carry out research in the new materials and align the themes in the group (coordination compounds, metal oxides, catalysts, ceramic, biodegradable polymer, bio polymer, membrane, composite, corrosion and comutation) into the main focus, i.e. the fuel cells materials; and
3. to enhance collaborations with various research groups.

The short term targets (within 5 years) are:

1. to continuously improve Inorganic and Physical Chemistry teaching and learning.
2. to carry out research in the new materials and align the themes in the group (coordination compounds, metal oxides, catalysts, ceramic, biodegradable polymer, bio polymer, membrane, composite, corrosion and computation) into the main focus, i.e. the fuel cells materials.
3. to enhance collaborations with various research groups

The long term targets (within 10 years):

1. to give qualified teaching in Inorganic and Physical Chemistry.
2. to develop new materials with emphasis for fuel cell applications.
3. to enhance collaborations with various research groups



Research Group Staffs

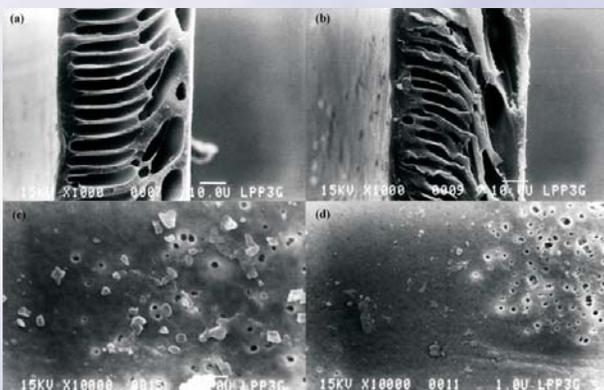
Head

Ismunandar, Prof., Dr.

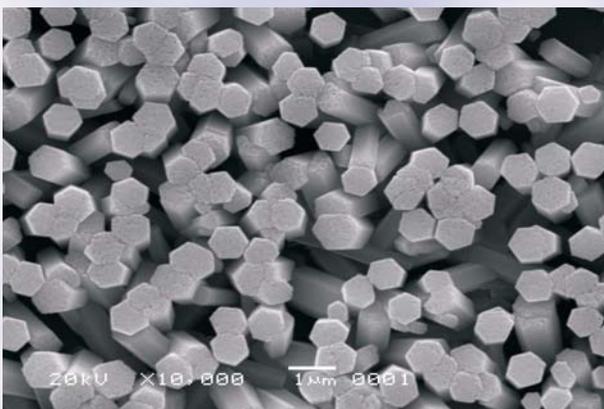
Members

Achmad Rochliadi, MS., Dr.
Bambang Prijamboedi, Dr., M.Eng.
Barnas Holil, Dr.Ing.
Bunbun Bundjali, Dr.,
Cynthia Linaya, Dr.Ing.
Djulia Onggo, Ph.D.,
I Made Arcana, Dr.,
I Nyoman Marsih, Dr.
Irma Mulyani, Dr.
Lubna Baradja, MS., Dra.
Muhamad Abdulkadir M., Ph.D.
Veinardi Suendo, Dr.





Gambar 4. Citra mikroskop elektron membrane polisulfon: citra penampang lintang membran setelah perendaman dalam air (a) dan etanol 80 % v/v (b), citra permukaan membran setelah perendaman dalam air (c) dan etanol 80 % v/v (d).



Publications Physical and Inorganic Chemistry

International Journals	: 25
National Journals	: 7
International Proceedings	: 31
National Proceedings	: 3

International Journals

1. Jahro, I.S., Onggo, D., Ismunandar, Rahayu, S.I., Munifoz, M.C., Gaspar, A.B., Seredyuk, M., Gul'tlich, P., Real, J.A. (2008). "Synthesis, crystal structure and magnetic properties of the spin crossover system $[\text{Fe}(\text{pq})_3]^{2+}$ ". *Inorganica Chimica Acta*, **361** (14-15), pp. 4047-4054.
2. Rosyidah A, Onggo D, Khairurrijal, and Ismunandar (2008). "Atomic Simulations of Aurivillius Oxides: $\text{Bi}_3\text{TiNbO}_9$, $\text{Bi}_4\text{Ti}_3\text{O}_{12}$, $\text{BaBi}_4\text{Ti}_4\text{O}_{15}$ and $\text{Ba}_2\text{Bi}_4\text{Ti}_5\text{O}_{18}$ Doped with Pb, Al, Ga, In, Ta". *J. Chin. Chem. Soc.*, Vol. **55**, No. 1, , 115.
3. Brendan J. Kennedy, Zhou Q, Ismunandar, Kubota Yoshika, Kato Kenichi. (2008), "Cation disorder and phase transitions in the four-layer ferroelectric aurivillius phases $\text{ABi}_4\text{Ti}_4\text{O}_{15}$ ($A=\text{Ca}, \text{Sr}, \text{Ba}, \text{Pb}$)". *J. Solid State Chem.*, , 1377-1386.
4. Prijamboedi B., Takashima H., Wang R., Shoji A. and Itoh M. (2008). "Dielectric Properties of SrTiO_3 thin film prepared in the mixture of $^{18}\text{O}_2$ and $^{16}\text{O}_2$ gas, *Journal of Alloys and Compounds* **48**, 449.
5. Radiman C.L., Widyarningsih S.** and Sugesty S. (2008). "New applications of kenaf (*Hibiscus cannabinus* L.) as microfiltration membranes". *J. Membrane Science*, **315**, 141-146
6. Onggo D. (2007). "Gadolinium (III) Complexes with Dialkyldithiocarbamates and 1,10-Pentantrolin". *Sains Malaysia*. **36**(1). 15-20.
7. Arcana I M, Bundjali B, Yudistira I *, Budiati Jariah*, and Lenggana*. (2007). "Study on Properties of Polyblends from Polypropylene with polycaprolactone and their Biodegradability". *Journal of Polymers*, Vol. **39**, No. 12. (1337-1344).
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9. Effendy H.***, Radiman C.L., Ramelan A., Nuruddin A. (2007). "Oxidation Protection of MgO-C Monolithic Refractories with Tar-resin binder and Metal antioxidants", *China's Refractories*, Vol. **16**, No. 3,
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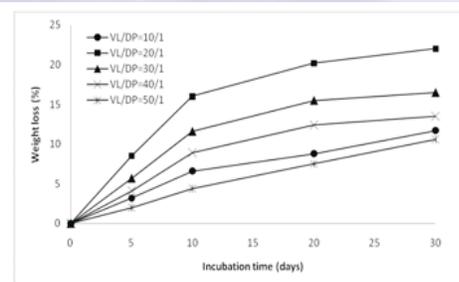


Figure 7. The influence of incubation time on biodegradability of poly(urethane-ester) prepared from P(VL-co-DF) copolymer with various VL/DP ratio.

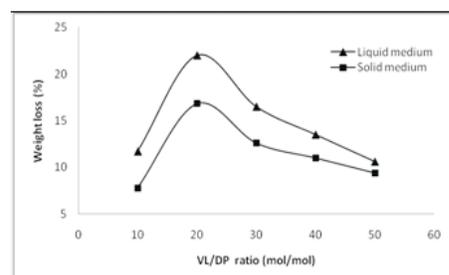
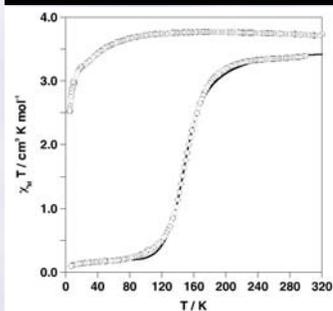
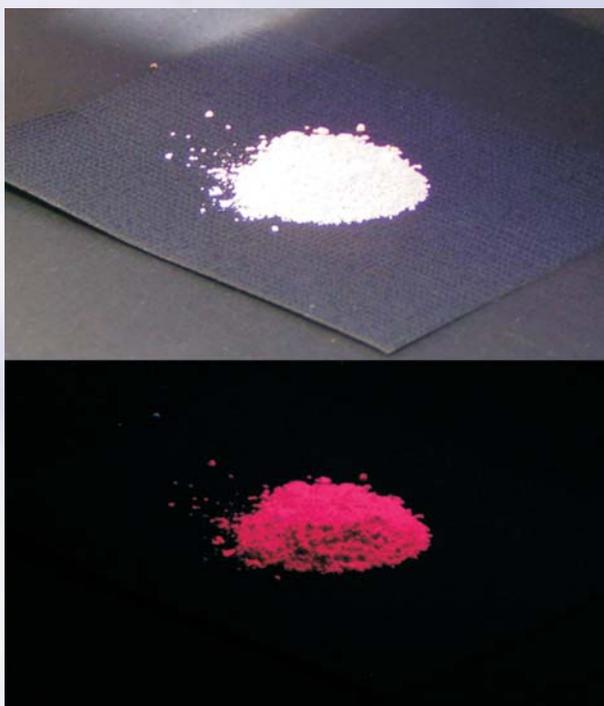


Figure 8. The influence of VL/DP ratio on biodegradability of poly(urethane-ester) for 30 days in solid and liquid mediums.



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2. Kiki Adi Kurnia*, Djulia Onggo, Dave Patrick, K.L Stevenson, (2006). "Sintesis Senyawa Kompleks $K[Cr(C_2O_4)_2(H_2O)_2] \cdot 2H_2O$ dan $[N(nC_4H_9)_4][CrFe(C_2O_4)_3] \cdot H_2O$ ", *Jurnal Kimia Indonesia*, **1**(1), 7-12.
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6. Tita Puspitasari**, CL. Radiman, (2007). "Study of Graft Copolymerization of Acrylic Acid onto Nata de Coco and its Application as Microfiltration Membrane", *Jurnal Atom Indonesia*, **32**(2), p. 119-128
7. Parsaoran Siahaan***, Cynthia L. Radiman, Susanto Imam Rahayu, Muhamad A. Martoprawiro, Dieter Ziessow, (2007). "Investigation of Molecular Interaction between Phenylacetylene and Hexamethylphosphoric Triamide by ^{13}C NMR T_1 Relaxation time studies and AB Initio QM Calculations", *Indonesia Journal Chemistry*, **7** (3), 273-277,

Research Interest

Organic Chemistry Research Group of the Faculty of Mathematics and Natural Sciences has a vision: to be the Indonesia's leading research groups in chemistry, with an international reputation for academic excellence and achievement. Its missions are: to study and develop organic chemistry with many related aspects focused on acquiring biodiversity for broadening molecular diversity regarding chemical and biological potential to the human race, as well as on developing organic synthesis to develop techniques and its applications on material science and bioscience.

Current activities cover a wide spectrum of topics with special emphasis on isolation techniques, structural science, semi synthesis, biosynthesis, bioassay, and tissue cultures for production of secondary metabolites and biotransformation; as well as organic synthesis which covers a wide spectrum topics on functional groups transformation, synthesis methods development, organ metallic compounds utilization, and synthesis of various functional compounds to be applied as many useful materials for mankind and environmental matter.

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Hidajat Muchsinudin, Drs.

Lia Dewi Juliawaty, Dr.

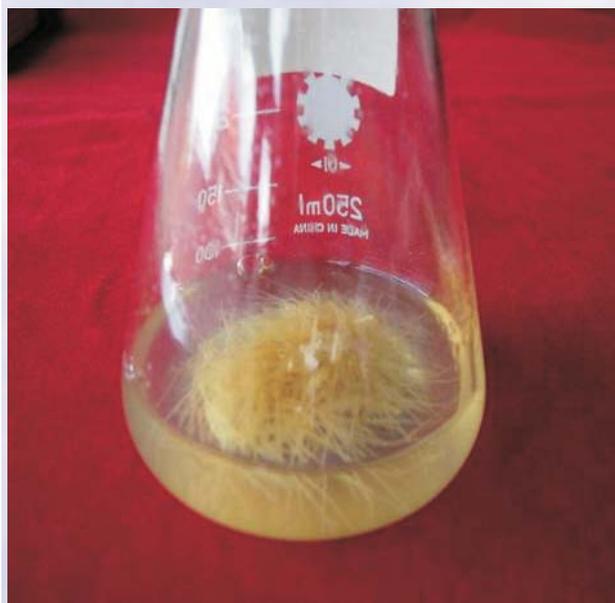
Megawati Santoso, PhD.

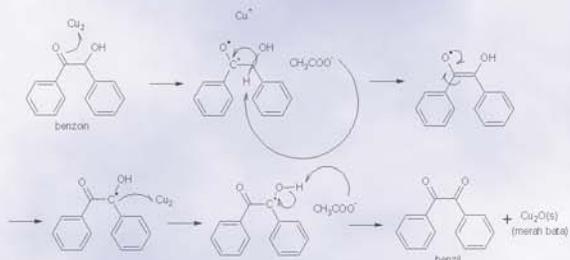
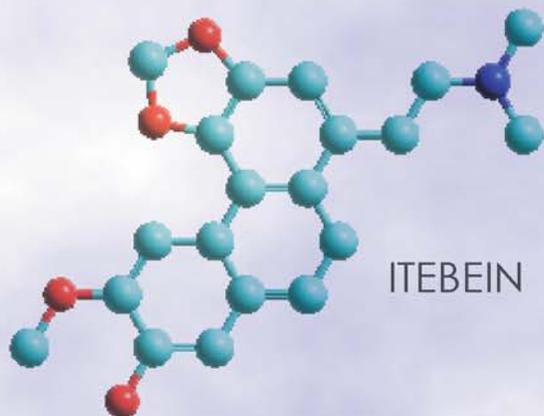
Rita Anggraini, M.Sc., Dra.

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Yana Maolana Syah, PhD.

Sjamsul A. Achmad, Prof (emeritus)





Publications Organic Chemistry

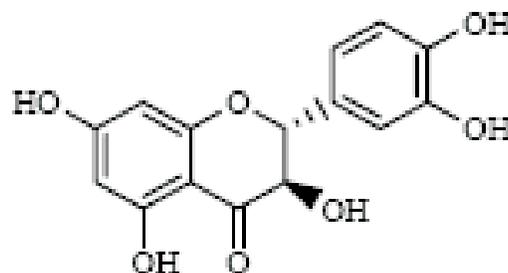
International Journals	: 16
National Journals	: 5
International Proceedings	: 46
National Proceedings	: 32

international Journals

1. Wahyuningrum, D., Sadijah, A., Syah, Y.M., Buchari, Bundjali, B. (2008). "The correlation between structure and corrosion inhibition activity of 4,5-diphenyl-1-vinylimidazole derivative compounds towards mild steel in 1% NaCl solution", *Inter. J. Electro. Sci.*, **3**, 154-166, ISSN 1452-3981
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6. Musthapa, I., Juliawaty, L.D., Syah, Y.M., Achmad, S.A., Hakim, E.H., Latip, L., Takayama, H. (2008). "Prenylated flavones from *Artocarpus lanceifolius* and their cytotoxic properties", *Fitoterapia.* (In press)
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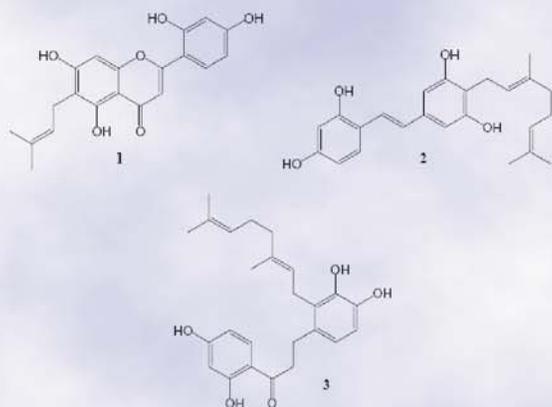




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National Journals

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Vision, Mision and Research Interest

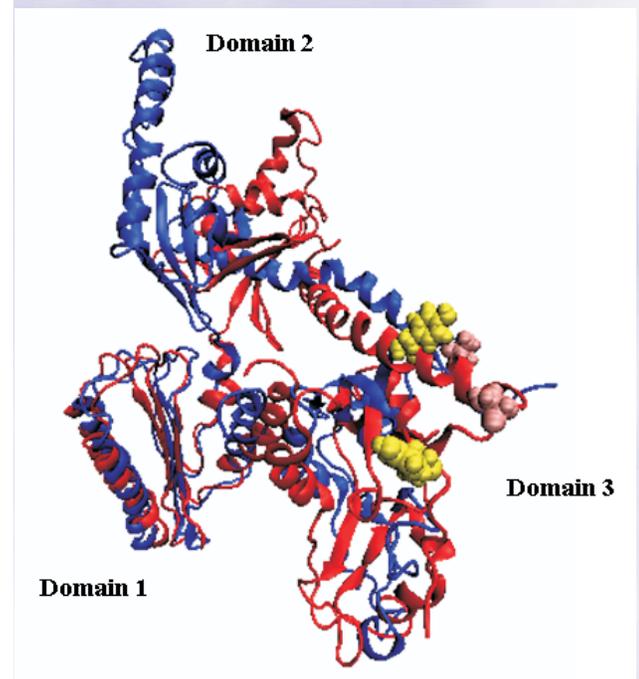
Biochemistry research group of the Faculty of Mathematics and Natural Sciences of ITB has visions and missions as follows:

- To be a leading research group in the field of biochemistry and molecular biology.
- To undertake education and research which contribute to the understanding of nature and to the improvement of human welfare, in particular Indonesian society.

The midterm goals are to produce high quality graduates; to generates scientific papers; to apply research results for industrial and society need such as industrial enzymes and diagnostis kits. The longterm goals are to produce a discovery or breakthrough in the field of biochemistry, patents, and enzyme industries.

Biochemistry Research Group of the Faculty of Mathematics and Natural Sciences of ITB has 9 full-time faculty members. Almost all of them obtaining their training overseas with research experience in an area related to molecular biology and biotechnology. Currently, main research interests which involve postgraduate students are the study of human mitochondrial genetics, molecular pathogenesis of tropical infectious diseases, molecular biology of thermophilic microorganisms, and biochemistry of thermostable enzymes using DNA Polymerase and Lipase as model enzymes. Molecular Biotechnology state of the art employed for the studies includes: construction of recombinant DNA, cloning and genetic manipulation of genes, amplification of DNA using Polymerase Chain Reaction, dideoxy Sanger nucleotide sequencing, random and targeted mutation, 16S rRNA gene sequences approaches, expression of rDNA fusion protein, production of antibodies, ELISA and WesternBlotting detection of protein, protein structure determination, and molecular dynamics simulation.

Human mitochondrial genetics exhibits unique features: having a high mutation rate compare to nuclear DNA, exist as a multicopy, and inherited maternally. The highly polymorphics and multicopy of mitochondrial DNA are very useful in forensics and fossil studies. Whereas its maternal inheritance could be exploited for the study of mitochondrial disorders. Multidrugs resistance tuberculosis recently become a mayor issue. Our collection showed that some of MDR M. tuberculosis were not associated with mutation in katG and rpoB genes which open a possibilities for the drugs discoveries studies. The study of molecular biology of thermophilic microorganisms and biochemistry of thermostable enzymes using DNA Polymerase and Lipase as model enzymes. The long-term goals of the project are to find out stability factors of thermostable enzyme and to explore the possibility of using local thermostable enzyme and commercial application.





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Head :

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Santi Nurbaiti, S.Si, M.Si

Publications Biochemistry

International Journals	: 7
National Journals	: 12
International Proceedings	: 29

Internatinal Journals :

1. Akhmaloka, P. E. Susilowati, Subandi, and Madayanti F. (2008). "Mutation at Tyrosine in GIRLY Motif of Yeast eRF1 on Nonsense Codons Suppression and Binding Affinity to eRF3". *International Journal of Biological Sciences*. **4**(2), 87-95
2. Aminin A. L. N., Madayanti F., Aditiawati P., and Akhmaloka (2008). "Culture-Independent and Culture-Dependent (Mimic In Situ Approaches) On Microbiol Community Analysis of Gedongsongo Hot Spring". *International Journal of Integrative Biology*, **2**(3), 145-152
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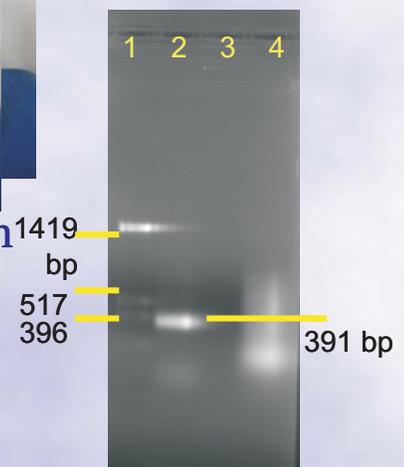


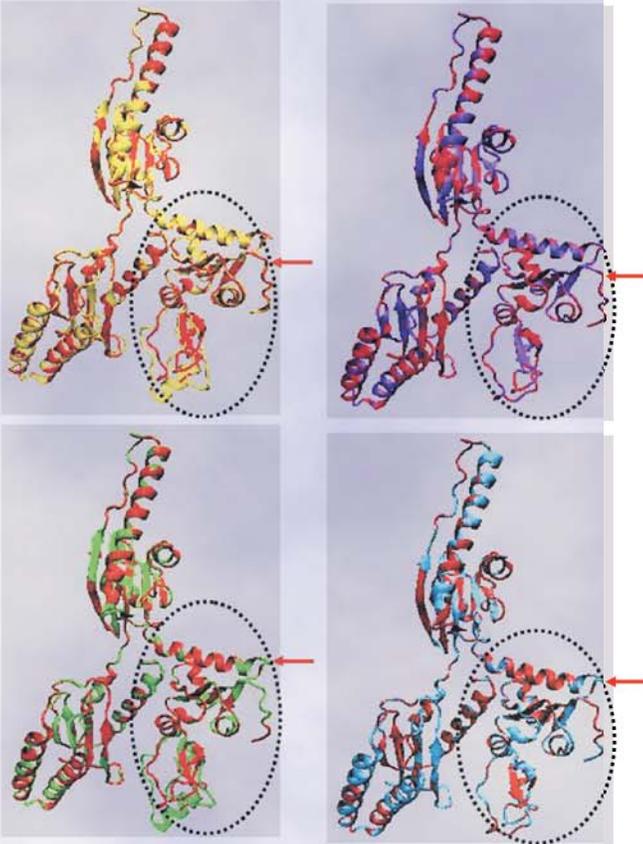
National Journals:

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10. Susilowati P. E, P. Aditiawati, F. Madayanti, and Akhmaloka (2008). "The Effect of Mutation at Treonine 295 of Saccharomyces cerevisiae on Nonsense Codon Suppression and eRF1 Structure". *Microbiology Indonesia*, **2**(1), 87-95.
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Mathematics

Mathematics

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The Queen of The Sciences

Mathematics is the body of knowledge centered on such concepts as quantity, structure, space, and change, and is also the academic discipline that studies them and their relationships. Other practitioners of mathematics maintain that mathematics is the science of patterns, and that mathematicians seek out patterns whether found in numbers, space, science, computers, imaginary abstractions, or elsewhere. Today, mathematics is used throughout the world in many fields, including natural sciences, business, engineering, medicine, and the social sciences such as economics, where patterns and abstraction are used. Mathematics is extremely useful for solving real-world problems. Applied mathematics, that is the application of mathematics to such fields, inspires and makes use of new mathematical discoveries and sometimes leads to the development of entirely new disciplines. Mathematicians also engage in pure mathematics, or mathematics for its own sake, without having any application in mind, although applications for what began as pure mathematics are often discovered later.

Mathematics is not a closed intellectual system, in which everything has already been worked out. There is no shortage of open problems. Mathematicians publish many thousands of papers embodying new discoveries in mathematics every month. As in most areas of study, the explosion of knowledge in the scientific age has led to specialization in mathematics. People often put distinction between pure mathematics and applied mathematics. In reality, the mathematical objects pure or applied mathematicians work on are largely the same; it is their orientation which gives pure or applied flavors, whether it is used for the sake of mathematics, or for solving problems from other field. Classical areas of mathematics, which by no means have become steady and stagnant, include Analysis, Geometry and Algebra. Several areas of applied mathematics have merged with related traditions outside of mathematics and become disciplines in their own right, including statistics, combinatorial mathematics, industrial and financial mathematics.



Carl Friedrich Gauss, himself known as the "Prince of Mathematicians".





Since the late 17th century, due to the increased demand for long-term insurance coverages, Actuarial science becomes a formal discipline that applies mathematical and statistical methods to assess risk in the insurance and finance industries. Actuaries are professionals who are qualified in this field through examinations and experience.

Actuarial science includes a number of interrelating subjects, including probability and statistics, finance, and economics. Historically, actuarial science used deterministic models in the construction of tables and premiums. The science has gone through revolutionary changes during the last 30 years due to the proliferation of high speed computers and the synergy of stochastic actuarial models with modern financial theory. In 2002, a Wall Street Journal survey revealed that Actuary is the second best job in the United States.

Faculty of Mathematics and Natural Sciences has two Study Programs whose courses have rooted to Mathematics as the main discipline; those are Mathematics Study Program and Actuarial Science Study Program.

Mathematics Study Program

Mathematics Study Program offers the degrees of Bachelor, Magister and Doctor of Philosophy (PhD) in Mathematics. It is currently the flagship of such programs in Indonesia. It is also the largest of its kind in terms of student body, and the breadth of programs offered. Academic staff which have educational background from some of the best universities in USA, UK, France, Netherlands, Japan and Australia, are teaching and actively conducting research as members of Research Groups as follows:

- Algebra,
- Analysis and Geometry,
- Combinatorial Mathematics,
- Industrial and Financial Mathematics,
- Statistics.

The research supports on-going theoretical development of the mathematical sciences. At the same time, it promotes interdisciplinary use of mathematics in sciences, and engineering. In turn, the research brings a flow of real mathematical problems to enrich the undergraduate and graduate programs. To cultivate research resources, collaborations with other world-class universities and industries have been built for a longtime.

The undergraduate program is normally completed in four years, with the minimum load of 144 credits, including a final project task. The 2-year Magister degree program consists of courses and a final project task which constitutes the research part of the program. The PhD degree can be obtained basically by extensive research works normally in 3–5 years. Excellent relationship between the student and his/her advisor is essential for the success of the research works during the study and after the student graduates.

Master's Program in Actuarial Studies

The Master's Program in Actuarial Studies offers a 2-year program which is supported by staffs from the Mathematics study program and well-known practitioners from actuarial or financial industries; for example, from PT Asuransi Jiwasraya and Department of Treasury. Long history of education in actuarial science had begun since 1960s when the Mathematics study program provided its courses as a new option of major. Even though some practitioners are involved in teaching, this study program also aims at the scientific development of this field. The academic staffs, who are actively teaching and conducting research (for example in applied statistics, general insurance, survival models and stochastic processes), are mostly from Statistics Research Division. The strong relationship between the Mathematics study program and the Society of Actuaries of Indonesia (PAI) has given good opportunities to the Mathematics study program graduates to be employed by insurance companies as soon as they graduate. At present, the cooperation between the Mathematics study program and the Society of Actuaries of Indonesia (PAI) is enhanced by a Memorandum of Understanding (MOU) between PAI and ITB in conducting actuarial science education at the S1 level. The MOU will benefit students who pass certain subjects with high distinction given at the Mathematics study program and in the Master's program in Actuarial Studies to be exempted from some professional examination subjects in the PAI curriculum.

The academic staffs have research interests in areas, such as, general insurance, survival models, financial mathematics, warranty, etc. The courses offered by the Program includes Actuarial Mathematics, Risk Theory, Probability, Stochastic Processes, Survival Models, and Credibility Theory.





Academics facilities

There is a range of integrated libraries provided by Institut Teknologi Bandung, consist of the Central Library, Mathematics Study Program's Library and other Study Programs' libraries. Once awarded as the best university library by Department of National Education, the Central Library has wide-spread collections of scientific books, micro-films, video cassette, CD ROM, etc. The literature subscriptions owned by the Library include full-text access to some prominent electronic journals, such as MathSciNet and SIAM (Society for Industrial and Applied Mathematics). The Central Library and all Study Program's libraries in ITB are connected in an integrated system that provides easy-access to all ITB academic community. The system also links to Indonesia DLN (Indonesian Digital Library Network), initiated by ITB, which joins many libraries in Indonesia and some other countries.

Graduates students are provided IT facilities including 2 computer laboratories (Graduate and Undergraduate labs), full access to email, internet, intranet and other online sources of information. There is several study rooms in campus specially assigned for students so they can study together or have a discussion with lecturers or fellow students.

Algebra

Algebra is a branch of mathematics concerning the study of structure, relation, and quantity. Together with geometry, analysis, combinatorics, and number theory, algebra is one of the main branches of mathematics. Elementary algebra is often part of the curriculum in secondary education and provides an introduction to the basic ideas of algebra, including effects of adding and multiplying numbers, the concept of variables, definition of polynomials, along with factorization and determining their roots.

Algebra is much broader than elementary algebra and can be generalized. In addition to working directly with numbers, algebra covers working with symbols, variables, and set elements. Addition and multiplication are viewed as general operations, and their precise definitions lead to structures such as groups, rings and fields.

Algebra may be divided roughly into 7 (seven) categories. The first category is Elementary algebra, which is the most basic form of algebra. It is taught to students who are presumed to have no knowledge of mathematics beyond the basic principles of arithmetic. The second category is Abstract algebra, sometimes also called modern algebra, which extends the familiar concepts found in elementary algebra and arithmetic of numbers to more general concepts. Other categories are Linear algebra, Universal algebra, in which properties common to all algebraic structures are studied, Algebraic number theory, in which the properties of numbers are studied through algebraic systems, Algebraic geometry, which is in its algebraic aspect, and Algebraic combinatorics, in which abstract algebraic methods are used to study combinatorial questions.

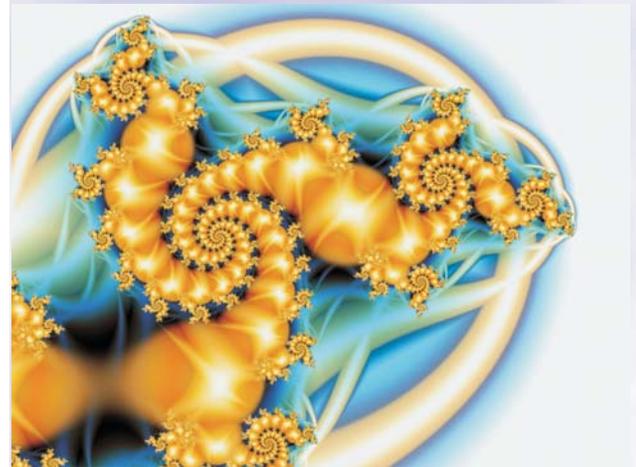
Research Interest

The mission of the Algebra research group at ITB is to pursue the Tridharma, which are providing a quality learning process in mathematics at all level, undergraduate and post-graduate, developing and extending the knowledge of algebra through research, and disseminating and applying the knowledge of algebra.

The group's program (road map) covers the fundamental research with emphasis on the development of the theory of module and co-module with categorical approach:

- Research on algebras, modules, co algebras and co modules: hereditary, co hereditary, Noether, coNoether, prime, co prime properties.
- Research on category and categorification
- Research on algebraic structures and their applications in bioinformatics/biochemistry and other areas

The other group's program (road map) is the applied research with emphasis on the methodological development of industry process quality control, which covers not only manufacturing industry but also service and information industries.





The group members are actively working in research on the following areas:

- comodule and coalgebra, hereditary, Noether and prime (HNP) ring and module and its generalization to module M-HNP M.
- module theory with categorical approach : abelian, triangulated and derived category
- algebraic structures and their application in system and control theory, bioinformatics/biochemistry and cryptography
- Applied research with emphasis on the methodological development of industry process quality control.

We also develop collaboration with other research groups for application of algebra in quantum theory, nano technology, graph theory, bioinformatics and cryptography.

Research Project

We have conducted many research projects yielding many scientific reports in conference proceedings and scientific journals, with regional and international scopes.

The 2006 Research Projects were

- On the search of effective and efficient robust estimation of location and scale (riset KK ITB 2006). PI: Prof.Dr. Maman Djauhari, Members: Dr.Pudji Astuti, Dr.Irawati
- Sekitar Koaljabar Koherediter dan Pengembangannya (Riset KK ITB 2006). PI: Dr. Irawati, Members: Dr. Pudji Astuti, A.Muchlis, PhD and Hanni Garminia, M.Si
- Homological and geometric methods in algebra. Riset dibiayai oleh Dept Math Sciences NTNU Norwegia, 2006 (Dr.I.Muchtadi-Alamsyah)

The 2007 Research Projects were

- Sekitar Jumlah Langsung Koaljabar Koherediter (Riset KK ITB 2007). PI: Dr. Irawati, Members: Dr. Pudji Astuti, A.Muchlis, PhD and Hanni Garminia, M.Si

The 2008 Research Projects are

- An Efficient and Highly Robust Estimate of Location and Scater (Riset KK ITB 2008). PI: Prof.Maman Djauhari
- Telaah Struktur Subruang Invarian yang Dibangun oleh Faktorisasi Matriks Perbandingan-Pasang-Demi-Pasang yang Berasal dari Metode Pengambilan Keputusan Kriteria Majemuk. (Hibah Fundamental DIKTI 2008) PI: Dr. Pudji Astuti
- Penggunaan Aljabar Hipergraf dan Generalisasinya dalam Pengelompokan dan Perbandingan Homologi Protein untuk Analisis Filogenetik (Insentif Riset Dasar RISTEK 2008) PI: Dr. Irawati, Members: Dr. Intan M, Dr. A.Muchlis, Muliana, M.Si.

Publication

There are 35 publication outputs of Algebra Research Group in the period 2006-2008, which are summarize as follows.

International Journals	: 10
National Journals	: 6
International Proceedings	: 13
National Proceedings	: 6

Research Group Staffs :

Head:

Maman Abdurachman Djauhari, Prof. Dr.

Members:

Ahmad Muchlis, Dr.

Aleams Barra, M.Si.

Hanni Garminia Yudhawisastra, Dr.

Intan Muchtadi-Alamsyah, Dr.

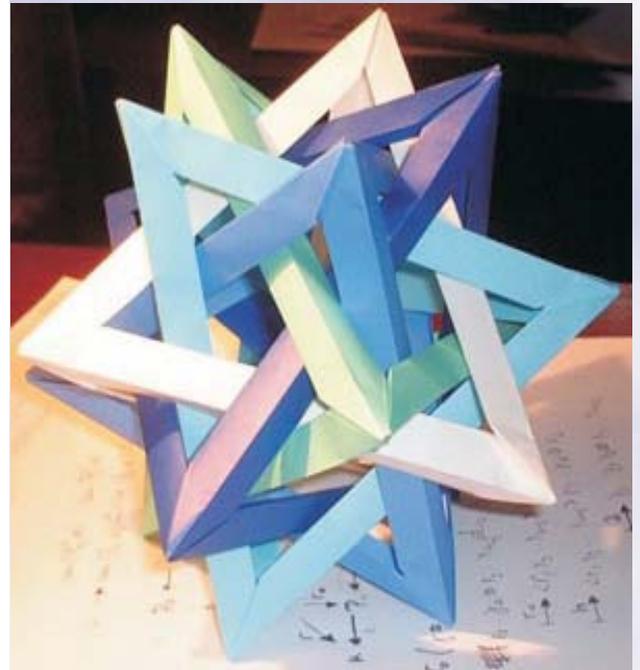
Irawati, Dr.

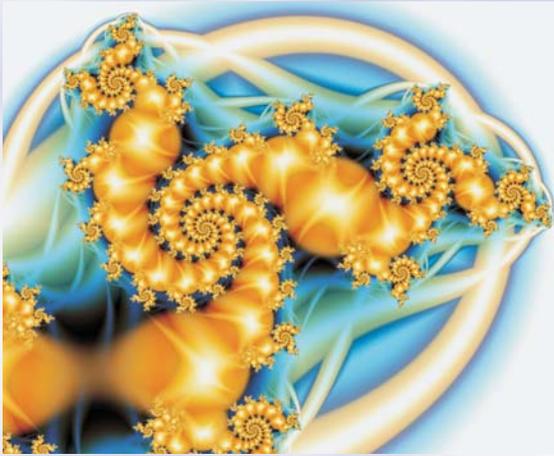
Muliana Halim, M.Si.

Pudji Astuti, Dr.

International Publications

1. P. Astuti and H.K. Wimmer, (2006). "Regular submodules of torsion modules over a discrete valuation domains", *Czechoslovak Math. Journal*, vol **56**, 349-357, 2006.
2. P. Astuti and H.K. Wimmer, (2006). "A Class of Marked Invariant Subspaces and Its Applications to Algebraic Riccati Equations", *Automatica*, **42**(9), 1503-1506, 2006.
3. M. A. Djauhari, A measure of multivariate data concentration, *Journal of Applied Probability and Statistics*, **2**(2), 139-155, USA.
4. M. A. Djauhari and R. F. Umbara. "A Redefinition of mahalanobis depth Function" *Journal of Fundamental Sciences*, **3**(1), 2007.
5. D.E. Herwindiati, M.A.Djauhari, and M. Mashuri, "Robust multivariate outlier labeling". *Journal Communication in Statistics - Computation and Simulation*, Canada, **36**(6), 1287-1294, 2007.





6. M.A. Djauhari, M. Mashuri, and D. E.Herwindiati, "A multivariate intrusion detection", *Journal Communication in Statistics: Theory and Method*, **37**(11), 1742-1754, 2008.
7. M.A. Djauhari, "A robust estimation of local and scatter". *Malaysian Journal of Mathematical Sciences*, 2008.
8. I. Muchtadi-Alamsyah, "Braid action on derived category of Nakayama algebras," *Communication in Algebra*, **36** (7), 2544-2569, 2008.
9. Irawati, "Uniserial Matrices." *International Math. Forum.* **3**(29), 1401-1407, 2008.
10. H. Garminia, P. Astuti, and Irawati, "An Intertwining of a hereditary algebra and a cohereditary", *Journal of Fundamental Sciences*, **4**(1), 263-267, 2008.

National Journals

1. M.A. Djauhari, "Pendidikan untuk apa?" *Jurnal Sosio-Teknologi*, 2006
2. H. Garminia, P. Astuti, "Karakterisasi modul $\sigma[M]$ -koherediter", *Majalah Ilmiah Himpunan Matematika Indonesia*, **12**(2), 225-231, 2006.
3. M.A. Djauhari, "Statistik: Salah satu indikator utama peradaban", *Jurnal Sosio-Teknologi*, 2007.
4. M.A. Djauhari, "Ketidakpastian itu Mahal", *Journal Socio-Technology*, 2007.
5. A. K. Amir dan P. Astuti, "Pembuktian isomorfisma malgrange menggunakan sifat sifat dasar aljabar", *Jurnal MIPA dan Pembelajarannya*, **23**(2), 115 - 121, 2007.
6. H. Garminia, P. Astuti and Irawati, (2007). "Properties of cohereditary comodule", *Jurnal Matematika dan sains*, **12**(2), 2007.

Mathematical Analysis and Geometry

Mathematical Analysis is a part of mathematics that was conceptually developed from calculus – which stems from the studies of rules for the effective calculation of magnitudes by instantaneous rates and infinite sums. It can be described as the development of intuitive methods of calculations, of a variety of formal concepts all found within one overarching axiomatics. It is transformed gradually to real and complex analysis that deals with functions and their deeper properties as to integrations, limits, and derivatives. It also expands to larger topics as functional analysis and harmonic analysis. These concepts are also investigated in topological space- any space of mathematical objects that is equipped with a definition of "nearness"- or more specifically "distance", that is a metric space.

The development of mathematical analysis is governed by many practical problems such as in physics, so that it includes subjects e.g. calculus of variations, ordinary and partial differential equations.

Geometry (gewmetria; geo = earth, metria = measure) is a part of mathematics concerned with questions of size, shape, relative position, figures and with properties of space. As one of the oldest sciences developed to meet some practical need in construction, surveying, navigation, astronomy, geometry is initially a body of practical knowledge concerned with lengths, areas, and volumes. Euclid, in the third century B.C., put them in an axiomatic form, that set a standard for many centuries to follow.

The introduction of coordinates by Descartes is a crucial towards an analytical studies of geometry. The subject of geometry was further enriched by the study of intrinsic structure of geometric objects that originated with Euler and Gauss. This led to the creation of topology and differential geometry.

The discovery of non-Euclidean geometry has revolutionized the notion of space. Contemporary geometry consider manifolds space that are considerably more abstract than the familiar Euclidean space. These spaces is endowed with additional structures allowing one to speak about length and angle. Geometry is now, in large part, the study of structures on manifolds that have a geometric meaning, in the sense of the principle of covariance that lies at the root of general relativity theory in theoretical physics. Modern geometry has multiple strong bonds with physics, exemplified by the ties between Riemannian geometry and general relativity.

The members of Analysis and Geometry Research Division work on most of areas in analysis and geometry. Some topics of their works are listed in the next page.





Research Interests

At Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung, Analysis and Geometry Group ITB is considered as one of the strongest groups which has good reputation among other mathematical analysis research group in Indonesia and neighboring countries. Our mission as a part of an education institution of ITB is to guarantee the high quality of analysis and geometry courses which are run in ITB so they become references for national standard. In research field, our mission is to become a productive and synergic group who is strong in fundamental knowledge, thriving in advance one and active in the applications. In community empowerment, we also have a mission to contribute significantly in community empowerment, not only for students and academic staff in ITB but also for the community outside ITB.

The member of the group are actively working in research on the following areas:

- Operator Algebra
- Partial Differential Equations and Fourier Analysis
- Functional Analysis
- Dynamical Systems: Theory and Applications
- Integral Equations
- Delay and Impulsive Differential Equations

We have conducted many research projects yielding many scientific reports in conference proceedings and scientific journals, with regional and international scopes. The 2006 Research Projects were :

- Hendra Gunawan and Yudi Soeharyadi: Ketaksamaan Olsen di ruang Morrey (Riset ITB 2006)
- J.M. Tuwankotta, Wono Setya Budi and Fajar A.K.: Sistem konservatif yang diperturbasi secara singular (Riset ITB 2006)
- Jalina Widjaja and Iwan Pranoto: Perancangan kontrol sistem multi-agen dengan menerapkan kontrol optimum (Riset ITB 2006)
- J.M. Tuwankotta and Sri Widiyantoro: Pencitraan tomografi untuk geotermal (Hibah Pekerti 2005-2006)

In 2007, the Research Projects had been done were

- J.M. Tuwankotta, H.W. Broer, F. Verhulst and K. Saleh: "Dynamics and bifurcation in a predator-prey type system under quasi periodic perturbation" (SPIN Postdoc Program KNAW, The Netherlands)
- J.M. Tuwankotta, Wono Setya Budi, Fajar A.K. and Annis D.R.: "Singularly perturbed conservative system: a toy

model for ultra-low frequencies variability” (Riset Internasional ITB 2007)

- Hendra Gunawan, Oki Neswan and Ferry P.: “Pengembangan metode interpolasi yang meminimumkan energi” (Riset ITB 2007)
- Janny Lindriani and M. Yunus: “Konstruksi dan komputasi wavelet frame melalui analisis multiresolusi” (Penelitian Fundamental 2007)
- Jalina Widjaja and Yudi Soeharyadi: “Logistic equation” (Penelitian Fundamental 2007)
- Oki Neswan: “Teori model tanpa tanda kesamaan” (Penelitian Fundamental 2007)

We also do some activities related to the community empowerment, such as: Teaching apprenticeships, Research apprenticeships, Training/workshops, General lectures, and Student's Mathematics competitions.

Research Group Staffs

Head :

Hendra Gunawan, Dr., Prof.

Members:

Ariyani, M.Si

Jalina Widjaja, M.Si., Dr.

Janny Lindiarni, M.Si., Dr.

Johan Matheus Tuwankotta, M.Si., Dr.

Koko Martono, Drs., MS.

Marcus Wono Setyabudhi, Dr.

Oki Neswan, M.Sc., Dr.

Samsiah Sanuri, Dra.

Samyoeto, Drs., M.Si

Yudi Soeharyadi, M.Si., Ph.D





Publications

There are 22 publication outputs of Analysis and Geometry Research Division in the period 2006 - 2008, which are summarize as follows.

International Journals	: 6
National Journals	: 6
International Proceedings	: 7
National Proceedings	: 3

International Journals

1. I. Sihwaningrum, H.P. Suryawan, H. Gunawan, (2008). "Fractional integral operators and Olsen inequalities in non-homogeneous spaces", *Austral. J. Math. Anal. Appl.* (in press).
2. H. Gunawan, Eridani, (2008). "Fractional integrals and generalized Olsen inequalities", *Kyungpook Math. J.* (in press).
3. H. Gunawan, F. Pranolo, E. Rusyaman, (2008). "An interpolation method that minimizes an energy functional of fractional order", in D. Kapur (Ed.): *ASCM 2007, LNAI 5081*, 151-162
4. A. Sahiner, M. Gurdal, S. Saltan, H. Gunawan, (2007). "Ideal convergence in 2-normed spaces", *Taiwanese J. Math.* **11**, 1477-1484
5. H. Gunawan, S. Gupta, (2007). "On integrals arising from a Lie group contraction problem", *Far East J. Math. Sci.* **24**, 321-328
6. H. Gunawan, Mashadi, S. Gemawati, Nursupiamin, I. Sihwaningrum, (2006). "Orthogonality in 2-normed spaces revisited", *Univ. Beograd Publ. Elektrotehn. Fak.* **17**, 76-83

National Journals

1. M. Yunus, H. Gunawan, (2008). "Tight wavelet frame decomposition and its application in image processing", *ITB J. Sci.* **40 A**
2. H. Gunawan, O. Neswan, J. Lindiarni, "P-, l-, g-, and D-angle in normed spaces", *ITB Journal of Science* **40 A** (2008), 24-32
3. H. Gunawan, I. Sihwaningrum, (2007). "Fractional integral operators and their boundedness on various spaces", *J. Matematika & Sains* **12** : 4, 119-126
4. M. Yunus, H. Gunawan, J. Lindiarni, (2007) "The initial functions in wavelet frame construction", *Proc. 5th SEAMS-GMU Int. Conference on Mathematics and Its Applications*, 475-482
5. G. Gunawan, H. Gunawan, (2006). "Keterbatasan operator Riesz di ruang Morrey", *Limits* **3**, 27-40.
6. E. Cahyono, Y. Soeharyadi, Mukhsar, (2008). "A Smooth diffusion rate model of wood drying: a simulation toward more efficient process in industry", *Jurnal Teknik Industri*, Vol **10**

Combinatorial Mathematics

The Combinatorial Mathematics Research Group at the Faculty of Mathematics and Natural Sciences ITB envisions to be a leader in the development of combinatorial mathematics in Indonesia and to be able to contribute internationally.

Its missions are to conduct research on the cutting-edge problems in combinatorial mathematics, to use the research results in practical purpose, to conduct teaching and develop innovative teaching materials in combinatorial mathematics and to promote the use and the importance of mathematics in today's life.

The members of the Group conduct research in various topics in combinatorial mathematics: extremal graphs and digraphs, graph labelings, random graphs, Ramsey numbers, combinatorial designs, and combinatorial number theory.

The Group is in charge of the teaching in combinatorial mathematics related courses in the Mathematics Study Programs, such as Discrete Mathematics, Computational Mathematics, Combinatorics, Graph Theory, and Algebraic Graph Theory. The members of the Group also supervise bachelor's final projects, master's thesis, and doctoral dissertations. The Group has graduated four PhDs in the area of Graph Theory, all of them with cum laude qualification.

Recently, the Group initiated the establishment of Indonesian Combinatorial Mathematics Society (InaCombs).

Publications

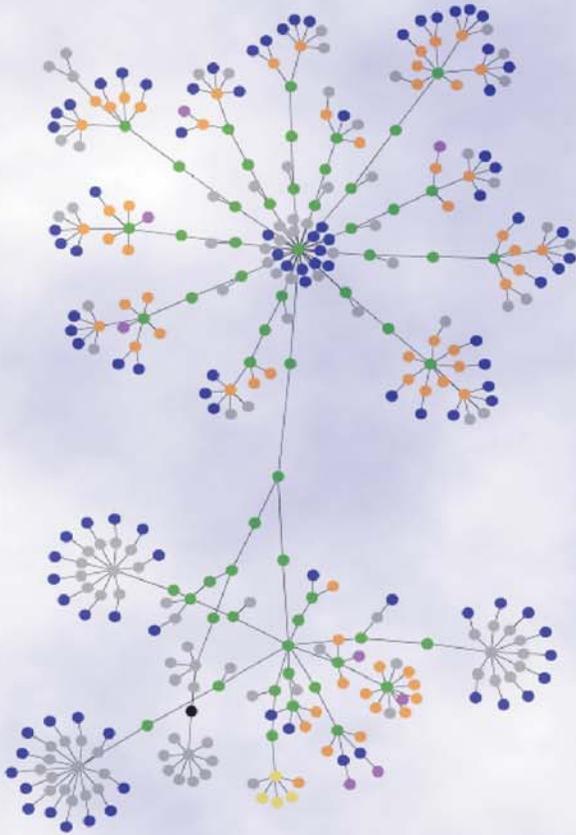
There are 71 publication outputs of Combinatorial Mathematics Research Division in the period 2006-2008, which are summarize as follows.

International Journals	: 29
National Journals	: 1
International Proceedings	: 35
National Proceedings	: 6

We develop collaboration in conducting research with:

- School of Information Technology and Mathematical Sciences, University of Ballarat, Ballarat Australia, contact person: Professor Mirka Miller.
- School of Mathematical Sciences, GC University, Lahore Pakistan, contact person: Professor. A.D.R. Choudary.
- Tokai University, Japan, contact person: Professor Jin Akiyama.





Research Interests

Combinatorial Mathematics Research Group constantly conducts various research activities. These activities lead to the big theme of optimization in combinatorics and its applications. This research theme consists of research topics in extremal problems, random graph for the existence of large subgraphs, graph coloring, cutting sequences in number theory, combinatorial designs, Ramsey numbers, and their applications in real problems. To support the research activities, the group has been conducting several international conferences on graph theory and related fields.

Researchers: Edy Tri Baskoro, Rinovia Simanjuntak

In the design of large interconnection networks there is usually a need for each pair of nodes to communicate or to exchange data efficiently, but it is impractical to directly connect each pair of nodes. Therefore, the problem of designing networks is concerned with two constraints: the limitation of the number of connections attached to every node and also the limitation of the number of intermediate nodes on the communication route between any two given nodes.

The first constraint is modeled by the degree of a node. The second constraint is modeled by distance parameters of a graph, such as diameter, radius, or average distance. We are particularly interested in the diameter parameter. In graph theoretical terms, the problem called the Degree/Diameter Problem, namely:

For given d and k , find graphs (if the network is unidirectional) or digraphs (for a bidirectional network) of maximum degree or out-degree d and diameter at most k with maximum number of vertices $n_{d,k}$.

A well-known upper bound for $n_{d,k}$ is the so-called Moore bound that was first proposed by E.F. Moore.

In general, the degree/diameter problem is not an easy problem to solve. For instance, the existence of Moore graph of degree 57 and diameter 2 is a long-standing (43 years and counting!) and famous open problem in Graph Theory. Two approaches that are used to attack the problem, i.e.,

- Establishing upper bound for $n_{d,k}$ by proving the nonexistence of graphs or digraphs with order “close” to the Moore bound and
- Establishing lower bound for $n_{d,k}$ by constructing large graphs and digraphs

progressed slowly during the years; the gaps between the two bounds are still enormous, especially for large values of d and k .

Cutting Sequences

Researchers: R.A. Desidera Kooswinarsinindyah

Two-symbol cutting sequences, also known as Sturmian words or billiard sequences, is a subject which is studied extensively either from mathematical or from computer science point of view. Extensions of Sturmian words, both in the direction of cutting sequences of more than two symbols and that of two-symbol cutting sequences in the dimension higher than two, are studied extensively by many authors.

Magic and antimagic graph labelings

Researchers: Edy Tri Baskoro, Hilda Assiyatun, M Salman A. N., Rinovia Simanjuntak

A labeling (or valuation) of a graph is any mapping that sends some set of graph elements to a set of numbers (usually positive or non-negative integers). If the domain is the vertex-set or the edge-set or both, the labelings are called respectively vertex-labelings or edge-labelings or total-labelings. A complete survey of graph labelings, written by Joseph Gallian, can be downloaded in [The Electronic Journal of Combinatorics](#).

We are working on some special types of graph labelings that are called magic and antimagic graph labelings. We especially consider the so-called (a,d) -antimagic labelings; and in this one type of graph labelings we have devised a new terminology for defining such labelings and found all possible combinations of the labelings within our terminology, studied properties of the labelings, and constructed labelings for several families of graphs.

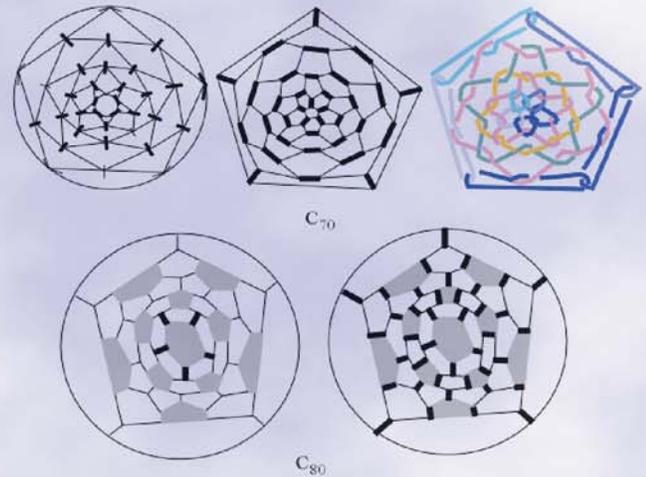
Together with Chris Rodger, we also introduced labelings that are both magic and distance-based; and we called such labellings the d -magic labellings, with d denote the desirable distance in the labellings.

We are also working on the application of the magic labeling to secret sharing scheme, by introducing a set called a critical set of a particular magic labeling of a graph.

Random Graphs

Researchers: Hilda Assiyatun

We are interested in investigating the existence of large subgraphs in random regular graphs. We are also interested in graph decomposition, in particular decomposition of regular graphs into certain classes of graphs using probabilistic method.



Nowhere-zero 5-flow conjecture

Researchers: Saladin Uttungadewa

Let G be an undirected graph. Orient G by putting arrows on each edge $e \in E(G)$, so that one vertex of e is distinguished as tail $t(e)$ of e and the other one as the head $h(e)$ of e . If $v \in V(G)$ and $e \in E(G)$ define $h(e,v) = 1$ if $v = h(e)$; 0 if v is not a vertex of e ; and -1 if $v = t(e)$. A Z -flow on G is a mapping $f : E(G) \rightarrow Z$ such that for each vertex v of G : $\sum_{e \in E(G)} h(e,v)f(e) = 0$

It is said that the mapping f is a nowhere-zero Z -flow if $f(e) \neq 0$ for every $e \in E(G)$. For every k greater or equal to 2 define a k -flow as $f : E(G) \rightarrow Z_k$ such that for each vertex v of G : $\sum_{e \in E(G)} h(e,v)f(e) = 0 \pmod k$. The support of a k -flow is the set of edges $\text{supp}_k(f) = \{e \in E(G) : f(e) \neq 0 \pmod k\}$. A k -flow f is a nowhere-zero k -flow if $\text{supp}_k(f) = E(G)$. W.T. Tutte (1954) proposed the following conjecture: "Every bridgeless graph has a nowhere-zero 5-flow". We are interested in proving or disproving this conjecture.

Ramsey Numbers

Researchers: Edy Tri Baskoro, Hilda Assiyatun, M. Salman A.N, Saladin Uttungadewa

Ramsey theory was initially studied in the context of the problem of finding a regular procedure to determine the consistency of any given logical formula (1928). Then, this became famous after Paul Erdos and George Szekeres (1935) applied it in graph theory. The idea behind 'classical' Ramsey number is basically the following. For any positive integers m and n , we would like to determine the smallest integer $R = R(m,n)$ so that every graph F of R vertices will satisfy the following condition: either F has K_m as a subgraph or the complement of F has K_n as a subgraph.

The research on finding the exact value of classical Ramsey numbers $R(m,n)$ has received a lot of attention. However, the results are still far from satisfactory. Since firstly introduced, there are only nine exact Ramsey numbers known so far.

The problem of finding classical Ramsey numbers have been generalized in various ways. One of them is the following. Let G and H be two graphs. The Ramsey number $R(G,H)$ is defined as the smallest integer N such that every graph F of order N will satisfy the following condition: either F contains G as a subgraph or the complement of F contains H as a subgraph.

Euclidean t-designs

Researcher: Djoko Suprijanto

A combinatorial t - (v,k,λ) design X is one of important objects in combinatorics. It might be viewed (Seidel, 1990), in a sense, as an approximation of the discrete sphere S_k of all k -subsets by the sub-collection X of S_k , where S_k is a set of v -tuple (consisting of 0 or 1 entries), with length k^2 .

Later, Delsarte, Goethals and Seidel (1977) introduced an analog concept of designs for (continuous) sphere by defining what they called a spherical t -design. This new concept might be viewed as an approximation of the unit sphere S^{n-1} by the subset X of S^{n-1} with respect to integral of polynomial functions.

The concept of spherical t -design was generalized by Neumaier and Seidel (1988) by allowing weights and multiple spheres. The new concept is called Euclidean t -design. There are natural lower bound for the size of Euclidean t -designs. Those which attain the lower bound are called tight Euclidean t -designs. We are interested in investigating the existence of tight Euclidean t -designs. We are also interested in constructing tight Euclidean t -designs as well as classifying them.

Research Group Staffs

Head :

Edy Tri Baskoro, Prof. Dr.

Members:

Djoko Suprijanto, Dr.

Hilda Assiyatun, Dr.

M. Salman A.N, Dr.

Nana Nawawi Gaos, Dr.

R.A. Desidera Kooswinarsinindyah, M.Sc.

Rinovia Mery Garnierita Simanjuntak, Dr.

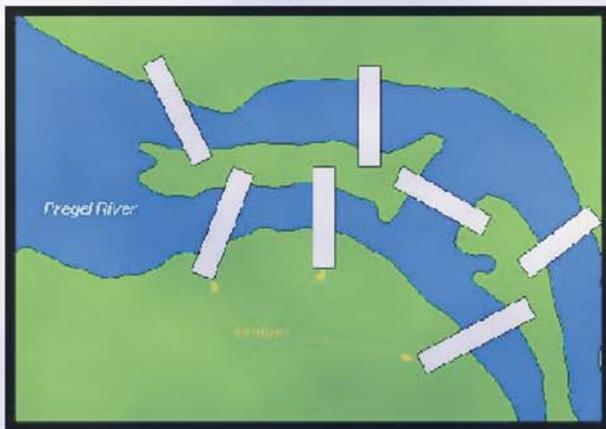
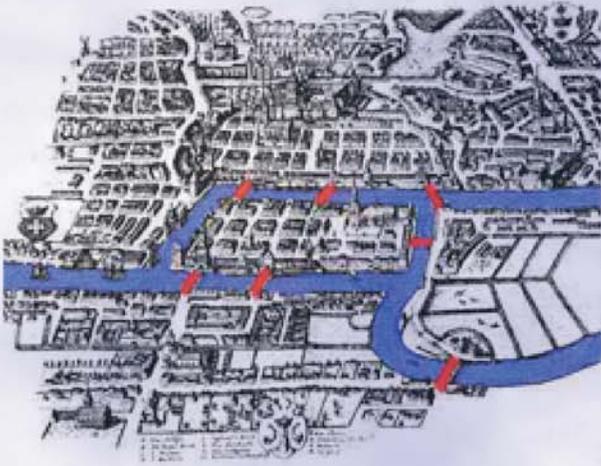
Saladin Uttunggadewa, Dr.

Warsoma Djohan, M.Si.

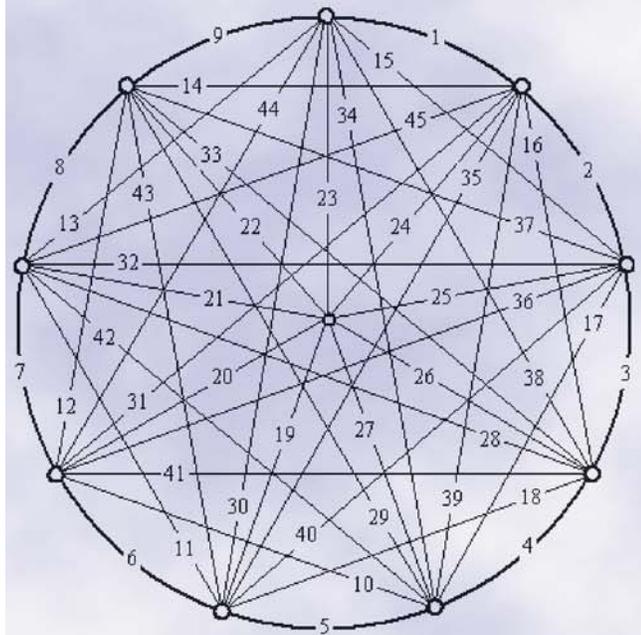


International Journals :

1. Hasmawati, E.T. Baskoro, H. Assiyatun, (2008). "The Ramsey numbers for disjoint unions of graphs", *Discrete Math.* **308:10** 2046-2049.
2. E.T. Baskoro, Y.M. Cholily, M. Miller, (2008). "Enumeration of vertex orders of almost Moore digraphs with selfrepeats", *Discrete Math.* **308** 123-128.
3. A.A.G. Ngurah, E.T. Baskoro, R. Simanjuntak, (2008). "On the super edge-magic deficiencies of graphs", *Australas. J. Combin.* **40**, 3-14.
4. Surahmat, E.T. Baskoro, I. Tomescu, (2008). "The Ramsey numbers of large cycles versus odd wheels", *Graphs Combin.* **24**, 53-58.
5. A.A.G. Ngurah, R. Simanjuntak, E.T. Baskoro, (2008). "On (super) edge-magic total labeling of subdivision of $K_{1,3}$ ", *SUT Journal of Mathematics*, **43: 2**, 127-136.
6. E.T. Baskoro, Lyra Yulianti, H. Assiyatun, (2008). "Ramsey $(K_{1,2}, C_4)$ -minimal", *J. Combin. Math. Combin. Comput.* **65**, 79-90.
7. Kashif Ali, E.T. Baskoro, (2008). "On the Ramsey numbers for a combination of paths and Jahangirs", *J. Combin. Math. Combin. Comput.* **65**, 113-120.
8. C. Imron, B. Setiyono, R. Simanjuntak, E.T. Baskoro (2008), "Critical set of caterpillar graph for secret sharing scheme", *J. Combin. Math. Combin. Comput.* **65**, 121-126.
9. H. Iswadi, E.T. Baskoro, R. Simanjuntak, A.N.M. Salman (2008), "The metric dimension of graph with pendant edges", *J. Combin. Math. Combin. Comput.* **65**, 139-146.
10. Surahmat, E.T. Baskoro, H.J. Broersma (2008), "The Ramsey number of large star-like trees versus odd wheels", *J. Combin. Math. Combin. Comput.* **65**, 153-162.
11. T. K. Maryati, E.T. Baskoro, A.N.M. Salman (2008), "Phypermagic labelings of some trees", *J. Combin. Math. Combin. Comput.* **65**, 197-204.
12. Nurdin, A.N.M. Salman, E.T. Baskoro (2008), "The total edge-irregular strengths of the corona product of paths with some graphs", *J. Combin. Math. Combin. Comput.* **65**, 163-176.



13. A.N.M. Salman (2008), "The computational complexity of lambda-backbone coloring of graphs with n complete backbones", *J. Combin. Math. Combin. Comput.* **65** 177-180.
14. Sy Syafrizal, Baskoro E.T., Uttunggadewa S., (2007), "The size multipartite Ramsey numbers for small paths versus other graphs", *Far East J. Appl. Math.* **28:1**, 131-138.
15. Ngurah A.A.G., Baskoro E.T., Simanjuntak R., (2007), "On the new families of (super) edge-magic graphs", *Utilitas Math.* **74**, 111-120.
16. Salman A.N.M. and Broersma H.J., (2007), "On Ramsey numbers for paths versus wheels", *Discrete Mathematics* **307**, 975-982.
17. Salman A.N.M. and Broersma H.J., (2007), "Path-kipas Ramsey numbers", *Discrete Applied Mathematics* **155**, 1878-1884.
18. Bannai Eiichi, Bannai Etsuko, and Supriyanto Djoko, (2007), "On the Strong-nonrigidity of certain tight Euclidian Designs", *European Journal of Combinatorics*, vol **28** issue 6, august 2007, pages 1662-1680
19. Baskoro E.T., Cholily Y.M., Miller M., (2006). "Structure of repeat cycles in almost Moore digraphs with selfrepeats and diameter 3", *Bull. Inst. Combin. Appl.* **46**, 99—109.
20. Ngurah A.A.G., Baskoro E.T., Simanjuntak R., (2006). "On the (a,d)-antimagic total labelling of $\mathcal{M}C_n$ ", *Bull. Inst. Combin. Appl.* **48**, 35-44.
21. Ngurah A.A.G., Baskoro E.T., Simanjuntak R., Uttunggadewa S., (2006). "On edge-magic total labeling of kC_4 -snakes", *Congressus Numerantium* , **179**, 97-107.
22. Baca M., Baskoro E.T., Miller M., Ryan J., Simanjuntak R., Sugeng K.A., (2006), "Survey of edge antimagic labelings of graphs", *J. Indones. Math. Soc.* **12:1**, 113-130.
23. Baskoro E.T., Hasmawati, Assiyatun H., (2006), "The Ramsey numbers for disjoint unions of trees", *Discrete Math.* **306**, 3297-3301.
24. Surahmat, Baskoro E.T., Tomescu I., (2006), "The Ramsey numbers of large cycles versus wheels", *Discrete Math.* **306**, 3334-3337.
25. Baskoro E.T., Subanji, (2006), "Methods of constructing a knight's tour on rectangular and diamond boards", *Math Track* **2**, 47-55.
26. Baskoro E.T., Nuraeni Y., Ngurah A.A.G., (2006), "Upper bounds for the size Ramsey numbers for \mathcal{P}_3 versus \mathcal{C}_3 or \mathcal{P}_n ", *Journal of Prime Research in Mathematics* **2**, 141-146.



27. Baca M., Baskoro E.T., Simanjuntak R., Sugeng K.A., (2006), "Super edge-antimagic labelings of the generalized Petersen graph $P(n, (n-1)/2)$ ", *Utilitas Math.* **70**, 119-127.
28. Salman A.N.M. and Broersma H.J., (2006), "Path-fan Ramsey numbers", *Discrete Applied Mathematics* **154** 1429-1436.
29. Assiyatun H. and Wormald N.C., (2006), "3-star factors in random d -regular graphs", *European Journal of Combinatorics*, **27**, 1249-1262

National Journal

Nurdin, Baskoro E. T., and Salman A. N. M., (2006), "The total edge irregular strengths of the union of $K_{2,n}$ ". *Jurnal Matematika dan Sains FMIPA ITB*. Vol **11** No. 3, 105-109

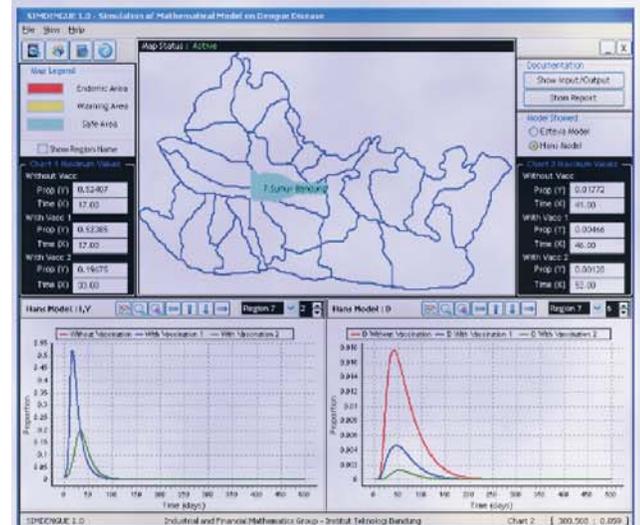
Applied Mathematics

Applied mathematics is a branch of mathematics that concerns itself with the mathematical techniques typically used in the application of mathematical knowledge to other domains. Industrial mathematics research studies the application of mathematics in the field of technology in industry.

Historically, applied mathematics consisted principally of applied analysis, most notably differential equations, approximation theory (broadly construed, to include representations, asymptotic methods, variation methods, and numerical analysis), and applied probability. Today, the term applied mathematics is used in a broader sense. It includes the classical areas above, as well as other areas that have become increasingly important in applications. Sometimes the term applicable mathematics is used to distinguish between the traditional field of applied mathematics and the many more areas of mathematics that are applicable to real-world problems.

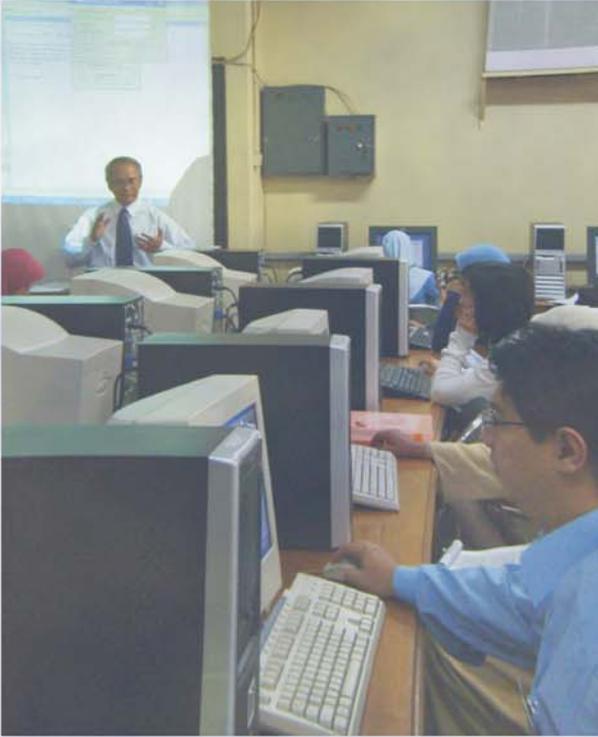
The success of modern numerical mathematical methods and software has led to the emergence of computational mathematics, computational science, and computational engineering, which use high performance computing for the simulation of phenomena and solution of problems in the sciences and engineering. These are often considered interdisciplinary programs.

The advent of the computer has created new applications, both in studying and using the new computer technology itself (computer science, which uses combinatorial, formal logic, and lattice theory), as well as using computers to study problems arising in other areas of science (computational science), and of course studying the mathematics of computation (numerical analysis). Statistics is probably the most widespread application of mathematics in the social sciences, but other areas of math are proving increasingly useful in these disciplines, especially in economics and management science.



Simulations of Math Model on Dengue Disease





Workshop on Financial Mathematics

Financial Mathematics

Financial Mathematics (also known as Mathematical Finance) is the branch of applied mathematics concerned with the financial markets. In economics, financial market is a mechanism that allows people to easily buy and sell (trade) financial securities (such as stocks and bonds), commodities (such as precious metals or agricultural goods), and other items of value at low transaction costs and at prices that reflect the efficient market hypothesis, which is prices on traded assets, e.g., stocks, bonds, or property, already reflect all known information. Financial Mathematics has a close relationship with the discipline of financial economics, which is concerned with much of the underlying theory. Generally, the subject will derive, and extend, the mathematical or numerical models suggested by financial economics. Thus, for example, while a financial economist might study the structural reasons why a company may have a certain share price, a financial mathematician may take the share price as a given, and attempt to use stochastic calculus to obtain the fair value of derivatives of the stock.

In terms of practice, mathematical finance also overlaps heavily with the field of computational finance (also known as financial engineering). Arguably, these are largely synonymous, although the latter focuses on application, while the former focuses on modeling and derivation.

Industrial and Financial Mathematics Group

This group aims to be the centre of science and research development in applied mathematics related to industry and mathematical finance. We aim to develop an active and strong network between Mathematician and the user of Mathematics in solving problems arisen in the real world using Mathematical Modeling. We aim to develop mathematics courses and workshops for undergraduate and graduate programs which are driven by needs of providing human resources with Mathematical problem-solving competence in industry.

Research conducting by the members of group are mainly classified into 4 fields:

- Optimization and Control
- Fluid Dynamics
- Bio-Mathematics
- Financial Mathematics

Optimization and Control

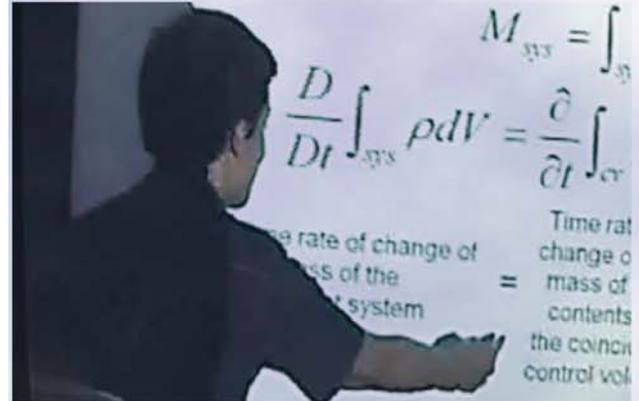
- Column Generation Technique in Cutting Stock Problem
- Genetic Algorithm in Inventory Problem & Finance
- Optimization in Pipeline Network
- Matrix Analytic Technique & Wiener-Hopf
- Factorization in Performance Analysis of Mobile Cellular Communication Network
- Markovian Model for Inventory Model & Over booking Model
- Adaptive Pricing in Airline Industries
- Robust Control System with minimum order for the infinite dimension system and the bilinear system
- Applications of the Descent Gradient Control in a non-holonomic system, which contain the stability analysis of the Descent Gradient Control using the partial stability concept, the stability analysis of the Descent Gradient Control in the Brockett Integrator System, and the application of the Descent Gradient Control for Optimum Control Problems with an infinite limit
- An analysis of re-determination of internal control in a non-conservative Fibration System
- Multi agent systems with constraints.

Fluid Dynamics

- § Hydrodynamic stability, flow in porous media, two-and-multi-phase flow
- § Tsunami, variational principles of physics
- § Free-surface potential flow, water waves, gravity-waves
- § Soliton and nonlinear interaction.

Bio-Mathematics

Mathematics models to solved problems in Life Sciences and epidemics spreading are studied in this subgroup, for examples dynamic models for the Kowak (local bird) population and models for epidemics spreading of some diseases such as Malaria, Dengue, Avian Flue, Filariasis.



Mathematical Modelling Course





Financial Mathematics

The Financial Mathematics Study in ITB is developed not only to fulfill the needs of financial institutions, but also to serve non-financial institutions. The activities of the study are integrated between education, research and public services. The topics in this field include Real Options, Actuarial Mathematics, Obligation Price Models and the yield curve model.

Collaborations

To build strong link with industry, we develop collaboration in conducting research with some institutions or industry. These include Citylink (Garuda Airways), PT Telkom, Lembaga Eijkman, Taspen, PT PAL, PAI (Persatuan Aktuaris Indonesia), STT Telkom, OPPINET (Research consortium with oil companies in Indonesia such as PT Pertamina (persero), CONOCO Philips, BOB Pertamina Hulu – PT Bumi Siak Pusako, Poma companies (Badak NGL, PL Pertamina (DOH Kalimantan), Total E&P Indonesia, Cevron, Vico Indonesia)). We also welcome initiatives from companies or education institutions to collaborate with us for the problem solving activities in application of Mathematics, especially problems in industry and manufacturing. We can provide workshops, seminars or trainings of Application of Mathematics which are preferable related with our members' specialties.

E-learning Project

As part of the Mathematics Study Program of ITB, we are nurturing Applied Mathematics courses for undergraduate students, and also some particular topics which are commonly related to the academics' research in Applied Mathematics for the students of 2-year Magister and PhD degree programs. Recent results from some leading references and our experiments are considered to enrich the content of the courses.

Some members of the group actively conduct E-learning projects. Electronic learning (or e-Learning or eLearning) is a general term used to refer to a form of learning in which the instructor and student are separated by space or time where the gap between the two is bridged through the use of online technologies. The projects in the group are the development of materials in Power Points, videos and other form. The subject of the courses being made or already made in the digital form includes Calculus I, Calculus II, Differential Equation, and Mathematical Modeling.

Research Group Staffs

Head:

Roberd Saragih, MT. Dr.

Members:

Agus Yodi Gunawan, Dr.

Andonowati, Dr.

Edy Soewono, Prof. Dr.

Hidayat Sardi, M.Si..

I Nyoman Susila, M.Sc.

Iwan Pranoto, Dr.

Janson Naiborhu, Dr.

Kuntjoro Adji Sidarto, Dr.

L. H. Wiryanto, Dr.

Muhammad Syamsuddin, Dr.

Novriana Sumarti, Dr.

Nuning Nuraini, Dr.

Rieske Hadianti, Dr.

Sri Redjeki Pudjaprasetya Francisca, Dr.

M. Ansjar, Prof. (emeritus)



Publication

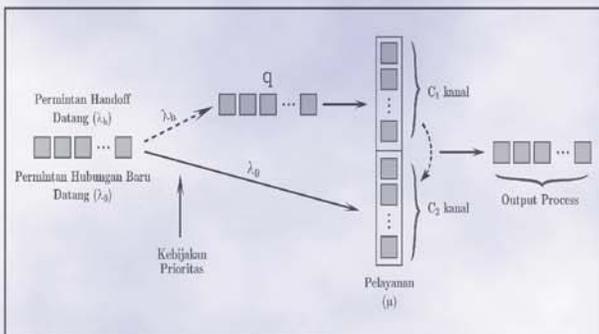
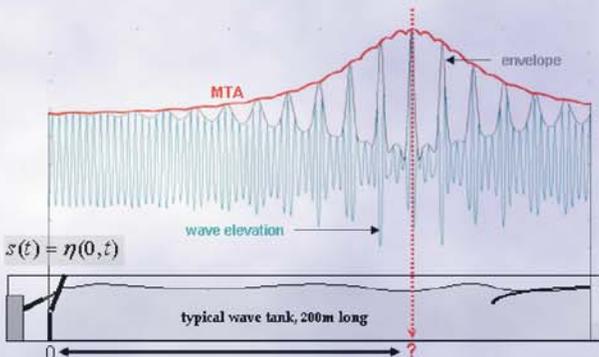
There are 40 publication outputs of Industrial and Financial Mathematics Research Group in the period 2006-2008, which are summarize as follows.

International Journals	: 18
National Journals	: 5
International Proceedings	: 22

International Journals :

1. E. van Groesen, D. Adytia, and Andonowati, (2008). "Near-coast tsunami waveguiding: phenomenon and simulations", *Nat. Hazards Earth Syst. Sci.*, **8**, 175–185.
2. Roberd Saragih and Widowati, (2008). "Coprime Factor Reduction of Parameter Varying Controller", *International Journal of Control, Automation, and System*, Vol **6**, No 6, Dec 2008.
3. N. Nuraini, H. Tasman, E. Soewono, K.A. Sidarto, (2008). "A with-in host Dengue infection model with immune response", *Mathematical and Computer Modelling*,
4. Deni Saepudin, Edy Soewono, Kuntjoro Adji Sidarto, Agus Yodi Gunawan, Septoratto Siregar, and Pudjo Sukarno, (2008). "An Investigation on Gas Lift Performance Curve in an Oil-Producing Well", *International Journal of Mathematics and Mathematical Sciences*, Article ID 81519



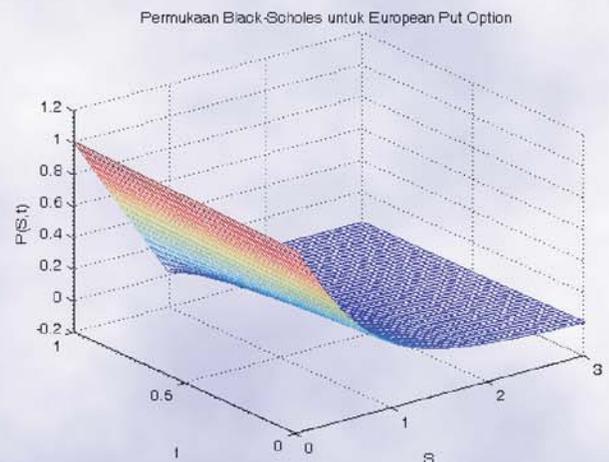
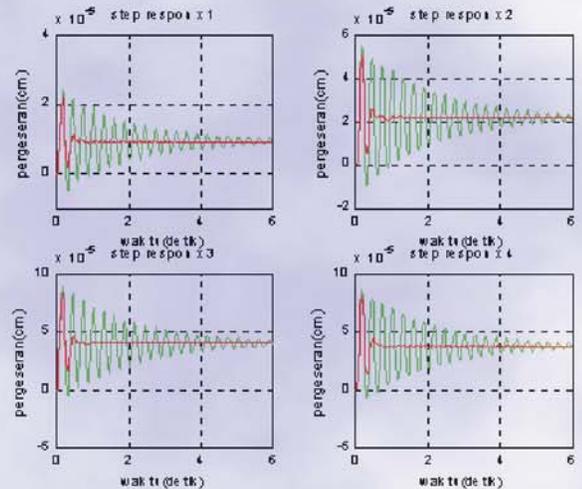


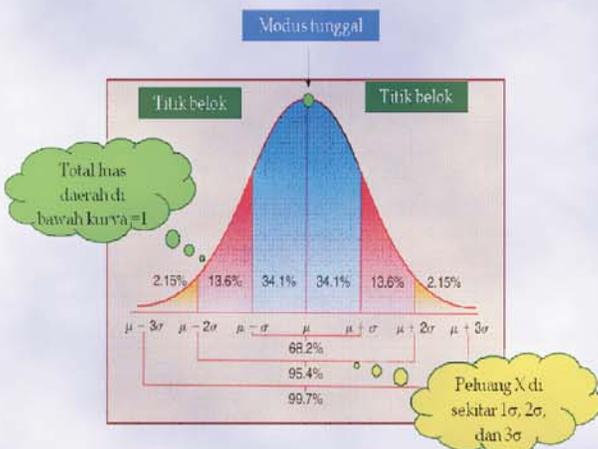
5. Nuning Nuraini, Hengki Tasman, Edy Soewono and Kuntjoro Adji Sidarto, (2008) "A with-in Dengue infection model with immune response", *Journal Mathematical and Computer Modelling*,
6. N. Sumarti, J.R. Cash, (2008). "Implicit Interpolation in the Solution of Stiff Two-Point Boundary Value Problems using Lobatto formulae", submitted to *Journal of the Indian Mathematical Society*
7. E. van Groesen , Andonowati , Lie She Liam , I. Lakhturov , (2007). "Characterization of ExtremalWaves in KdV-type models", *Geophysical Research Abstracts*, Vol. **9**, 01674,
8. E. van Groesen and Andonowati, (2007). "Variational derivation of KdV-type of models for surface water waves". *Physics letters*. Section A, 366. pp. 195-201. ISSN 0375-9601
9. E. van Groesen and Andonowati, Extremal periodic wave profiles, (2007). "Natural Hazards and Earth System Science", Volume **7**, Issue 1, pp.33-40
10. N. Nuraini, E. Soewono, and K.A. Sidarto, (2007), "Mathematical model of dengue disease transmission with severe DHF compartment", *Bull. Malays. Math. Sci. Soc.* **2**, Vol.**30**, No.2, 15-29.
11. N. Nuraini, E. Soewono, and K.A. Sidarto, (2007), "Population affect of dengue vaccine", *Journal of Mathematical Bioscience*. (in press).
12. E. van Groesen, Andonowati, N. Karyanto, (2006). "Displaced Phase-Amplitude variables for waves of finite background", *Physics Letters A* **354**, 312-319.
13. E. van Groesen, Andonowati, (2006). "Finite energy wave signals of extremal amplitude in the spatial NLS-dynamics", *Physics Letter A* **357**, 86-91.
14. Andonowati, W.M. Kusumawinahyu, E. van Groesen, (2006). "A numerical study of the breaking of modulated waves generated at a wave maker", *Applied Ocean Research* **28**, 9-17.
15. JR Cash, N. Sumarti, TJ Abdulla, I. Vieira, (2006). "The Derivation of Interpolants for Nonlinear Two-Point Boundary Value Problems", *Journal of Numerical Analysis, Industrial and Applied Mathematics*, **1**, pp.49-58.
16. JR Cash, F. Mazzia, N. Sumarti, D. Trigiante, (2006). "The role of conditioning in mesh selection algorithms for first order systems of linear two-point boundary value problems", *J. Comp. and Appl. Maths.*, **185**, pp. 212– 224.
17. J. Naiborhu, S.M Nababan, R. Saragih, and I. Pranoto, (2006). "Direct Gradient Desscent Control as a Dynamic Feedback Control for Linear System", *Bull. Malaysian Mathematical Science Society* (**2**) 29(1), 131-146.

18. E. Soewono, and A. K., Supriatna, (2006), " Paradox of Vaccinations Predicted by a Simple Dengue Disease Model", ed. , Mohan C. Joshi et al, Narosa. Publ. House, New Delhi, India.

National Journals :

1. Widowati, S.M. Nababan, B. Ryanto, R. Saragih, (2006). "Reduced-Order Parameter Varying Controller with Guaranteed Closed-loop Performance", *J. Indones. Math. Soc. (MIHMI)*, Vol.12, No.1, 1-15
2. K. Novianingsih, R. Hadianti, and S. Uttunggadewa, (2006). "Column Generation Technique for Solving Two-Dimensional Cutting Stock Problem: Method of Stripe Approach", *MIHMI*.
3. LH. Wiryanto, (2006). "Zero gravity of a jet emerging from a slit", *J. Indons. Math. Soc (MIHMI)*, Vol. 12, No.1, pp.89-98
4. LH. Wiryanto dan Warsoma Djohan, (2006). "Metoda beda hingga pada persamaan KdV gelombang interface, *Jurnal Matematika*", Vol.9, 117-123
5. Marwan, Toto Nusantara, Andonowati, (2006). "Evolusi Spasial Gelombang Permukaan Multi Arah Berdasarkan Solusi Orde ke Tiga Persamaan KP", *Journal of Indonesian Mathematical Society MIHMI*. 12, no. 2.





Statistics

Statistics is the science of collecting, organizing and interpreting numerical facts called data. Some of those who use statistics are: government (or policy makers in the government); economists; econometricians; financial advisors; policy makers in business; meteorologists; psychologists; politicians; doctors; farmers; teachers; engineers and scientists.

Statistical methods can be used to summarize or describe a collection of data; this is called descriptive statistics. In addition, patterns in the data may be modeled in a way that accounts for randomness and uncertainty in the observations, and then used to draw inferences about the process or population being studied; this is called inferential statistics. Both descriptive and inferential statistics comprise applied statistics. There is also a discipline called mathematical statistics, which concerns with the theoretical basis of the subject.

Prior to 2006, there were five Kelompok Bidang Keahlian at the Mathematics Department, Institut Teknologi Bandung: Algebra, Analysis, Applied Mathematics, Computation and Statistics. In 1998, the Statistics group was in charge in the establishment of the Master's Program in Actuarial Studies at the Mathematics Department. One major contribution of the Statistics group in maintaining political stability and promoting democracy in Indonesia, is when the Statistics group, working together with National Democratic Institute from Carter Centre, USA, was in charge in running the Parallel Vote Tabulation (PVT) program of the Rectors Forum in monitoring the 1999 Indonesian General Election. The 1999 general election was considered the "first democratic general election" in Indonesia.

In 2006, the previous five Kelompok Bidang Keahlian at the Mathematics Department evolved into five research divisions in the Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung. The five research divisions are: Algebra, Analysis and Geometry, Combinatorics, Industrial and Financial Mathematics, and Statistics. Also, in the same year, discussions on the establishment of cooperation between Institut Teknologi Bandung and the Society of Actuaries of Indonesia to conduct actuarial studies education in the S1 Mathematics study program, were intensified in which the Statistics Research Division played a major role. The Memorandum of Understanding between Institut Teknologi Bandung and the Society of Actuaries of Indonesia was signed on 15 April 2008.

Publications

There are 27 publication outputs of Statistics Research Group in the period 2006-2008, which are summarize as follows.

International Journals	: 5
National Journals	: 4
International Proceedings	: 11
National Proceedings	: 5

Research Interest

Members of the Statistics Research Division have divers research interests and always aiming to give significant contributions to the needs in industries; and in other disciplines than statistics and mathematics. Cooperation with Indonesian government, industries, and other universities (national and international) have been established for decades. Members of the Statistics Research Division receive research grants from the Indonesian Ministry of Research and Technology and from Institut Teknologi Bandung.

Currently, one member of the Statistics Research Division is involve in: updating seismic recurrence model; modeling reservoir performance using sequential least squares; carrying out research in interference modeling using Kalman Filter; and analyzing the reliability of teaching performance index.

Another member is more interested in the area of Biostatistics; in particular, in enzyme reaction, process control for vaccine, and ecology. In the last four years, together with other faculty members in Institut Teknologi Bandung, is developing markovian model in Biology Molecular (or Bioinformatics), such as in alignment and phylogenetics.

One member of the research division is more interested in general insurance area. Working closely with the Society of Actuaries of Indonesia, the member involves in the development of actuarial studies education in Institut Teknologi Bandung and in Indonesia. Current research topic is in the estimation of the outstanding claims liability in general insurance; including measuring the sensitivity of the estimation.

Statistical Process Control and Reliability, is one field which is of interest of a member of the research division. In the past two years, the member also involves in projects between Institut Teknologi Bandung and Perusahaan Listrik Negara.

Financial Stochastics, in particular, modeling stock prices using Ito Lemma and modeling volatility, is the area which is of interest of one member of the Statistics Research Division. The member is also interested in developing the area of Financial Time Series, in particular, the estimation and diagnostics of volatility modeling.



Sutawir Darwis (standing, far right); Sumanto (standing, far left); Udjianna Sekteria Pasaribu (sitting down, far righth); Dumaria Rulina Tampubolon (sitting down, far left); and some postgraduate students in Statistics.



SPACE TIME MODELS

VAR(p) $\rightarrow Z(t) = \Phi_1 Z(t-1) + \Phi_2 Z(t-2) - \dots - \Phi_p Z(t-p) + \varepsilon(t)$

STAR(p,1) $\rightarrow Z(t) = \sum_{s=1}^p \phi_{s0} Z(t-s) + \sum_{s=1}^p \phi_{s1} WZ(t-s) + \varepsilon(t)$

STMA(q,1) $\rightarrow Z(t) = \varepsilon(t) - \sum_{s=1}^q \theta_{s0} \varepsilon(t-s) - \sum_{s=1}^q \theta_{s1} W\varepsilon(t-s)$

STARMA(p,q) $\rightarrow Z(t) = \sum_{s=1}^p \sum_{k=0}^k \phi_{sk} W^{(k)} Z(t-s) + \varepsilon(t) - \sum_{s=1}^q \sum_{k=0}^{m_k} \theta_{sk} W^{(k)} \varepsilon(t-s)$

G-STAR $(p, \lambda_1, \lambda_2, \dots, \lambda_p)$ \rightarrow

$$Z_i(t) = \sum_{k=1}^p \sum_{l=0}^{\lambda_k} \phi_{kl}^{(k)} (w_{k1}^{(k)} Z_1(t-s) + w_{k2}^{(k)} Z_2(t-s) + \dots + w_{kM}^{(k)} Z_M(t-s)) + \varepsilon_i(t)$$

Research Group Staffs

Head :

Sutawanir Darwis, Dr.

Members:

Bernadetta Br. Tarigan, M.Si., Dr.

Dumaria Rulina Tampubolon, M.Sc, Dr.

Khreshna Imaddudin Ahmad S, M.Si., Dr.

Sapto Wahyu Indratno, M.Sc.

Sumanto, M.Com.

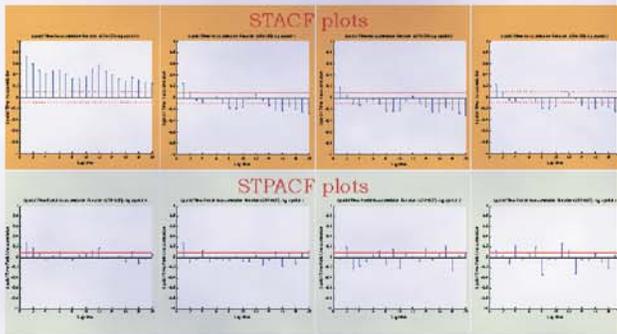
Udjiana Sekteria Pasaribu, Dr.

International journals :

1. Nurtiti Sunusi, Sutawanir Darwis, Wahyu Triyoso, I Wayan Mangku, (2008). "Brownian Passage Time for Earthquake Recurrence", *Far East Journal of Mathematical Sciences*, www.pphmj.com
2. Syuhada K., Kabaila K., (2008). "Improved Prediction Limits for AR(P) and ARCH(P) Processes" *Journal of Time Series Analysis*, Vol. **29**, Issue 2, pp. 213-223
3. Sutawanir Darwis, Ali Ashat, and Isnani, (2007). "Structural Analysis of Geothermal Decline Rate", *Sains Malaysiana* **36**, 2, 207-211
4. Syuhada K., Kabaila P., (2007). "The Relative Efficiency of Prediction Intervals". *Communications in Statistics - Theory and Methods*, Volume **36**, 15, pages 2673 – 2686
5. Bernadetta Tarigan, (2006). "Classifiers of Support Vector Machine Type with l(1) complexity Regulation", *Bernoulli* **12**(6), 1045-1076, Dec 2006, tarigan@stat.math.ethz.ch, geer@stat.math.ethz.ch, Publisher: Int Stat Inst, 428 Princes Beatrixlaan, 2270 AZ Voorburg, Netherlands, ISSN 1350-7265.

National Publications :

1. Sri Wahyuningsih, Sutawanir Darwis, Agus Yodi G, and Asep K Permadi, (2008). "Estimating Hyperbolic Decline Curves", *Jurnal Matematika dan Sains (in press)*.
2. Sutawanir Darwis, and Kuslan, (2008). "On Estimating the Transition Probabilities", *J Matematika dan Sains (in press)*.



3. Nurhayati, N., Pasaribu, U. S., Sutawanir Darwis., and Neswan, O., (to be published), Spectrum GSTAR(1;1), *Jurnal Matematika dan Sains*.
4. Pasaribu, U. S., and Susanto, B., (2006). " On Asymptotic Normality of L^2 Estimators", *Journal of the Indonesian Mathematical Society*, Vol. **12**, No. 2, 169-174.

GSTAR(1₁) MODEL

General form: $Z_i(t) = \varphi_{0i} Z_i(t-1) + \varphi_{1i} \sum_{j=1}^M w_{ij} Z_j(t-1) + e_i(t)$

In matrix notation: $\vec{Z} = X\beta + \varepsilon \Rightarrow$ GSTAR(1₁) model stationarity

Linier model structure: \Rightarrow

$$\text{eig}(\Phi_0 + \Phi_1 W) < 1$$

$Z(t) = (\Phi_0 + \Phi_1 W)Z(t-1) + e(t) \Rightarrow$ Parameter consistency



Physics

Physics

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The Foundation in The Development of Science and Technology



Physics

Physics is a foundation in the development of science and technology. It provides the understanding of physical phenomenon and its possible applications to improve the quality of human life. Physics Study Program educates students to be graduates who have strong basic knowledge in physics; able to adapt and to compete in the global era; creative problem solver; and have attitudes of scientists.

Undergraduate Program

The outcome of the program is graduates in physics who are able to work in variety fields, including non-physics fields. Courses offered by Physics Study Program consist of compulsory courses and elective courses. Compulsory courses are fundamental physics courses given to students as tools to observe, analyze, and describe the physical states and their interactions. In the upper level, students are offered advanced physics courses and elective courses in several fields of study, such as: Theoretical Physics; Physics of Electronic Material; Physics of Magnetic and Photonic; Earth Physics, Computational Physics; Nuclear and Reactor Physics; Biophysics and Medical Physics; and Instrumentation Physics. Physics fundamental courses and specialized courses are offered to students at sufficient level to continue their study to a higher educational program (Master or PhD Program). In addition, students are equipped with transferable skills, such as mastery of foreign language, communication and information technology and entrepreneurship. Opportunity to exercise and to practice the student independence and their skill development in research are widely opened through independent study course, internship and a final research project. Career of graduates in physics are spanned over a wide range of fields, including education, industry (mining, banking, electronics, information and communication technology), as well as research and development professionals in public and private sectors.

Master Program

- Master Program in Physics is continuing program of Undergraduate in Physics which is integrally implemented.
- Objective: to produce graduates who have knowledge in advance physics and able to accomplish research.
- Students may choose one out of five research divisions to self-improve their expertise: High Energy Theoretical Physics and Instrumentation; Physics of Electronic Material; Physics of Complex System; Nuclear Physics & Biophysics; Physics of Magnetism and Photonics.
- Research component in Master Program in Physics is one third of total academic activities (12 CU out of 36 CU).
- To enhance the students ability in scientific experience, students are supported to attend scientific forum, such as seminar and conference.

Doctoral Program

- Objective: to produce PhD graduates who acquire/possess excellent academic competence and attitude, have independent research competence, and develop a significant scientific contribution in the field of physics.
- Experienced supervisors are actively engaged in several research projects in the research division.
- Research and supporting facilities dedicated for graduate students are prepared/available in the research division laboratory. Duration of the program is scheduled for 3 maximum years. Physics study program also offer fast track program for certain circumstances.

Alumni

The Department is not particularly directed its alumni to work in particular area. The alumni themselves that choose the job they want based on interest, ability, and opportunity. For those who enjoy education and research, the Physics alumni can choose to have a career in higher education or research institute, for example BATAN and LIPI. For those who love true challenges in industry, they can have their career in instrumentation, telecommunication, mining, petroleum, banking, and any other industry. More than 60% of Physics alumni work in industry (IBM, Astra, Siemens, Satelinod, Pertamina, Schlumberger, Elnusa, IPTN, Lotus, Oracle, Banks, and other companies). Besides that, the Department also provide its alumni with entrepreneurship so that the alumni have the ability to build their own business.





Facilities

Teaching Laboratories:

- Elementary Physics Laboratory
- Advanced Physics Laboratory
- Electronics Laboratory
- Computational Physics Laboratory

Research Laboratories:

- Polymer and Biosensor Laboratory
- X-Ray Diffraction Laboratory
- Theoretical Physics Laboratory
- Laboratory of Nuclear and Reactor Physics
- Biophysics Laboratory
- Rock Physics Laboratory
- Rock Magnetism and Paleomagnetism Laboratory
- Earth Physics Laboratory
- Electromagnetic Induction Laboratory
- Computational Physics Laboratory
- Laboratory of Electronic Material and Devices
- Conjugated Materials and Superconductors (FISMOTS) Laboratory
- Instrumentation Physics Laboratory
- Nanomaterial Laboratory
- Semiconductors and Superconductors Laboratory
- Laboratory of Magnetic and Photonic Materials
- Lab. of Wave Inversion and Fluid Imaging
- Lab. of Optical Devices

Academic Staffs

As of June 2007, the Physics Study Program of ITB has 50 staff members; most of them (48) have doctoral degree. The remaining 2 have master degree holders are currently pursuing doctoral degree either at home or abroad. Their research interests and expertise are grouped into the five research divisions.

Students

Annually students body is around 450 for undergraduate, 50 master, and 40 doctoral

Research Interests

The scopes of Physics for Electronic Material Research Group research activities are growth and characterization of electronic materials, theoretical/numerical studies of electronic material properties, and its application for electronic and optoelectronic devices. Research areas that we are interested in are divided into four major groups that are of amorphous semiconductors, compound semiconductors, superconductors and oxides, and theory and simulations. The study of amorphous semiconductor is focused on the growth and characterization of amorphous silicon and its application to some electronic and optoelectronic devices such as solar cell, thin film transistor for flat panel display, light emitting diode, and color sensor. The a-Si:H, a-SiC:H, a-SiN:H, a-SiGe:H, \square c-Si:H, poly-Si, and CNT (carbon nano-tube) have been resulted in this field. In another field, the study of compound Semiconductor is focused to III-V compound semiconductor and their related materials, such as gallium, nitrate, and antimony based compound semiconductors. These deposited materials have been applied to various electronic devices such as ultraviolet and infrared detectors, gas sensor, laser diode, FET, and MOSFET. It has also been successful grown the quantum-dot GaN type.

Different with two above fields, the study of superconductor and oxides is focused to superconductors, ferroelectric, and pyroelectric materials investigation. Research on superconductor is directed to thin film high critical temperature superconductor, particularly YBCO, NBCO, HgSnBCCO, and their application in electronic devices. The NdCeO₂ material for solid electrolyte fuel cell application has also been studied in this field. While, the study of theoretical and simulation is specialized to investigate the electronic material properties through theoretical analysis using computer simulation and its probability usage to experimental process of electronic devices.

Research Group Staffs

Head:

Khairurrijal, Dr.Eng.

Members:

Ariando, Dr.

Euis Sustini, Dr.

Maman Budiman, Ph.D.

Mikrajuddin Abdullah, Dr.Eng.

Pepen Arifin, Dr.

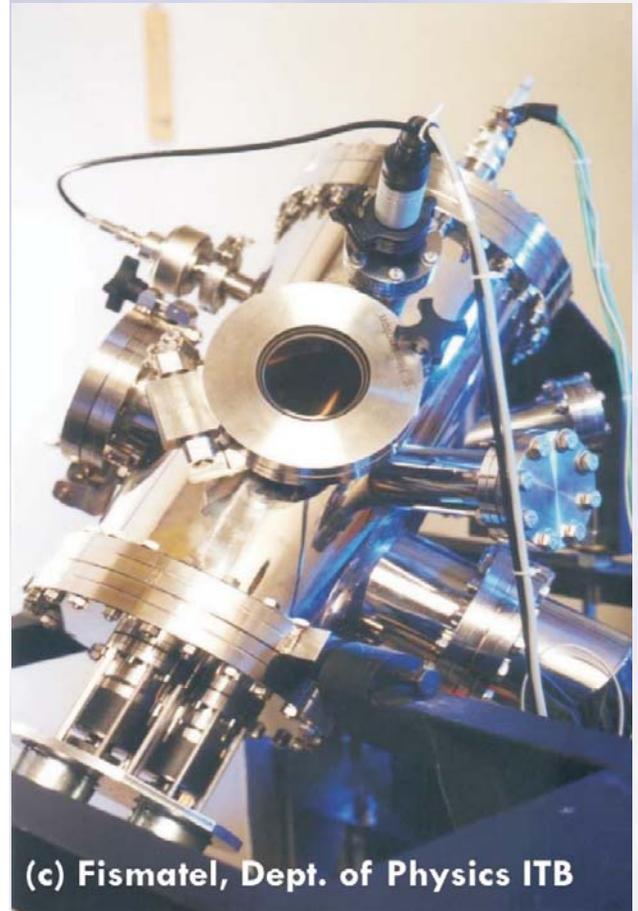
Sukirno, Dr.

Toto Winata, Dr.

Wilson Walery Wenas, Dr. M.Eng.

Yudi Darma, Dr.

M. Barmawi, Prof. (emeritus)



(c) Fismatel, Dept. of Physics ITB





List of Publications

International journals : 5
National journals : 7

International Journals

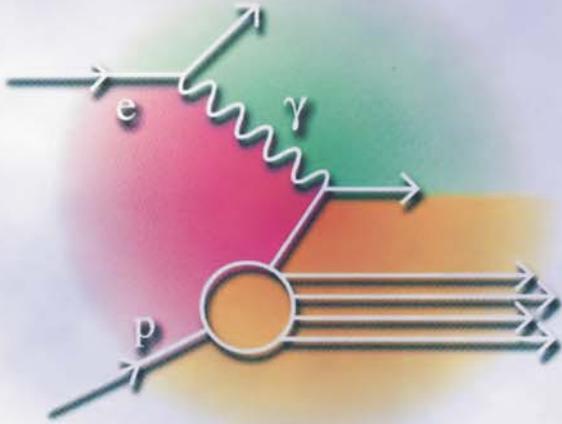
1. Munir, M.M., Iskandar, F., Yun, K.M., Okuyama, K. and Abdullah, M., (2008), "Optical and Electrical Properties of Indium Tin Oxide Nanofibers Prepared by Electrospinning", *Nanotechnology*, **19**, p.145-603.
2. Abdullah, M., Khairurrijal, Abdul Waris, Widayani, Sutrisno, Iis Nurhasanah, and Auniddin S. Vioktamala, (2008), "An Ultraviolet Phospor from Submicrometer-sized Particles of Gadolonium-doped Yttrium Oxide Prepared by a Polymer Heating Process", *Powder Technology*, **183** (2), pp.297-303
3. Maulana, A., Su'ud, Z., Dipoyono. H.K., Khairurrijal, (2008) "Simulation Study of Steels Corrosion Phenomenon in Liquid Lead-Bismuth Cooled Reactors using Molecular Dynamic Methods", *Progress in Nuclear Energy*, **50** (2-6), pp.616-620
4. Rosyidah, A., Onggo, D., Khairurrijal, and Ismunandar (2008), "Atomic Simulations of Aurivillius Oxides: Bi TiNbO , Bi Ti O , BaBi Ti O and Ba Bi Ti O Doped with Pb, Al, Ga, In,Ta", *Journal of Chinese Chemical Society*, **55** (1), pp. 115-120
5. Hasanah, L., Abdullah, M., Sukirno, Winata, T., and Khairurrijal (2008), "Model of Tunneling Current in an Anisotropic Si/Si_{1-x}Gex/Si Heterostructure with Nanometer-thick Barrier Including Effect of Parallel-Perpendicular Kinetic Energy Coupling", *Semiconductor Science and Technology*, **23** (12), pp. 125024-1-125024-6.

National Journals

1. Abdullah, M. and Khairurrijal, (2008), "Sumber Cahaya Putih Struktur LuCoLED Menggunakan Nano dan Submikro Partikel (Y,Gd) Al O yang Didop Cerium dengan Eksitasi Cahaya Biru (LuCoLED-Structure White Source using Cerium-Doped (Y,Gd) Al O Nano-and Submicron Particles by Blue Excitation)", *Jurnal Nanosains & Nanoteknologi*, **1** (2), pp.33-57

2. Abdullah, M., Virgus, Y., Nirmin, and Khairurrijal, (2008), "Review: Sintesis Nanomaterial (Review: Synthesis of Nanomaterials)", *Jurnal Nanosains & Nanoteknologi*, **1** (2), pp.33-57
3. Abdullah, M. dan Khairurrijal, (2008), "Pemanasan Nanopartikel dengan Sintering Rendah (Heating Nanoparticles using Low Temperature Sintering)", *Jurnal Nanosains & Nanoteknologi*, **1** (1), pp.12-14
4. Hadiyawarman, Rijal, A., Bebeh, W., Nuryadin, Abdullah, M., dan Khairurrijal, (2008), "Fabrikasi Material Nanokomposit Superkuat, Ringan, dan Transparan Menggunakan Metode Simple Mixing (Fabrication of Superhard, Light, and Transparent Nanocomposite Materials)", *Jurnal Nanosains & Nanoteknologi*, **1** (1), pp.15-22.
5. Lihierlinah, Sanny, M., Marully, A.R., Abdullah, M. dan Khairurrijal, (2008), "Desain Prototipe Reaktro Steam Reforming Menggunakan Ultrasonik Nebulizer (Designing Prototype of Steam Reforming Menggunakan Ultrasonic Nebulizer)", *Jurnal Nanosains & Nanoteknologi*, **1** (1), pp.23-29
6. Abdullah, M. and Khairurrijal, (2008), "Derivation of Scherrer Relation using an Approach in Basic Physics Course", *Jurnal Nanosains & Nanoteknologi*, **1** (1), pp.30-34
7. Abdullah, M., Khairurrijal, Marully, A.R., Lihierlinah, dan Sanny, M., (2008), "Sintesis dan Pengujian Katalis Nanokristalin Cu/Zn/Al O dengan Metode Pemanasan dalam Larutan Polimer untuk Aplikasi Konversi Metanol Menjadi Hidrogen (Synthesis and Characterization of Cu/Zn/Al O Nanocrystalline Catalyst using Method of Heating Polymer Solution for Application of Methanol Conversion into Hydrogen)", *Jurnal Nanosains & Nanoteknologi*, **1** (1), pp.1-11





Research activities of the Theoretical High Energy Physics and Instrumentation may be grouped into two main streams of research: researches in theoretical aspects of fundamental physics and researches in physical instrumentation. The first research stream concentrates on theoretical high energy physics, the frontier of physics in understanding fundamental nature. The topics considered by members of the group include, among others, quantum field and gauge theory, topological gauge theory, supersymmetry and supergravity, integrable and dynamical systems, and superstring and brane world. The second research stream weighs on the development of sensors and system of instrumentation. This kind of research is very important in many aspects, including supporting research experiments in various research areas. The group develops, among others, sensors, imaging and signal processing, bioinstrumentation and also instrumentation for research and education purposes.

Fields of interest:

Theoretical High Energy Physics : Fock-Schwinger, teleparallel gravity, Chern-Simon Theory, extra dimensional super gravity and superstring; extra dimensional braneworld and super gravity domain walls; braneworld gravity and geometric flow; extra dimensional geometric flow; super gravity on Ricci flow; deformation of M Theory; integrable and dynamical systems.

Instrumentation: Development of new sensors especially high resolution magnetic sensors based on fluxgate and giant magneto resistance (GMR) material, biosensors, smart home, mobile robot, digital signal and image processing, material science computation, instrumentation for education

Research Group Staffs

Head :

Mitra Djamal, Dr.Ing.

Members :

Bobby Eka Gunara, Dr., M.Si., S.Si.

Freddy Permana Zen, Prof., D.Sc.

Hendro, MS,

Jusak Sali Kosasih, Dr.

Soeparno, Dr.Ing.

Suprijadi, Dr.

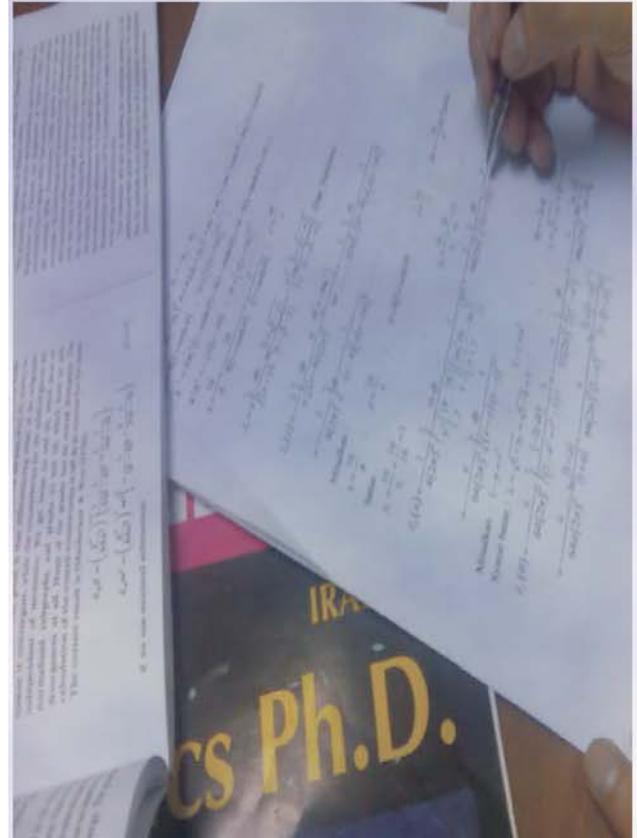
Triyanta, Ph.D.

List of Publications

International journals : 11
National journals : 15

International Journals

1. F.P. Zen, Arianto, B.E. Gunara, Triyanta, A. Purwanto, (2008). "Cosmological Evolution of Interacting Dark Energy in Lorentz Violation" *Journal of Cosmology and Astroparticle Physics*, IOP. (in press).
2. F.P. Zen, A. Y. Wardaya, J.S. Kosasih, Triyanta, (2008). "Tetrahedron Digram and Perturbative Calculation in Chern-Simons-Witten Theory", *Advanced Studies in Theoretical Physics*, Vol. 2, No. 18, (p. 871-901).
3. R. Muhida, M. David, W. A. Diño, Riza Muhida, H. Nakanishi, F.P. Zen, H. Akinaga, H. Kasai, (2008). "First principle calculations-based cluster model for the reactive ion etching (RIE) of interaction between FeNi₄ cluster and CO gases", *International Journal of Science Engineering and Technology*. (in press).
4. Arianto, F.P. Zen, Triyanta, B.E. Gunara, (2008). "Attractor Solutions in Lorentz Violating Scalar-Vector-Tensor Theory", *Physical Review D*, Vol. 77, No. 12, 123517-1
5. B.E. Gunara, F.P. Zen, (2008). "Deformation of Curved BPS Domain Walls and Supersymmetric Flows on 2d Kahler-Ricci Soliton", *Communication in Mathematical Physics*, Springer Verlag. (in press).
6. B.E. Gunara, F.P. Zen, (2008). "Kahler-Ricci Flow, Morse Theory and Vacuum Structure Deformation of N=1 Supersymmetry in Four Dimension", *Advanced in Theoretical and Mathematical Physics* 13, Springer Verlag
7. T. Saito, B.E. Gunara, H. Yamamoto, F.P. Zen, (2008). "Astrophysical Condition on the Attolensing for a Possible Probe of a Modified Gravity Theory", *International Journal of Modern Physics A*, Vol. 23, No. 1, 167-179.
8. Arianto, F.P. Zen, B.E. Gunara, Triyanta, Supardi, (2007). "Some Impacts of Lorentz Violation on Cosmology", *Journal of High Energy Physics*, IOP Institute of Physics, JHEP 09 (2007) 048.
9. B.E. Gunara, F.P. Zen, Arianto, (2007). "BPS Domain Wall and Vacuum Structure of N=1 Supergravity Coupled to a Chiral Multiplet", *Journal of Mathematical Physics*, 48, p. 053505.
10. H. Zainuddin, A. Bouketir, A.A. M. Siddiq, F.P. Zen, N. Mohd Shah, (2007). "Group Theoretic Quantization on Triply-Punctured Two-Sphere", *Jurnal Fizik, Universiti Putra Malaysia*, (in press)





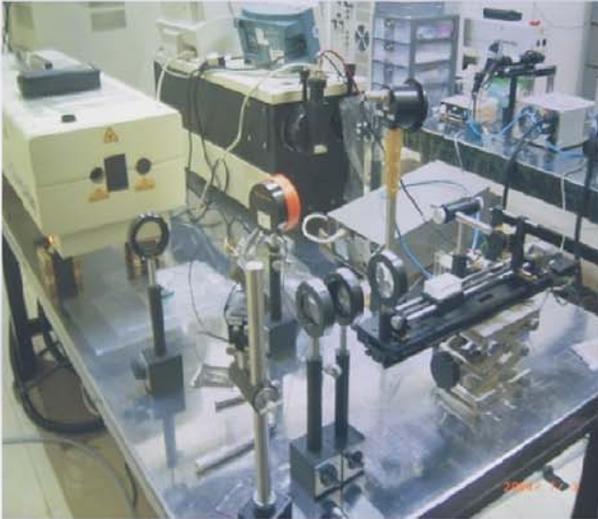
11. Mitra Djamal, Darsikin, Togar Saragih, M. Barmawi, (2006). "Design and Development of Magnetic Sensors based on Giant Magnetoresistance (GMR) Materials", *Functional Materials and Devices*, Trans Tech Publication Ltd, Swiss

National Journals

1. A. Y. Wardaya, F. P. Zen, J.S. Kosasih, Triyanta, (2008). "Perturbative and Non-Perturbative Aspects of Chern-Simons-Witten Theory", *Indonesian Journal of Physics*, Vol. **19**, No. 1,.
2. Haryanto M. Siahaan, and Triyanta, (2008). "On the Napsuciale-Kirchbach Formalism for Spin 3/2 Field Theory", *IJP* **19**(2)
3. Hendro, Wirawan, Mitra Djamal, Rahmat Hidayat, (2008). "Development of Visible Light Absorption Measurement for Concentrated Dye Solution based on Attenuated Total Reflection Technique and Improvement on its Analysis Method", *Indonesian Journal of Physics*, Vol. **19** No. 2
4. Mitra Djamal, (2007). "Sensor magnetik fluxgate dan aplikasinya untuk mengukur kuat arus", *Jurnal Sains & Teknologi Nuklir*, Vol. **VIII**, No. 1, 51-67
5. Harri Sapto Wijaya, Mitra Djamal, (2007). "Simulation of Mobile Robot Navigation System Using Combination Method of A* Algorithm with Virtual Force Field", *Indonesian Journal of Physics*, Vol. **18** No. 1
6. Yulkifli, Rahmondia N. S., Mitra Djamal, Khairurrijal, Deddy Kurniadi, (2007). "The Influence of FerromAGNETIC Core, Pick-up Coil Winding Number and Enviromental Temperature to the Output Signal of a Fluxgate Magnetic Sensor", *Indonesian Journal of Physics*, Vol. 18 No. 3
7. Mitra Djamal, Suyatno, Yulkifli dan Rahmondia N. Setiadi, (2007). "Sensor Magnetik Fluxgate Karakteristik dan Aplikasinya", *Jurnal Materi Indonesia*, 207-214, ISSN : 1411-1098 Akreditasi No. : 39/DIKTI/Kep/2004

8. Yulkifli, Rahmondia N. S., Suyatno, Mitra Djamal, (2007). "Linieritas Tegangan Keluaran Sensor Magnetik Fluxgate Menggunakan Elemen Sensor Multi Core", *Jurnal Materi Indonesia*, Edisi khusus, 215-219, ISSN : 1411-1098 Akreditasi No. : 39/DIKTI/Kep/2004
9. Suprijadi, R. Maula and H. Saka, (2007). "Observation of micro crack propagation in a thin materia", *Indonesian Journal of Physics*, Vol. **18** No. 2
10. F.P. Zen, B.E. Gunara, Arianto, S. Feranie, (2006). "S-Brane Solution with Accelerating Cosmology in M-Theory", *Journal of Mathematics and Sciences*, Vol. **11**, No. 1
11. F.P. Zen, Arianto, B.E. Gunara, H. Zainuddin, (2006). "The Effective Equation of Motion on the Brane World Gravity", *Proc. ITB on Science and Technology*, Vol. **38 A**, No. 1
12. Irwandi and Triyanta, "Multiplet Mass Spectra of the $SU(3)$ Skyrme Model with Color Symmetry Breaking and the Guadagnini terms", *IJP* **17**(1)
13. Mitra Djamal, "Design and Development of Fluxgate Magnetometer and Its Applicacations", *IJP*, Vol. **17** No. 1, 7-14.
14. Mitra Djamal, (2006). "Sensor Modeling of a Vibration Sensor", *IJP*, Vol. 17 No. 4, 103-107.
15. M. Djamal, R. N. Setiadi, (2006). "Pengukuran Medan Magnet Lemah Menggunakan Sensor Magnetik Fluxgate dengan Satu Koil Pick-Up", *PROC. ITB Sains & Tek.* Vol **38 A**, No. 2, 99-115





Researches in photonic material and technology are focused on the development of photonic and nonlinear optical materials, waveguide based optical periodic systems, light emitting sources for applications in telecommunication/information technology as well as optical sensors. Meanwhile, researches in magnetic materials and technology are focused on the development of superconductors, dilute magnetic semiconductors (DMS), transition metal oxides for applications in frictionless magnetic bearing, superconducting magnetic energy storage (SMES), fault current limiter, spintronics and thermoelectric power source. Our research is intertwined between theories, experiments and modeling by emphasizing analyses of experimental results based on theoretical model as well as computational and simulation results.

Our vision and mission

Our vision is geared to the institutional (ITB) vision of achieving a research based university in response to growing global competition in all aspects, particularly in science and technology. We are thus committed to the contribution of new knowledge in science and technology needed for the support of short-term and long-term development of national resilience and industrial as well as economic prowess. The strong research competence will also assure the production of high quality graduates ready to cope with the growing demand of the job markets.

In compliance with the vision described above, our group has taken upon itself the mission of developing a consistent and eventually self-sustaining research activities as well as an R and D basis of the highest international standard. In view of the existing lacks of infrastructure and financial supports, we are vigorously engage in the pursuit of international networking and research collaborations with reputable research institutes world wide.

On-Going and Planned Research :

- Polymer LED and optical amplifiers
- Current limiter superconductor
- UV curable photonic device fabrication
- Spin controlled thermoelectric power
- Photonic crystals for WDM and optical sensing applications
- Multiferroic (Ferroelectric and ferromagnetic)
- Nonlinear Waveguide
- Study of Nonlinear Optical Properties of Vapor deposited film of DR1
- Band structure calculation for dilute magnetic semiconductor
Ferromagnetic semiconductor

Research Group Staffs :

Head :

Herman, Dr.

Members :

Agoes Soehianie, Dr.

Agustinus Agung Nugroho Sulisty Hutomo, Dr.

Alexander Agustinus P. Iskandar, Ph.D.

Aloysius Rusli, Dr.

Andrivo Rusydi, Dr.

Daniel Kurnia, Dr.

Inge Magdalena Sutjahja, Dr.

Rachmat Hidayat, Ph.D.



List of Publications

International journals : 14

National Journals : 2

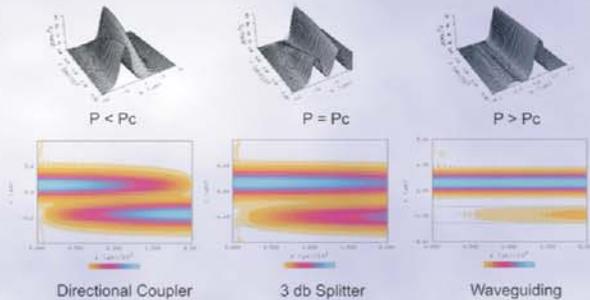
International Proceedings : 3

International Journals

1. A.A. Iskandar, W. Yonan, M. O. Tjia, I. vande Voordeand E. van Groesen, (2007). "Effective Medium Formulation for Band Structure Design of a Finite 1D Optical Grating", *Jap. Journ. of Appl. Phys.* **46**. 187.
2. R. Hidayat, O. Sugihara, M. Tsuchimori, M. Kagami, T. Nishikubo, and T. Kaino, (2007). "Binding of Europium Complex to Polymerizable Macrocyclic Molecules and its Optical Properties", *Optical Materials*. Vol. **29** p. 1367-1374
3. U. Adem, A. A. Nugroho, A. Meetsma, and T. T. M. Palstra, (2007). "Ferroelectric displacements in multiferroic $Y(\text{Mn,Ga})\text{O}_3$ ", *Phys. Rev.* B75 014108.
4. M. Corti, F. Carbone, M. Filibian, Th. Jarlborg, A. A. Nugroho, and P. Carretta, (2007). "Spin dynamics in a weakly itinerant magnet from 29Si NMR in MnSi ", *Phys. Rev.* B75 **115111**.
5. A. A. Nugroho, N. Bellido, U. Adem, G. Nénert, Ch. Simon, M. O. Tjia, M. ostovoy, and T. T. M. Palstra, (2007). "Enhancing the magnet electric coupling in YMnO_3 by Ga", *Phys. Rev. B* **75**, 174435



Modeling and Simulations

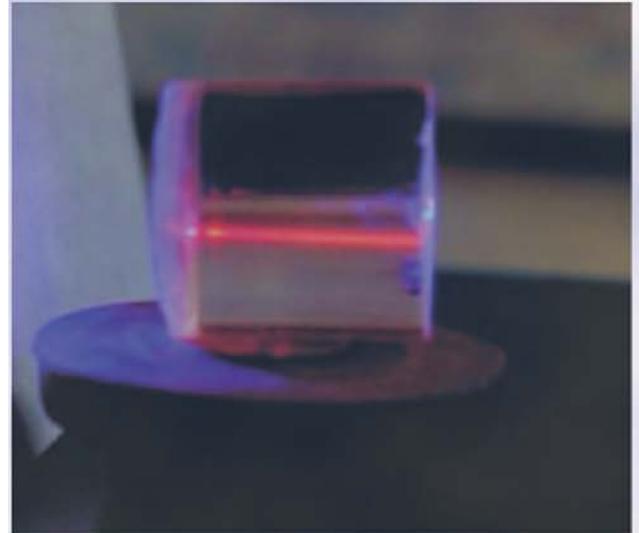


Optically Controlled Waveguide Coupler

6. M. Sikora, C. Marquina, M.R. Ibarra, A. A. Nugroho, T.T.M. Palstra, (2007) "Lattice effects in HoVO_3 single crystal", *Journal of Magnetism and Magnetic Materials*, **316** e692-e694 .
7. S Riyadi, Muafif, A A Nugroho, A Rusydi and M O Tjia, (2007). "Mndopant-induced effects in $\text{Zn}_{1-x}\text{Mn}_x\text{O}$ compounds", *Journal of Physics: Condensed Matter* **19** 476214.
8. R. Hidayat, O. Sugihara, M. Tsuchimori, M. Kagami, T. Nishikubo, and T. Kaino, (2007). "Binding of Europium Complex to Polymerizable Macrocyclic Molecules and its Optical Properties", *Optical Materials*, Vol. **29** p. 1367-1374
9. A.A. Iskandar, W. Yonan, M.O. Tjia, I. van de Voorde and E. van Groesen, (2007). "Effective Medium Formulation for Band Structure Design of a Finite 1D Optical Grating", *Jap. Journ.of Appl. Phys.* **46** . 187
10. F.Carbone,M.Zangrando,H. J.A.Molegraaf, A.A.Nugroho,T.T. M. Palstra, F. Parmigiani, D. can der Marel, (2006). "Experimental evidence for localized high spin ground state in MnSi ", *Phys.Rev.***B73**,085114.
11. Daniele Fausti, Agung Nugroho, Paul H.M. van Loosdrecht, Sergei A. Klimin, Marina N. Popova, Leonard N. Bezmaternykh, (2006). "Raman Scattering from phonon and magnons in $\text{RFe}_3(\text{BO}_3)_4$ ", *Phys. Rev. B* **74**, 024403.
12. H. Alatas, A.A. Iskandar and M.O. Tjia, (2006). "Lowest-Intensity Optical Bistability Characteristics of a Deep Nonlinear Bragg Grating", *J.of Nonlin. Opt. Phys. And Mat.* **15**.345.
13. H. Alatas, H.Mayditia, H. Hardhienata, A. A. Iskandar, M. O. Tjia, (2006). "Analysis of Finite One Dimensional Asymmetric Photonic Crystals with Two Defects for Sensor Applications", *Jap. Journ. Of Appl. Phys.* **45** .6754.
14. H. Alatas, A.A. Iskandar, M.O. Tjia and T.P. Valkering, (2006). "Rational Solitons in Deep Nonlinear Bragg Gratings", *Phys. Rev.* **E73** .066606.

National Journals

1. Hendro, Wirawan, R. Hidayat and M. Djamal, (2008). "Development of Visible Light Absorption Measurement for Concentrated Dye Solution based on ATR Technique and Improvement on its Analysis Method", *Indonesian Journal of Physics*, Vol. **19** No. 2.
2. Wirawan dan Rahmat Hidayat, (2006). "Studi Awal Pengembangan Modul ATR-Inframerah untuk Pengukuran In-Situ Polutan Bahan Organik", *Jurnal Teknik Lingkungan Edisi Khusus*





Research agenda in nuclear reactors field includes nuclear reactors/ power plant design and safety analysis especially for the fourth generation of nuclear power plant which have some advantages such as inherent safety capability, fuel breeding capability, economical, able to burn their own wastes, and non-proliferation features. The detail analysis includes neutronic analysis (solving of neutron transport/diffusion problems, burnup analysis, fuel cycle analysis, and radiation protection analysis), thermal hydraulic (multi channel core thermal hydraulic analysis, steam generator analysis, etc), and safety analysis which is combination of transient neutronic and thermal hydraulic analysis. In order to participate in the Nuclear power plant era in Indonesia we develop research topics with wide overlap area with current LWR nuclear power plant technology.

Research agenda in biophysics is directed to study advanced physical mechanisms in biosystems (molecules, cells, organs). It includes the fields of molecular biophysics, membrane biophysics and radiation biophysics and medical physics. In molecular biophysics, research is carried out to study structure-function relationships, the basic principles of biochemical reaction happened in many biosystems. Current research in this field is focused on bioluminescence and biosensor. In membrane biophysics, research is carried out to study transport phenomenon, the basics principle of regulation system and physical measurements in biosystems.

Fields of interest:

Research in nuclear reactors field includes nuclear reactors/ power plant design and safety analysis especially for the fourth generation of nuclear power plant which has some advantages such as inherent safety capability, fuel breeding capability, economical, able to burn their own wastes, and non-proliferation features. Research in biophysics is directed to study advanced physical mechanisms in biosystems (molecules, cells, organs) including molecular biophysics, membrane biophysics and radiation biophysics and medical physics.

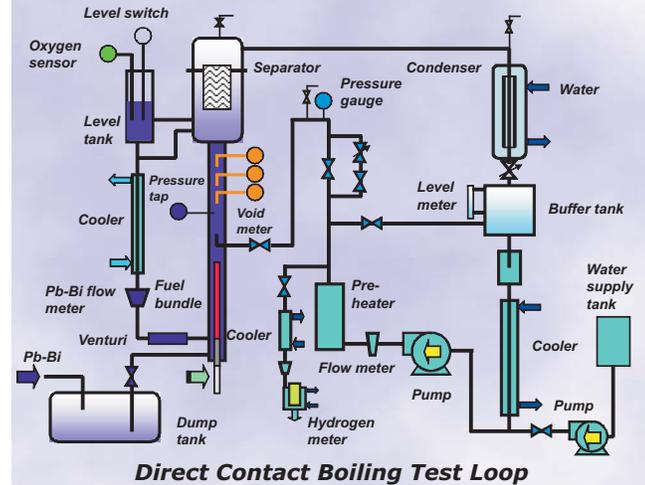
Research Group Staffs

Head:

Zaki Su'ud, Dr.

Members :

Abdul Waris, Ph.D.
 Freddy Haryanto, Dr.
 Idam Arif, Dr.
 Khairul Basar, Dr.
 Novitrian, M.Si., Dr.
 Rena Widita, Dr.
 Rizal Kurniadi, Dr.
 Siti Nurul Khotimah, Dr.
 Sparisoma Viridi, Dr.
 Widayani, Dr.

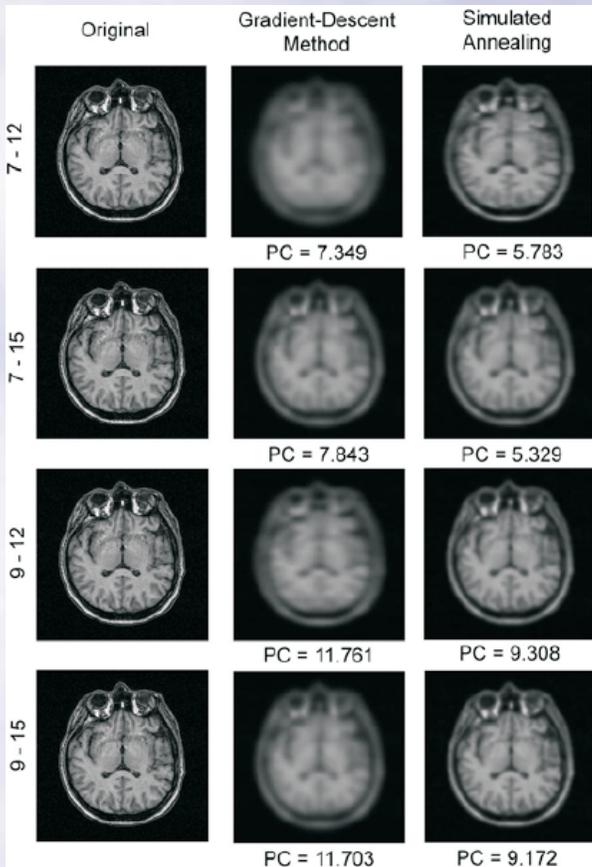


List of Publications

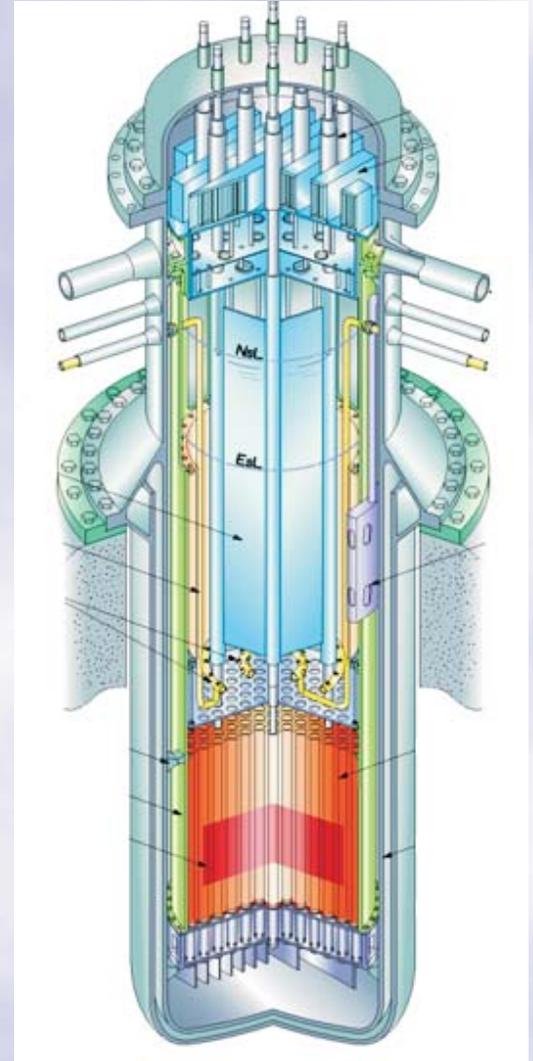
International journals : 18
 National journals : 11

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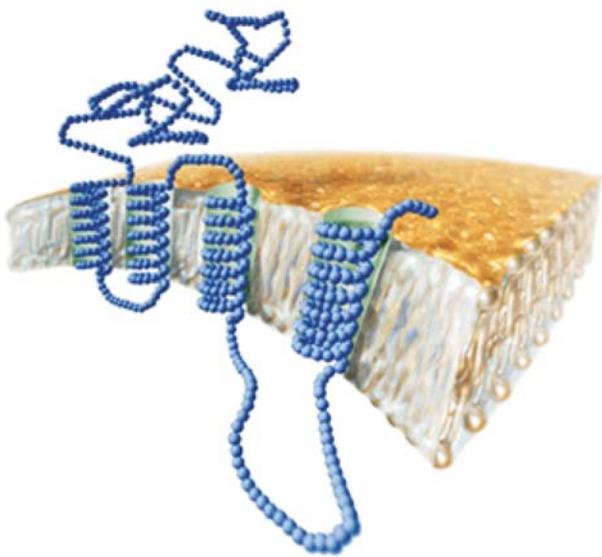
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 17. Takashi Sakuma, Xianglian, Khairul Basar, (2007). "Structure and Diffuse Scattering of Superionic Conductor CuI ", in *Diffusion and Reactivity in Solids* (Ed.: James Y. Murdoch), *Nova Science Publishers*. 209-226,ISBN:978-1-60021-890-3.
 18. Takashi Sakuma, Khairul Basar, Tomotaka Shimoyama, Daiki Hosaka, Xianglianand MasajiArai, (2006). "Static and Dynamic Structure in Solid State Ionics", in *Physics of Solid State Ionics* (Eds: T. SakumaandH. Takahashi), Research Signpost. 323-346.

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Physics of complex systems focuses on the study of natural phenomena related to the complex systems by means of physical concepts. Those concepts are then used to understand the systems. Study of complex systems includes development of concepts and methodology to conduct observation, processing, modeling, and interpretation of its response functions and also their applications to improve human welfare. Research topics include natural resources, environmental problems and disasters, properties of materials, image processing and noise analysis, as well as computer intelligence, chaos and fractals. Expertise on computational and instrumentation are also interests of our groups. Staff member of our group have expertise and interest in various fields, such as seismology, magnetisms electromagnetisms, rock physics, physics of volcanic processes and natural hazards, geo-technique and environmental and exploration geophysics.

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To be a world-class research group in the physics of complex system that has significant role in the study of natural phenomena.

Mission:

- Growing (fostering) and developing expertise in the field of the physics of complex systems through research and scientific tradition.
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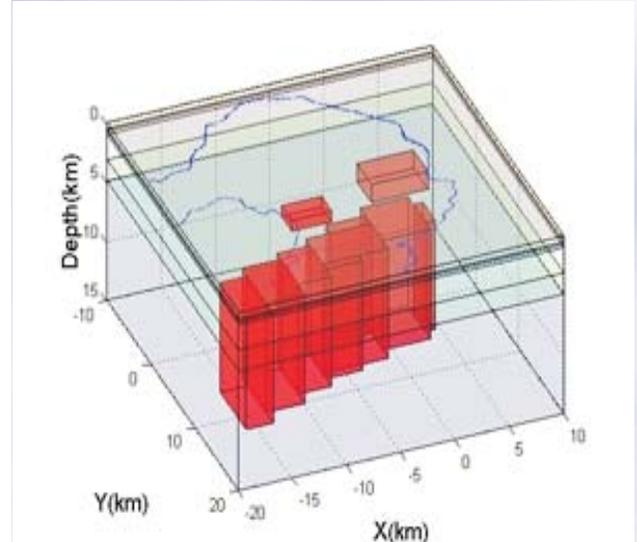
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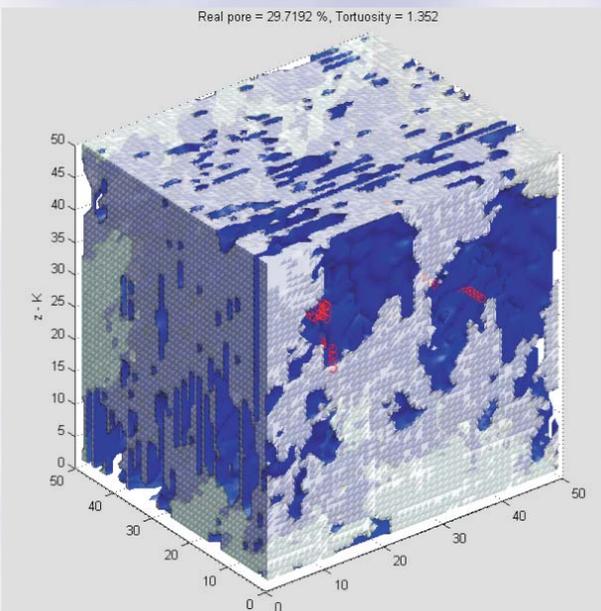
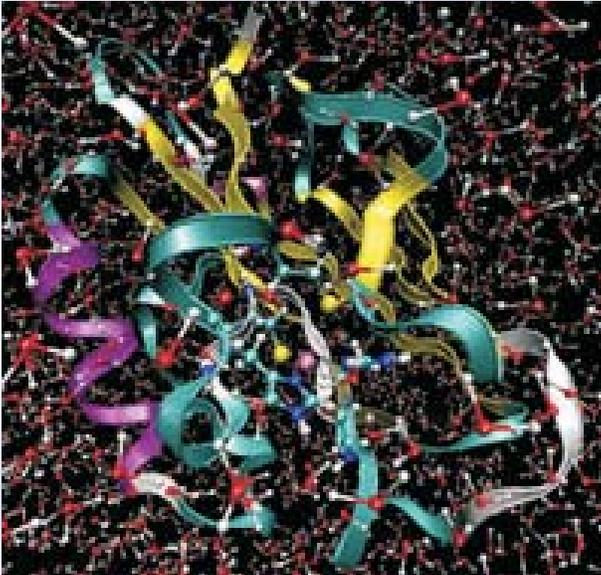
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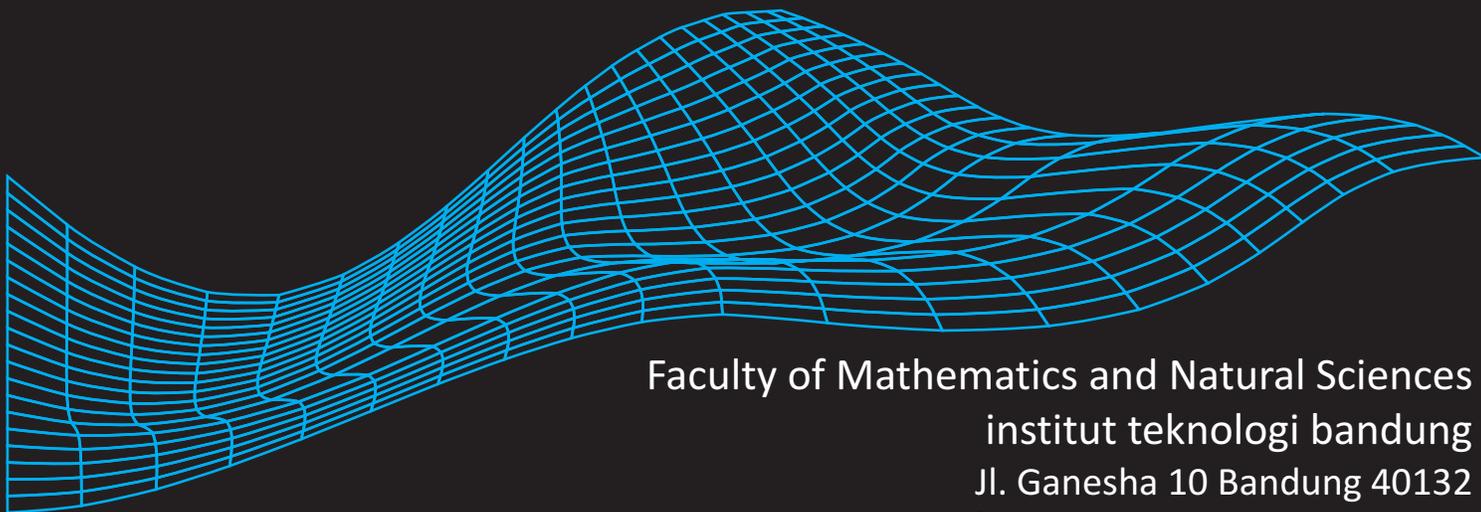
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National journals : 1

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3. Bijaksana, S., Puradimaja, D. J., (2008). "Quality Policy as a Manifestation of Strategic Plan at Bandung Institute of Technology, Indonesia", *Journal of Technology Management*.
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