



CERTIFICATE

Awarded to

PRANOWO

As

Presenter

Who presented the academic manuscript entitled

“Parallel Natural Convection Simulation on GPU Using Lattice Boltzmann Method“

In

**The 5th Indonesia Japan Joint Scientific Symposium (IJSS 2012)
on 25-26 October 2012 at Chiba University, Japan.**

Chiba, 26 October 2012

The IJSS 2012 General Chairman



Prof. Koichi Ito

INDONESIA-JAPAN JOINT SCIENTIFIC SYMPOSIUM IJSS 2012

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October 25-26, 2012
Chiba University
Japan

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Indonesia-Japan Joint Scientific Symposium

**October 25–26, 2012
Chiba University, Japan**

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Indonesia-Japan Joint Scientific Symposium

October 25–26, 2012
Chiba University, Japan

IJJSS 2012 SPONSORS



IJSS 2012 SESSIONS



RS	REMOTE SENSING
UE	URBAN ENVIRONMENT
MP	MEDICINE AND PHARMACY
EC	ENVIRONMENTAL CHEMISTRY
AG	AGRICULTURE
HT	HORTICULTURE
ME	MICROELECTRONICS AND ELECTRONIC DEVICE
EP	ENERGY AND POWER SYSTEM
PH	PHYSICS
CI	COMPUTER AND INFORMATION
AM	ANTENNA, MICROWAVE AND MOBILE COMMUNICATION
MM	MECHANICAL, METALLURGY AND MATERIALS ENGINEERING
ES	ENVIRONMENTAL SCIENCE
IP	IMAGE, OPTICAL COMMUNICATION AND SIGNAL PROCESSING
P	POSTER

The 5th Indonesia Japan Joint Scientific Symposium (IJSS) 2012

Nishichiba Campus, Chiba University, JAPAN

25 - 26 OCTOBER 2012

FINAL PROGRAM

25 OCTOBER 2012 (THU)				26 OCTOBER 2012 (FRI)		
International Exchange Center (IEC) Office opening ceremony (08:30-11:30) Place : KEYAKI KAIKAN 3rd FLOOR				ROOM A	ROOM B	ROOM C
				IJSS 2012 REGISTRATION (08:30-09:00) PLACE : ACADEMIC LINK, CHIBA UNIVERSITY LIBRARY		
				MICROELECTRONIC AND ELECTRONIC DEVICE (09:00-09:50)	ENERGY AND POWER SYSTEM (09:00-10:05)	COMPUTER AND INFORMATION 1 (09:00-10:05)
IJSSS 2012 REGISTRATION (11:00-11:30) PLACE : LECTURE HALL, FACULTY OF EDUCATION				Break (15 minutes)	Break (15 minutes)	Break (15 minutes)
IJSS 2012 OPENING CEREMONY (11:15-12:00) PLACE : LECTURE HALL, FACULTY OF EDUCATION				AGRICULTURE 2 (10:05-11:25)	PHYSICS (10:20-11:25)	COMPUTER AND INFORMATION 2 (10:20-11:25)
LUNCH TIME						
IJSSS 2012 REGISTRATION (13:45-14:45) PLACE : ACADEMIC LINK, CHIBA UNIVERSITY LIBRARY				IJSS 2012 REGISTRATION (13:00-14:00) PLACE : ACADEMIC LINK, CHIBA UNIVERSITY LIBRARY		
ROOM A	ROOM B	ROOM C	ROOM D	ROOM A	ROOM B	ROOM C
REMOTE SENSING 1 (13:45-15:05)	URBAN ENVIRONMENT 1 (13:45-15:05)	MEDICINE AND PHARMACY (13:45-14:50)	AGRICULTURE 1 (13:45-14:50)	ANTENNA, MICROWAVE & MOBILE COMMUNICATION 1 (13:00-14:20)	ENVIRONMENTAL SCIENCE 1 (13:00-15:20)	IMAGE, OPTICAL COMMUNICATION AND SIGNAL PROC. (13:00-14:05)
Break (15 minutes)	Break (15 minutes)	Break (15 minutes)	Break (15 minutes)	Break (15 minutes)	Break (15 minutes)	Break (15 minutes)
REMOTE SENSING 2 (15:20-16:25)	URBAN ENVIRONMENT 2 (15:20-16:25)	ENVIRONMENTAL CHEMISTRY (15:05 -17:10)	HOLTICULTURE (15:05-15:55)	MECHANICAL, METALLURGY AND MATERIALS ENG. (14:35-16:25)	ANTENNA, MICROWAVE & MOBILE COMMUNICATION 2 (15:35-16:40)	ENVIRONMENTAL SCIENCE 2 (14:20-16:40)
POSTER SESSION (17:00-18:00) Center for Environmental Remote Sensing (CEReS) 1st Floor				BANQUET (18:00-19:00) Colza, Keyaki Kaikan Hall 1st Floor		

ROOM A : MULTIMEDIA ROOM - JINBUN SHAKAI KEI BUILDING 2nd FLOOR
 ROOM B : ACADEMIC LINK 1 Floor - CHIBA UNIVERSITY LIBRARY
 ROOM C : ACADEMIC LINK 3 Floor - CHIBA UNIVERSITY LIBRARY
 ROOM D : ROOM 102 - Center for Environmental Remote Sensing (CEReS) BUILDING 1st FLOOR

THURSDAY, 25 October 2012 (13:45 - 17:00)
ORAL SESSION

ID	Time (Duration)	TITLE	AUTHORS
ROOM A			
REMOTE SENSING 1			
Chair : TBD			
RS01 (Invited)	13:45-14:05 (20 min)	Assessment of fully polarimetric POLSAR Remote Sensing & Geophysical Stress-change Monitoring for implementing Equatorially Orbiting Satellites over Indonesia	Wolfgang-Martin Boerner, Jorge Javier Morisaki
RS02	14:05-14:20 (15 min)	Development of Synthetic Aperture Radar onboard Unmanned Aerial Vehicle	Josaphat Tetuko Sri Sumantyo
RS03	14:20-14:35 (15 min)	Remote Sensing and GIS Technology for Investigating Land Subsidence Impact in Demak Coastal Area-Indonesia	Andung Bayu Sekaranom, Fitria Nucifera, Muh Aris Marfai
RS04	14:35-14:50 (15 min)	IDENTIFYING VOLCANIC ROCKS USING GEOMORPHOLOGIC AND STRUCTURAL FEATURES OF POLARIMETRIC SAR DATA	Asep Saepuloh, Asep Saepuloh, Minoru Urai, Luhur Bayuaji, Prihadi Sumintadireja, Emmy Suparka
RS05	14:50-15:05 (15 min)	PLANIMETRIC ACCURACY ASSESSMENT OF HIGH RESOLUTION IMAGE BY GOOGLE EARTH FOR BASE MAP AT SCALE 1:100000 THE DISTRICT OF EAST BANJAR, BANJARMASIN CITY	Noorlaila Hayati, Muhammad Taufik
Break (15 Minutes)			
REMOTE SENSING 2			
Chair : TBD			
RS06 (Invited)	15:20-15:40 (20 min)	ACTIVE AND PASSIVE REMOTE SENSING APPROACHES FOR THE CHARACTERIZATION OF OPTICAL PROPERTIES OF THE ATMOSPHERE	Hiroaki Kuze
RS07	15:40-15:55 (15 min)	LANDSLIDE POTENTIAL ANALYSIS USING MODIS LAI/FPAR PRODUCT DATA. CASE STUDY: EASTERN INDONESIA	Dodi Sudiana, Endriadi Rukmana
RS08	15:55-16:10 (15 min)	PREDICTION OF GEOTHERMAL MANIFESTATIONS AREA USING ASTER IMAGERY IN NORTH SUKABUMI, WEST JAVA, INDONESIA	Ibni Sabil A. Z. M., Fidelis Awig Atmoko, Miqdad Anwarie, Wido Cepaka Warih
RS09	16:10-16:25 (15 min)	CHANGES PATTERN OF SPACE UTILIZATION FOR URBAN HEAT ISLAND PHENOMENA PREDICTION (CASE STUDY IN TANGERANG MUNICIPALITY)	Adi Wibowo, Iqbal Putut Ash Sidiq, Andry Rustanto

ROOM B			
URBAN ENVIRONMENT 1			
Chair : TBD			
UE01 (Invited)	13:45-14:05 (20 min)	APPROPRIATE TECHNOLOGIES FOR REGIONAL DEVELOPMENT	Mitsuteru Irie
UE02	14:05-14:20 (15 min)	Design Learning Through Participatory Method on Improvement Sanitation Facility Project in Cikini Kramat Area, Central Jakarta	Achmad Hery Fuad , Joko Adianto
UE03	14:20-14:35 (15 min)	THREE BUILT ENVIRONMENT SCENARIOS FOR THE FUTURE OF HIGH DENSITY KAMPUNG IN CENTRAL JAKARTA IN CONTEXT OF STRATEGIC APPROACH TO MANAGE MEGACITIES PRAGMATICALLY	Yuki Yoshikata, Ou ueno, Tomohiro Amemiya, Akiko Okabe
UE04	14:35-14:50 (15 min)	Scoring Urban Spaces in an Indonesian City Based on Biodiversity	Hari Iswoyo, Brenda Vale, Martin Bryant
UE05	14:50-15:05 (15 min)	QUESTIONNAIRE SURVEY BASED EARTHQUAKE DAMAGE ESTIMATION IN KATHMANDU VALLEY OF NEPAL	Pralhad Uprety, N. P. Bhandary, R. Yatabe
Break (15 Minutes)			
URBAN ENVIRONMENT 2			
Chair : TBD			
UE06 (Invited)	15:20-15:40 (20 min)	GIS BASED EVACUATION PLANNING FOR EARTHQUAKE PREPAREDNESS IN KATHMANDU, NEPAL	Pralhad Uprety, N. P. Bhandary, R. Yatabe

UE07	15:40-15:55 (15 min)	DENGUE HAEMORRHAGIC FEVER (DHF) AND ENVIRONMENTAL CHARACTERISTIC CASE STUDY: DHF IN YOGYAKARTA, INDONESIA)	Fitria Nucifera, Andung Bayu Sekaranom, Emilya Nurjani
UE08	15:55-16:10 (15 min)	SHAPE EFFECTS OF SHALLOW FOUNDATION REINFORCED WITH BUIS CONCRETE ON SETTLEMENT DUE TO STATIC AND DYNAMIC LOADING (MODELING AT LABORATORY)	Ria Asih Aryani Soemitro, Trihanyndio Rendy Satrya, Dwa Desa Warnana, Kumara Bagus Raditya W, Muh. Ferdi Darwis, Marlini
UE09	16:10-16:25 (15 min)	ASSESSMENT STUDY OF DRYING-WETTING CYCLE ON DYNAMIC PROPERTY OF UNSATURATED EXPANSIVE CLAY SOIL STABILISED BY FLY ASH MATERIAL USING BENDER ELEMENT APPARATUS	Trihanyndio Rendy Satrya, Ria Asih Aryani Soemitro, Mohammad Muntaha, Tommy, Rano Adex

ROOM C			
MEDICINE AND PHARMACY			
Chair : TBD			
MP01 (Invited)	13:45-14:05 (20 min)	Acquisition and Analysis of Dynamic 3D Medical Image	Hideaki Haneishi
MP02	14:05-14:20 (15 min)	LEVEL OF ALANINE AMINOTRANSFERASE(ALT) AND URIC ACID IN THE FEMALE WHITE RATS (WISTAR GROOVE) BLOOD WHICH IS GIVEN BY CHRONIK AND ACUTE ALKOHOL	Salmah Orbayinah, Emi tri Siswanti
MP03	14:20-14:35 (15 min)	STUDY OF HESPERIDIN AS PREVENTIVE RESISTANCE AGENT IN MCF-7 BREAST CANCER CELLS LINE RESISTANCE TO DOXORUBICIN	Rifki Febriansah, Aries Nurulita, Agung Endro Nugroho, Edy Meiyanto
MP04	14:35-14:50 (15 min)	OPTICAL CHARACTERIZATION OF PATIENT'S BLOOD IN DENGUE HEMORRHAGIC FEVER AND TYPHOID FEVER	Cholid Badri, Nurhadi Ibrahim, Dias Rima Sutiono, Rahmapuspita
Break (15 Minutes)			
ENVIRONMENTAL CHEMISTRY			
Chair : TBD			
EC01 (Invited)	15:05-15:25 (20 min)	Removal of pollutants from aqueous solutions using various activated carbons	Motoi Machida, Yoshimasa AMANO
EC02	15:25-15:40 (15 min)	ADSORPTION PROPERTIES OF ORGANIC COMPOUNDS WITH DIFFERENT SIZES ON ACTIVATED CARBONS WITH DIFFERENT PORE DIAMETERS	Shohei OISHI, Yoshimasa AMANO, Motoi MACHIDA
EC03	15:40-15:55 (15 min)	WATER VAPOR ADSORPTION-DESORPTION OF BAMBOO-BASED ACTIVATED CARBONS WITH VARIOUS STRUCTURAL AND SURFACE CHARACTERISTICS	Rui Wang, Yoshimasa Amano, Motoi Machida
EC04	15:55-16:10 (15 min)	EFFECTS OF NITROGEN CONCENTRATION ON THE GROWTH, UPTAKE, AND COMPETITION BETWEEN MICROCYSTIS AERUGINOSA AND CYCLOTELLA SP.	Kosei TAKAHASHI, Yoshimasa AMANO, Motoi MACHIDA
EC05	16:10-16:25 (15 min)	Green Fluorescence from Yb:YAG Crystals Excited by Infrared Wavelength	Nobuo Takeuchi, Eiichiro Nakazawa, Takunori Taira, Hiroaki Kuze
EC06	16:25-16:40 (15 min)	EFFECTS OF ACIDIC FUNCTIONAL GROUPS OF ACTIVATED CARBON AND MESOPOROUS SILICA AND POLARITY OF ADSORBATE ON ADSORPTION CHARACTERISTIC OF AROMATIC COMPOUNDS	Hiroaki Yoshida, Yoshimasa Amano, Louis Mercier, Motoi Machida
EC07	16:40-16:55 (15 min)	EFFECTS OF HYDROPHOBIC NANOSPACES ON STRUCTURES OF LYSOZYME	Hirofumi KANO, Koki TAKENAKA, Tomonori OHBA, Kazuo TAKEI, Kuniko AKAMA
EC08	16:55-17:10 (15 min)	MECHANISMS ON THE TRANSITION OF DOMINANCE SPECIES BETWEEN SCENEDESMUS QUADRICAUDA AND MICROCYSTIS AERUGINOSA IN EUTROPHIC CONDITION	Ryohei TAKEUCHI, Yoshimasa AMANO and Motoi MACHIDA

ROOM D			
AGRICULTURE 1			
Chair : TBD			
AG01 (Invited)	13:45-14:05 (20 min)	Research collaboration with Indonesia and South East Asia	Inubushi Kazuyuki
AG02	14:05-14:20 (15 min)	"Cip cup tea"; Tea Bags Ciplukan Physalis angulata l), Instant Beverage Product Innovations for People with Diabetes mellitus	Ridho Andika Putra
AG03	14:20-14:35 (15 min)	STUDY OF WATER CONSUMPTION, GROWTH RESPONSES AND PRODUCTION OF TWO RICE VARIETIES IN DIFFERENT IRRIGATION SYSTEMS	Ahmad Rifqi Fauzi, Ahmad Junaedi, Iskandar Lubis, Hiroshi Ehara
AG04	14:35-14:50 (15 min)	GROWTH AND YIELD OF SRI (SYSTEM OF RICE INTENSIFICATION) PADDY	Gede Menaka Adnyana, I Nyoman Rai, Made Sudiana Mahendra

Break (15 Minutes)			
HORTICULTURE			
Chair : TBD			
HT01 (Invited)	15:05-15:25 (20 min)	Identification of dominant loci in the interspecific hybridization of <i> Capsicum annuum</i> x <i> C. frutescens</i> revealed by RAPD	Aziz Purwantoro, Irifan Binawa, Christina Astri
HT02	15:25-15:40 (15 min)	Estimating of RAPD marker Associated to color gene in <i> Zinnia elegans</i> Jacq.	Tumiur Gultom, Aziz Purwantoro, Endang Sulistyaningsih, Nasrullah
HT03	15:40-15:55 (15 min)	SCREENING FOR SALINITY TOLERANCE IN SHALLOT (<i> Allium cepa</i> L. Aggregatum group) AND WAKEGI ONION (<i> A. x wakegi</i> Araki)	Endang Sulistyaningsih, Astuty Sariningtyas, Aziz Purwantoro, Nasrullah



FRIDAY, 26 October 2012 (09:00 - 12:00)
ORAL SESSION

ID	Time (Duration)	TITLE	AUTHORS
ROOM A			
MICROELECTRONICS AND ELECTRONIC DEVICE			
Chair : TBD			
ME01 (Invited)	09:00-09:20 (20 min)	DESIGN OF CONCURRENT QUADBAND BANDPASS FILTER USING LUMPED COMPONENTS FOR m-BWA	Gunawan Wibisono, Daniel Simanjuntak, Teguh Firmansyah, Taufiq Alif K, Toto Supriyanto, Hsiao-Chin Chen
ME02	09:20-09:35 (15 min)	DESIGN OF 16 TO 1 MULTIPLEXER IC USING HIGH SPEED CMOS TECHNOLOGY	Eka Maulana, M Julius St, R Arief Setyawan, Ceri A, Tito Panca N
ME03	09:35-09:50 (15 min)	GAIN PERFORMANCE ANALYSIS OF INDUCTIVE SOURCE DEGENERATION AMPLIFIER IN 0.18- μ m CMOS TECHNOLOGY	Taufiq Alif Kurniawan, Gunawan Wibisono, Hsiao-Chin Chen, Chia-Yu Yao
Break (15 Minutes)			
AGRICULTURE 1			
Chair : TBD			
AG05 (Invited)	10:05-10:25 (20 min)	Precision Forestry in Tropical Countries	Akira Kato
AG06	10:25-10:40 (15 min)	THE APPLICATION OF MISTING PERIOD ON OYSTER MUSHROOM (<i>Pleurotus ostreatus</i>) IN THE LOWLAND AREAS	Ni Nyoman Ari Mayadewi, Made Sudiana Mahendra, I Nyoman Rai
AG07	10:40-10:55 (15 min)	PHENOTYPIC AND AGRONOMIC CHARACTERS IDENTIFICATION OF BALI WANI (<i>Mangifera caesia</i> Jack.) AS A BASE OF THE PRODUCTION DEVELOPMENT	I Made Sukewijaya, Made Sudiana Mahendra, I Nyoman Rai
AG08	10:55-11:10 (15 min)	ZERO WASTE FARMING AS FUEL OIL AND NATURAL GAS SUBSTITUTIONS AND UNEMPLOYMENT SOLUTION IN MARGAASIH AND NARAWITA VILLAGES, CICALENGKA, BANDUNG.	Nurfardah, Achmad Khoibar Tridakusuma
AG09	11:10-11:25 (15 min)	THE MEANING OF SUCCESS IN THE FARMER COMMUNITY EMPOWERMENT	Indardi
ROOM B			
ENERGY AND POWER SYSTEM			
Chair : TBD			
EP01 (Invited)	09:00-09:20 (20 min)	ENERGY SAVING AND LOAD LEVELING TECHNOLOGIES ON MOBILE APPLICATIONS	Kondoh Keiichiro
EP02	09:20-09:35 (15 min)	UNDERSTANDING THE MAGNETOTELLURIC METHOD IN GEOTHERMAL EXPLORATION	Rivan Tri Yuono
EP03	09:35-09:50 (15 min)	Geothermal Potential and Its Exploration in Indonesia	Desy Rhobiatul Adhawiyah, dwi fortuna anjusa putra, abdul karim
Break (15 Minutes)			
PHYSICS			
Chair : TBD			
PH01 (Invited)	10:05-10:25 (20 min)	VARIOUS MAGNETIC PROPERTIES IN BSCCO ₂ SUPERCONDUCTORS: FROM BULK STATE TO NANO-SIZE CRYSTAL	Darminto
PH02	10:25-10:40 (15 min)	ANALYSIS OF THE INITIAL PHASE OF P-WAVE FOR INDONESIA EARTHQUAKE EARLY WARNING	HENDAR GUNAWAN, NANANG T. PUSPITO
PH03	10:40-10:55 (15 min)	RAPID INFORMATION OF MACRO-SEISMIC INTENSITY MAP FOR EARTHQUAKE EARLY WARNING	HENDAR GUNAWAN, NANANG T. PUSPITO
PH04	10:55-11:10 (15 min)	PHYSICAL PRINCIPLES OF NON-INVASIVE CANCER TREATMENT: HIFU THERAPY	Dandi Hambali, nurdina gita pratiwi, wuri handayani
ROOM C			
COMPUTER AND INFORMATION 1			
Chair : TBD			
CI01 (Invited)	09:00-09:20 (20 min)	A unified Cloud Service Ontology for Scientific Applications	Nick A. Tahamtan, A. Anjomshoaa and A.M. Tjoa

CI02	09:20-09:35 (15 min)	Leukocyte Recognition using Window Cropping and Co-occurrence Matrix Method	Lina, Arlends Chris, Bagus Mulyawan
CI03	09:35-09:50 (15 min)	WEB-GIS APPLICATION FOR PUBLIC TRANSPORT INFORMATION IN YOGYAKARTA CITY	Muhammad Iqnaul Haq, Rendra Ady Wijaya, Imam Santoso
CI04	09:50-10:05 (15 min)	Encrypting Text Into Image With MATLAB	Indra Riyanto, Muhammad Syahid Adam
Break (15 Minutes)			
COMPUTER AND INFORMATION 2			
Chair : TBD			
CI05 (Invited)	10:20-10:40 (20 min)	Comparison of Similar Word Searching Algorithm to Improve Performance of EMPL-0 Essay Grading System	Anak Agung Putri Ratna, Rizka Haifa, Meirisal Dwi Walid, Prima Dewi Purnamasari
CI06	10:40-10:55 (15 min)	CLASSIFICATION OF THE QUALITY OF URANIUM GREEN PELLETS BASED ON IMPROVED LEVENBERG-MARQUARD ALGORITHM	Rozandi Prarizky, Benyamin Kusumoputro
CI07	10:55-11:10 (15 min)	MOBILE SYSTEM TO SUPPORT FLOOD AREA INFORMATION DISTRIBUTION CASE STUDY: CENTRAL JAKARTA AREA	Wihartini, Wahyu Pramusinto, Indra Riyanto
CI08	11:10-11:25 (15 min)	SPOT-4 Imagery Metadata Conversion For National Institute Of Aeronautics And Space Remote Sensing Technology And Data Laboratory	Sulis Darmanto, Syamsul Abbas Ras, Indra Riyanto

FRIDAY, 26 October 2012 (13:00 - 17:00)
ORAL SESSION

ID	Time (Duration)	TITLE	AUTHORS
ROOM A			
ANTENNA, MICROWAVE AND MOBILE COMMUNICATION 1			
Chair : TBD			
AM01 (Invited)	13:00-13:20 (20 min)	PERFORMANCE OF A SMALL HELICAL DIPOLE ANTENNA FOR UHF BAND COMMUNICATIONS	Eko Tjipto Rahardjo, Basari, Dwyan Zakaria, Fitri Yuli Zulkifli
AM02	13:20-13:35 (15 min)	GAIN ENHANCEMENT MICROSTRIP ANTENNA BY USING HAMMER HEAD STUB FEEDING TECHNIQUE	Fitri Yuli Zulkifli, Taufal Hidayat, Basari, Eko Tjipto Rahardjo
AM03	13:35-13:50 (15 min)	AN OPTIMIZED INTERNAL L-DIPOLE ANTENNA FOR DIGITAL TV RECEIVER	Nurmayanti Zain, Elyas Palantei
AM04	13:50-14:05 (15 min)	SIMPLE AND LOW COST DESIGN OF RF PASSIVE COMPONENTS FOR GPS APPLICATION	Danang Santoso, Elyas Palantei, Merna Baharuddin, Ade Chandra
AM05	14:05-14:20 (15 min)	BANDWIDTH ENHANCEMENT AND SIZE REDUCTION OF WLAN PATCH ANTENNA USING METAMATERIALS	Achmad Munir, Sutinah, Chairunnisa
Break (15 Minutes)			
MECHANICAL, METALLURGY AND MATERIALS ENGINEERING			
Chair : TBD			
MM01 (Invited)	14:35-14:55 (20 min)	EFFECT OF CALCINATION HOLDING TIME ON THE BARIUM M-HEXAFERRITE (BaFe _{12-x} Zn _x O ₁₉) MAGNETIC PROPERTIES WITH DOPING Zn ION	Mochamad zainuri, Findah R. S, Irwan R
MM02	14:55-15:10 (15 min)	CARS MEASUREMENT OF N ₂ ROTATIONAL/VIBRATIONAL TEMPERATURES AROUND WEDGE MODEL IN THE FLOW BEHIND HYPERVELOCITY SHOCK WAVE	Shirota Daiki, Venigalla Hima Bindu, Oguro Masashi, Eto Wataru, Ota Masanori, Maeno Kazuo
MM03	15:10-15:25 (15 min)	APPLICATION OF HIGH-SPEED CAMERA TO 4D-LICIT DENSITY MEASUREMENT OF UNSTEADY SHOCK-VORTEX FLOW DISCHARGED FROM TWO INCLINED AND CYLINDRICAL HOLES	Aratani Tomomi, Inage Tatsuro, Miwa Yoshihiro, Ota Masanori, Maeno Kazuo
MM04	15:25-15:40 (15 min)	Parallel Natural Convection Simulation on GPU Using Lattice Boltzmann Method	Adhika Widyaparaga, Pranowo
MM05	15:40-15:55 (15 min)	VISUALIZATION OF JET-PLANE WALL INTERACTION UNDER LOW PRESSURE CONDITIONS BY I ₂ -LIF MEASUREMENT	Kawakami Hiroshi, Takatuka Yuki, Maeno kazuo
MM06	15:55-16:10 (15 min)	IMPROVEMENT OF THREE-DIMENSIONAL BOS DENSITY MEASUREMENT FOR SUPERSONIC WIND TUNNEL FLOWS	Yusuke KIKUMA, Xiao Shen, Masanori Ota, Kazuo MAENO
MM07	16:10-16:25 (15 min)	COMPARATIVE SYNTHESIS OF Pb AND Ni ? DOPED MULTIFERROIC BiFeO ₃ BY CO-PRECIIPITATION, LIQUID MIXING AND SOL-GEL METHODS	Muhammad Ghuftron, Darminto

ROOM B			
ENVIRONMENTAL SCIENCE 1			
Chair : TBD			
ES01 (Invited)	13:00-13:20 (20 min)	SEA WATER QUALITY IN MARINE TOURISM AREA OF SOUTH BALI ISLAND COASTAL AREAS; A CASE STUDY IN SANUR, KUTA AND NUSA DUA	Made Sudiana Mahendra, I Wayan Budiarsa Suyasa, Abd. Rahman As-syakur
ES02	13:20-13:35 (15 min)	MODELING OF PYROCLASTIC FLOW BY USING TITAN2D TO PREDICT PYROCLASTIC HAZARD ZONE IN MERAPI VOLCANO AFTER 2010 ERUPTION	Herlan Darmawan, Junun Sartohadi, Kirbani Sri Brotopuspito
ES03	13:35-13:50 (15 min)	Analysis of forest and land fires in Riau Province based on the use of land for mitigation of smoke disaster	Prayoto
ES04	13:50-14:05 (15 min)	Implementation of Integrated Coastal Zone Management (ICZM) on Southern Area of Java Island (Case Study: Sadeng Coastal Area, Gunung Kidul)	Agam Rafsanjani
ES05	14:05-14:20 (15 min)	EFFECT OF TYPE OF ELECTRODE AND DISTANCE BETWEEN ELECTRODES IN CONTINUOUS FLOW MONOPOLAR ELECTROCOAGULATION SYSTEM FOR REMOVAL OF COD AND TSS IN LAUNDRY WASTEWATER	ANGELINA PUSPITA SANDY, Evy Hendriarianti, Made Sudiana Mahendra

ES06	14:20-14:35 (15 min)	USING CELLULOLYTIC BACTERIA FROM THE GUT OF GOURAMI (Ospbronemus gouramy Lac.) AS A BIODEINKING AGENT IN RECYCLE PAPER PROCESS, FIRST STEP FOR SAVING THOUSAND TREES	Rena Nurul Ummah, Tyas Ismi Trialfhianty, Dewi Kusumasati, Yunita Dwi Setyorini
ES07	14:35-14:50 (15 min)	STUDY ON PREDICTION OF BACKFLOW (BACK WATER) IN BOGOWONTO ESTUARY, PURWOREJO DISTRICT, CENTRAL JAVA PROVINCE, INDONESIA USING MATHEMATICAL MODEL	Marfidha Dian Ayu Iswandari, Mira Anantha Yosilia
ES08	14:50-15:05 (15 min)	GIS and Remote Sensing Integration To Mitigate Seismic Data Acquisition Activities; A Case Study of Sumatra, Indonesia	Manahan Kristian Sihotang, I Setiaji Ronoatmojo, Ryutaro Tateishi
ES09	15:05-15:20 (15 min)	The Impact of Land Cover Changes to Bed Morphology of Mrica Reservoir, Central Java	Elgodwistra Kartikoputro

Break (15 Minutes)

ANTENNA, MICROWAVE AND MOBILE COMMUNICATION 2

Chair : TBD

AM06 (Invited)	15:35-15:55 (20 min)	IMPROVING THE ERROR PERFORMANCE OF VARIOUS CLIPPED-OFDM SYSTEMS	Dadang Gunawan, Filbert H. Juwono
AM07	15:55-16:10 (15 min)	CAPACITOR-BASED RECONFIGURABLE FILTER FOR 2.4GHz WLAN, UWB, AND UPLINK GSM-900	Hardy Lukius, Mohammad Sigit Arifianto, Achmad Munir
AM08	16:10-16:25 (15 min)	RESEARCH AND DEVELOPMENT OF A FM-CW RADAR FOR LOW ALTITUDE AIR SURVEILLANCE	Mashury Wahab, Daday Ruhayat, Suhana Hermana, Asep Yudi Hercuadi

ROOM C

IMAGE, OPTICAL COMMUNICATION AND SIGNAL PROCESSING

Chair : TBD

IP01 (Invited)	13:00-13:20 (20 min)	PORTABLE PHYTOPLANKTON COUNTER BASED ON FLUORESCENCE AND ABSORPTION FOR MEASURING PHYTOPLANKTON SUSPENSION CONCENTRATION	Retno Wigajatri Purnamaningsih, Nining B Prihantini
IP02	13:20-13:35 (15 min)	APPLICATION OF CONCENTRIC CIRCLE METHOD FOR DETECTION OF REAR-VIEW MIRROR DISTORTION	A.Kusumawardhani, H. Setijono, M. T. Nurismu, Irwansyah, Sekartedjo
IP03	13:35-13:50 (15 min)	A LOAD SENSOR BASED ON SINGLEMODE-MULTIMODE-SINGLEMODE FIBER STRUCTURE FOR WIIGH-IN-MOTION SYSTEM	Sekartedjo, R. Kuntaraco, S. Haryo, A. M. Hatta, C. A. Prastyanto, I. B. Mochtar
IP04	13:50-14:05 (15 min)	AN EXPERIMENTAL INVESTIGATION OF A SINGLEMODE-MULTIMODE-SINGLEMODE FIBER STRUCTURE FOR A STRAIN MEASUREMENT USING AN OPTICAL TIME DOMAIN REFLECTOMETER INTERROGATION TECHNIQUE	Heru Setijono, A. M. Hatta, H. E. Permana, A. Kusumawardhani, Sekartedjo

Break (15 Minutes)

ENVIRONMENTAL SCIENCE 2

Chair : TBD

ES10 (Invited)	14:20-14:40 (20 min)	Ionospheric Anomalies Possibly Associated with Large Earthquakes: Statistical Study and Case Study for the 20110311 M9 Earthquake	Katsumi HATTORI, Takashi ICHIKAWA, Shinji HIROOKA, Jann-Yenq LIU
ES11	14:40-14:55 (15 min)	THE DISTRIBUTION OF INTERNAL WAVES IN THE LOMBOK STRAIT AREA STUDIED BY MULTI-SENSOR SATELLITE IMAGES	I Wayan Gede Astawa Karang, Fumihiko Nishio
ES12	14:55-15:10 (15 min)	ASIA VLF OBSERVATION NETWORK (AVON) SYSTEM FOR MONITORING THE LOWER IONOSPHERE AND LIGHTNING IN INDONESIA	Hiroyo Ohya, Tsuchiya Fuminori, Yamashita Kozo, Takahashi Yukihiro, Shiokawa Kazuo, Miyoshi Yoshizumi, Nakata Hiroyuki
ES13	15:10-15:25 (15 min)	Effect of Environmental Degradation on Animal Diversity in Bali, Indonesia	I Wayan Kasa
ES14	15:25-15:40 (15 min)	STUDY OF TIDAL FLOOD INUNDATION BASE ON LAND SUBSIDENCE AND SEA LEVEL RISE EFFECT USING GEOSTATISTIC AND CELL BASED MODELING METHODS IN SEMARANG, CENTRAL JAVA, INDONESIA	Muhammad Helmi, Subandono Diposaptono, Agus Hartoko, Denny Nugroho Sugianto
ES15	15:40-15:55 (15 min)	OPTICAL/PHYSICAL PROPERTIES OF TROPOSPHERIC AEROSOLS MEASURED BY HYPERSPECTRAL VIDEO CAMERA	Naohiro Manago, Hayato Saito, Yusaku Mabuchi, Yohei Takara, Makoto Suzuki, Hiroaki Kuze
ES16	15:55-16:10 (15 min)	Dengue and Weather in Indonesia; A Comparison Between Cities.	Titik Respati, Wanti, Ardini Raksanagara, Henni Djuhaeni, Asep Sofyan

THURSDAY, 25 October 2012 (17:00-1800)
POSTER SESSION

ID	TITLE	AUTHORS
P01	THE ABILITIES OF PHYLLOPLANE BACTERIA FROM TOMATO AND COGON GRASS LEAVES TO SUPPRESS POWDERY MILDEW DISEASE (<i>Oidium</i> sp.) ON TOMATO.	Khoirunnisa Qisthi Syahida, Noor Istifadah
P02	THE APPLICATION OF ORGANIC FERTILIZERS (STRAW COMPOST + BIO-FERTILIZER) TO INCREASE THE EFFECTIVENESS OF INORGANIC FERTILIZER (N, P, K), PLANT GROWTH AND YIELD PRODUCTION OF CIHERANG LOWLAND RICE VARIETY BASED ON IPAT-BO CULTIVATION TECHNIQUE	Tien Turmuktini, ania citraresmini, betty natalie, hersanti, yuyun yuwariah, benny joy, tualar simarmata
P03	EFFECTIVITY OF PHOSPHATE SOLUBILIZING MICROBE TO REDUCE THE RATE OF INORGANIC P FERTILIZER ON LOWLAND RICE GROWTH	Mutiara Dewi Puspitawati, Sugiyanta, Iswandi Anas
P04	AGRO-TOURISM DEVELOPMENT BASED ON ENVIRONMENTAL CONCEPT IN PONCOKUSUMO VILLAGE, MALANG, EAST JAVA, INDONESIA	Tedy Agvita Qurota A'yun, Ahmad Bayhaqi, Luh Irma Irviani, Shinta Hiflina Yuniari
P05	MICROSTRIP ANTENNA DUALBAND WITH SLOT AND PARTIAL GROUND PLANE	Arwidya Tantri Agtusia , Fitri Yuli Zulkifli, Eko Tjipto Raharjo
P06	2.1GHz CONFORMAL MICROSTRIP ANTENNA FOR AIR VEHICLE APPLICATION	Cahya Edi Santosa, Eka Kurnia Sari, Achmad Munir
P07	Design of An Implantable Folded Antenna of 2.4 GHz for In-Body Wireless Communication	HOYU Lin, Masaharu TAKAHASHI, Kazuyuki SAITO, Koichi ITO1
P08	CHARACTERISTIC OF PRINTED LOG-PERIODIC FRACTAL KOCH ANTENNA AS INFLUENCE OF NUMBER OF ITS ELEMENTS	Achmad Munir, Dida Tuhu Putranto, Devy Freshia, Chairunnisaa
P09	A LOW SIDELobe LEVEL ARRAY ANTENNA FOR CP-SAR SENSOR	Yohandri, Josaphat Tetuko Sri Sumantyo
P10	CIRCULARLY POLARIZED MICROSTRIP ARRAY ANTENNAS USING SEQUENTIAL ROTATION FEEDING NETWORK FOR GPS-SAR SYSTEM INSTALLED ON UNMANNED AERIAL VEHICLE	Takafumi Kawai, Takuji Ebinuma, J.T.Sri Sumantyo
P11	Dual-mode Antenna for Body-Centric Wireless Communications	Chia-Hsien Lin, Kazuyuki Saito, Masaharu Takahashi, Koichi Ito
P12	IMPLEMENTATION OF MULTI CRITERIA DECISION MAKING IN A VERTICAL HANDOVER FOR A WIRELESS HETEROGENEOUS NETWORK ENVIRONMENT	Gita Mahardhika, Mahamod Ismail, Rosdiadee Nordin
P13	TESTING AND DETECTING OF FAULTY LINKS INSIDE THE NETWORK ON CHIP SWITCHES	Takieddine SBIAI, Wenpo ZHANG, Kazuteru NAMBA, Masato KITAKAMI
P14	ERROR CORRECTION IN GEOMETRIC METHOD OF 3D GAZE MEASUREMENT USING SINGULAR VALUE DECOMPOSITION	Sunu Wibirama, Kazuhiko Hamamoto
P15	Current distortion characteristics of a single and simultaneous operated load in the frequency range of 2-150 kHz	Budi Sudiarto, Holger Hirsch, Dodi Sudiana
P16	FREQUENCY CONTROL HARDWARE SYSTEM ON WIRELESS POWER TRANSFER USING MAGNETIC COUPLING RESONANCE	Eko Adhi Setiawan, Arriyadhul Qolbi, Dodi Sudiana
P17	EFFECTIVENESS OF DOMESTIC WASTEWATER TREATMENT AT DENPASAR WASTEWATER INSTALLATION CENTER	NI PUTU VIVIN NOPIANTARI
P18	THE EFFECT OF CONCENTRATION AND SOAKING PERIODE IN POTASSIUM CARBONATE (K ₂ CO ₃) SOLUTION ON DEGRADATION OF TANNIN CONTENT IN MILLED RED SORGHUM RICE (SORGHUM BICOLOR (L.) MOENCH) VARIETY OF FETERITA.	Marsetio, Saripah Hudaya
P19	Mapping of Potential Natural Resources at Caldera of Mount Batur Area in Bali	I Gede Budiarta, Made Sudiana Mahendra, I Wayan Budiarsa Suyasa
P20	CARBON STOCK ESTIMATION OF PEATLAND USE ALOS PALSAR IN KAMPAR PENINSULA, RIAU PROVINCE, INDONESIA	Miqdad Anwarie, Fidelis Awig Atmoko, Ibni Sabi A. Z. M, Abdul Aziz
P21	ENTOMOLOGY SURVEILLANCE AFTER MOSQUITO CONTROL PROGRAM; A SURVEY OF HOUSE INDEX (HI), BRETEAU INDEX (BI) AND CONTAINER INDEX (CI) IN AREA WITH DENGUE CASES IN BANDUNG, INDONESIA	Titik Respati, Rizqi Kurnia, Budiman
P22	MARINE FISHERIES OPERATING SYSTEM ROOM THAT AIMS TO MAKE INDONESIA SUSTAINABLE FISHERIES SECTOR AND MORE ADVANCED FOR WELFARE OF THE COMMUNITY	Rizal Babil Yasari Akbar, Rizal Babil Yasari Akbar

P23	THE GROWTH AND SURVIVAL RATE OF GOLDFISH REARED IN A MEDIA CONTAINING BATIK WASTE	Siti Rudiyaniti
P24	BASE CHIRP GENERATOR FOR UNMANNED AERIAL VEHICLE SYNTHETIC APERTURE RADAR SYSTEM	Kyohei Suto
P25	TOTAL PRESSURE MEASUREMENT BY USING PITOT TUBE IN HYPERSONIC SHOCK TUNNEL WITH DIAPHRAGMLESS DRIVER SECTION	Hirose Yusuke, Udagawa Shinsuke, Inage Tatsuo, Ota Masanori, Maeno Kazuo
P26	The Effect of Buah Merah (Pandanus conoideus Lamk.) Active Fraction on Cell Proliferation, COX-2, and p53 Expression of C3H Mice Breast Cancer Model	Lisna Hidayati, sitarina widyarini, sukarti moeljopawiro
P27	THE EFFECTIVENESS OF THE ELECTRODES AND ELECTRIC CURRENT IN THE SEPARATION OF METALLIC SILVER (AG) FROM WASTE POTOGRAHY BY ELECTROLYSIS METHOD	I PUTU YUDIANDIKA
P28	^{69,71} Ga-NQR STUDY OF YbNi ₃ Ga ₉	Naoya Kamiyama, Ryo Nagashima, Hideto Fukazawa, Yoh Kohori, Tetsuro Yamashita, Shigeo Ohara
P29	NUCLEAR QUADRUPLE RESONANCE STUDY OF Ce ₂ PdIn ₈	Sho Shimatani, Ryo Nagashima, Hideto Fukazawa, Yoh Kohori, D. Kaczorowski
P30	LAND USE AND LAND COVER MAPPING WITH JERS-1 SAR DATA	M. Mahmudur Rahman, Josaphat Tetuko Sri Sumantyo
P31	TSUNAMI INUNDATION HAZARD MAPPING OF SAND DUNE AREA IN PARANGTRITIS SUB DISTRICT, YOGYAKARTA, INDONESIA	Ratih Fitria Putri, Josaphat Tetuko Sri Sumantyo
P32	RIVER WATER QUALITY STUDY IN BADUNG REGENCY	I Nengah Sukarta, Made Sudiana Mahendra
P33	The relationship between the paddy rice field and growing environment in west Jawa	ryohei shikata, C.Hongo, G. SIGIT, K. Honma, K. Yoshida, M. Maki, K. Oki, H. Shirakawa
P34	COMPARISON OF STATISTICAL MODELS FOR ESTIMATING RICE YIELD USING REMOTELY SENSED DATA	Chiharu HONGO, Gunardi Sigit, Hiroaki Shirakawa, Koki Honma, Masayasu Maki, Koshi Yoshida, Kazuo Oki
P35	IDENTIFICATION OF DEFORESTATION IN BORNEO FROM 2007 TO 2009 USING ALOS PALSAR MOSAIC	Ardiansyah, Rokhmatuloh
P36	EVALUATING LAND SURFACE CHANGES OF MAKASSAR CITY USING DINSAR AND LANDSAT IMAGES	Ilham Alimuddin, Luhur Bayuaji, Josaphat Tetuko Sri Sumantyo, Hiroaki Kuze
P37	Monitoring urban land deformation using DInSAR technique on combination of L, C and X-band SAR data	Luhur Bayuaji, Josaphat Tetuko Sri Sumantyo
P38	GRASP OF UNMANNED AERIAL VEHICLE FLIGHT STATE USING GPS AND INERTIAL MEASUREMENT UNIT	Takahiro Miyazaki, Takuji Ebinuma, J.T. Sri Sumantyo
P39	SIGNIFICANCE OF INTERNET IN INCREASING INTENSITY OF INTERPERSONAL COMMUNICATION TOWARD SOCIAL SOLIDARITY (Study in Cyber Village, Yogyakarta)	Leo Susanto, Rayhana Anwarie, Ricky Abdurrahman Hafidz
P40	CULTURAL IDENTITY OF A SHIFT IN DESCENDANTS THE URBAN TRIBE JAVA AT METROPOLITAN CITY (Study in the District of Jagakarsa, South Jakarta)	Rayhana Anwarie, Fitri Dwi Lestari, Iqbal Al Khazim, Yuning Ika Rohmawati
P41	ROOF GARDEN RECYCLING MODEL (RGRM): ALTERNATIVE TECHNOLOGIES FOR LOW COST, FRIENDLY RESIDENTIAL IN LIMITED AREA URBAN ENVIRONMENT AND OPTIMIZING RECYCLED MATERIALS	Achmad Suryadi, Agustina Setiawati
P42	"HANA" HEALTHY ANTIOXIDANT NOODLES: THE UTILIZATION OF LOCAL FOOD MADE OF PURPLE SWEET POTATO (Ipomoea batatas Lamb.), BLACK SOYBEAN (Glycine soja), GREEN JELLY GRASS (Cyclea barbata L. Miers)	Qisthira Swasti Amirina, Aryo Dwi Nugroho
P43	Reduction of Synthetic Aperture Radar Raw Data Using Compressive Sensing	Rahmat Arief
P44	CURRENT RESEARCH ON TROPICAL PEATLAND VOLUME ESTIMATION IN INDONESIA	Rokhmatuloh
P45	STUDY OF MOISTURE TRANSPORT ON LOW LEVEL TROPOSPHERE BASED ON GPS DATA OBSERVATION CONNECTED TO THE PROCESS OF CONVECTIVE'S EVOLUTION	Kristianto Aries, Widiyantoro Sri, Hadi Wahyu Tri, Wijaya Darmawan Dudy
P46	The Sensitivity Analysis of Ekman Layer Modeling	Syamsul Rizal, Anita Talib, Khairun Yahya, Abdul Halim
P47	PIKOHIDRO SAWANGAN, THE IMPLEMENTATION OF RENEWABLE ENERGY FOR THE PROSPERITY OF THE PEOPLE IN REMOTE VILLAGES IN BANJARNEGARA, INDONESIA	Fitrotun Aliyah, Tri Handoyo, Ahmad Baihaqqi, Dwi Ulfa Nur Izzati, Prasetyan Nur Firdaus, Rachmawan Budiarto
P48	HARVEST ESTIMATION OF GLYCINE MAX L USING LANDSAT 7 ETM+ BY INFRARED II INDEX AND MOISTURE STRESS INDEX (MSI)	Ridho Kurniawan, Ridho Kurniawan, Hanandy Y.L., Iswari N.H., Meidi N.A.

P49	Adaptive-ARQ Applications Based On CRC And RS Code In The Millimeter Wave Radio Communication System Under Rainy Conditions	Indah Kurniawati, Suwadi, Gamantyo Hendrantoro, Muhammad Taufik, Noorlaila Hayati
P50	PARAMETER COPULA ESTIMATION AND APPLICATIONS ON CLIMATOLOGY	irwan syahrir, Ismaini Zain, Heri Kuswanto, Muhammad Taufik, Noorlaila Hayati



MECHANICAL, METALLURGY AND MATERIALS ENGINEERING (MM)

MM01	EFFECT OF CALCINATION HOLDING TIME ON THE BARIUM M-HEXAFERRITE (BaFe _{12-x} Zn _x O ₁₉) MAGNETIC PROPERTIES WITH DOPING Zn ION <i>Mochamad zainuri, Findah R. S, Irwan R</i>	349
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MM04	Parallel Natural Convection Simulation on GPU Using Lattice Boltzmann Method <i>Adhika Widyaparaga, Pranowo</i>	365
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MM07	COMPARATIVE SYNTHESIS OF Pb AND Ni - DOPED MULTIFERROIC BiFeO ₃ BY CO-PRECIPITATION, LIQUID MIXING AND SOL-GEL METHODS <i>Muhammad Ghufron, Darminto</i>	381

Parallel Natural Convection Simulation on GPU Using Lattice Boltzmann Method

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KEY WORDS: natural convection, LBM, Parallel, GPU

ABSTRACT: In this paper, we propose the implementation of a parallel lattice Boltzmann method (LBM) algorithm for the simulation of two-dimensional natural convection heat transfer problems. The LBM code is written using NVIDIA C language and is run on the graphical processing unit (GPU) of a Nvidia GeForce9600 card. The behaviour of the convective flows, which are driven by buoyancy forces, was numerically studied for Rayleigh numbers (Ra) from 1×10^3 to 1×10^6 . Our numerical results show a good agreement with the experimental and numerical results obtained in the literature. Based on performance comparison, it is shown that performance utilizing the processing power of the GPU is significantly faster than unaided CPU processing.

1. Introduction

Natural convective flows occur in many industrial situations. These kind of flows are particularly important in passive cooling electronic components, heat exchanger, solar energy and thermal storage systems. Such flows are very complicated. Therefore, it is necessary to clarify the flow structure and the mechanism in detail to establish an improved design technique. The numerical method has a powerful ability to investigate the flows and to clarify the predominant factors that influenced the flows.

Extensive numerical research works have been done in this field. Most of them are based on traditional numerical methods such as the finite difference, finite volume and finite element methods for solving the Navier-Stokes equations. De Vahl Davis (de Vahl Davis, 1983) provided “benchmark solutions” that were obtained with a second-order finite-difference scheme. The Navier Stokes equations are nonlinear equations and hard to be solved by traditional methods numerically, so recently the Lattice Boltzmann method (LBM) was introduced as an alternative method for solving Navier Stokes Equations especially in natural convection (Dixit and Babu, 2006; Guo, Shi, and Zheng, 2002). Lattice Boltzmann algorithms are simpler and easier to be implemented than the traditional methods. The main advantage LBM is its data parallel nature, so one can parallelize the LBM code relatively easily and accelerate the execution time.

In this paper, we propose the implementation of a parallel LBM scheme for the simulation of two-dimensional natural convection heat transfer problems on a graphical processing unit (GPU) (Obrecht et al., 2011). The LBM code is written using NVIDIA C language and is run on the graphical processing unit (GPU) of a Nvidia GeForce9600 card.

2. Problem Description

The physical domain of problem is described by figure 1. The domain consists of a square enclosure with side length of 1. Constant uniform temperatures T_h and T_c ($T_h > T_c$) are imposed at the left and right walls of the domain respectively. Buoyancy forces drive the circulation flow in the enclosure. These forces are induced by constant heating from the left side. An appropriate scaling for the flow regime is characterized by the Prandtl (Pr) and Rayleigh (Ra) number. In LBM, both of the parameters are related to density relaxation τ_f and temperature relaxation τ_g .

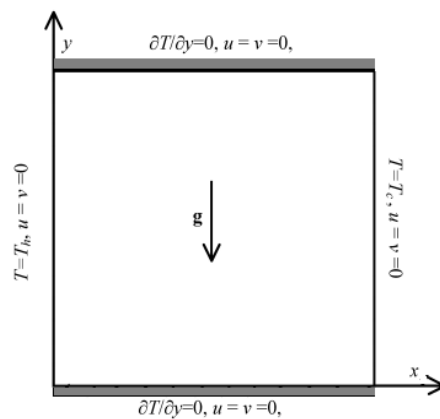


Figure1. Square enclosure and boundary conditions

3. Lattice Boltzmann Method

The Lattice Boltzmann originates from the lattice gas cellular automata method(Sukop and Thorne, 2006). It is based on discretization of the Boltzmann Equation with the Bhatnagar-Gross-Krook (BGK) relaxation for the collision operator. Through the Chapman Enskog expansion, the discrete Boltzmann Equation with the BGK relaxation can easily derive the Navier Stokes Equations.

Two kind of particle distribution functions are used for modeling the natural convective flows, i.e. density distribution functions f_i for calculation of density and velocity fields and energy distribution functions g_i for calculation of the temperature(Guo, Shi, and Zheng, 2002).

$$\begin{aligned} f_i(\mathbf{x} + \mathbf{e}_i \Delta \mathbf{x}, t + \mathbf{e}_i \Delta t) - f_i(\mathbf{x}, t) &= -\frac{1}{\tau_f} (f_i(\mathbf{x}, t) - f_i^{eq}(\mathbf{x}, t)) + \mathbf{F} \\ g_i(\mathbf{x} + \mathbf{e}_i \Delta \mathbf{x}, t + \mathbf{e}_i \Delta t) - g_i(\mathbf{x}, t) &= -\frac{1}{\tau_g} (g_i(\mathbf{x}, t) - g_i^{eq}(\mathbf{x}, t)) \end{aligned} \quad (1)$$

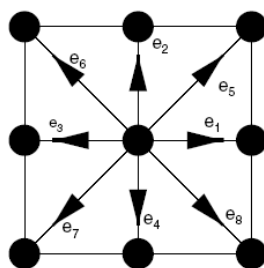


Figure 2. Discrete velocity for D2Q9

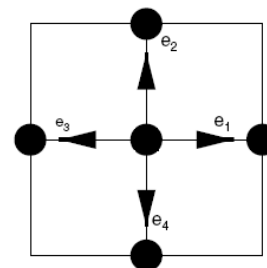


Figure 3. Discrete velocity for D2Q5 Lattice

In this paper, the D2Q9 lattice is used to represent density distribution function and D2Q5 lattice is used to represent energy distribution function. The macroscopic variables, such as density, velocity and temperature can be calculated as follow:

$$\rho = \sum_{i=0}^8 f_i \quad ; \quad \rho u_j = \sum_{i=0}^8 f_i e_{ij} \quad ; \quad \rho T_j = \sum_{i=0}^4 g_i e_{ij} \quad (2)$$

The discretized equilibrium distribution functions are given by:

$$\begin{aligned} f_i^{eq} &= \rho \omega_{nsi} (1 + 3e_i \cdot u + 4.5(e_i \cdot u)^2 - 1.5|u|^2) \\ g_i^{eq} &= T \omega_{Ti} (1 + 3e_i \cdot u_i) \end{aligned} \quad (3)$$

The Boussinesq approximation is used to calculate the buoyancy force ($\mathbf{F}$)

$$F_i = 3\omega_{nsi} (e_{xi} g_{xi} + e_{yi} g_{yi}) \frac{(T - T_0)}{(T_h - T_c)} \quad (4)$$

where $\mathbf{g}$ is gravitational acceleration, ω is weight function and T_0 is averaged temperature.

The no slip boundary condition at the walls is implemented by using bounce back rule. For the top and bottom boundary nodes, the energy distribution functions are set equal to value g_i at nearest nodes, which are perpendicular to the wall. The Dirichlet boundary conditions of the left and right sides were implemented as follow:

```
for ( j=0; j<nj; j++){
    i0 = I2D(ni,0,j);
    i1 = I2D(ni,ni-1,j);
    T3[i1]=T_cold-T0[i1]-T1[i1]-T2[i1]-T4[i1];
    T1[i0]=T_hot-T0[i0]-T2[i0]-T3[i0]-T4[i0];}
```

3. GPU CUDA

The GPU was originally built for graphics rendering purposes, but now the GPU can be applied to accelerate numerical computation processing. In GPU CUDA programming, tasks of an application are grouped into instruction sets and passes onto the GPU such that each thread core works on different data but executes the same instruction(Thibault, 2009). In LBM methods, each node is addressed into a block thread and takes into account the value of the offset input. Basically the algorithm of LBM consists of two steps, namely, streaming and colliding. The parallel streaming step is implemented as follows:

```
i = blockIdx.x*TILE_I + threadIdx.x;
j = blockIdx.y*TILE_J + threadIdx.y;
i2d = i + j*pitch/sizeof(float);
f1_data[i2d] = tex2D(f1_tex, (float) (i-1) , (float) j);
f2_data[i2d] = tex2D(f2_tex, (float) i , (float) (j-1));
f3_data[i2d] = tex2D(f3_tex, (float) (i+1) , (float) j);
f4_data[i2d] = tex2D(f4_tex, (float) i , (float) (j+1));
...
```

The implementation of the parallel of the colliding step is:

```
i = blockIdx.x*TILE_I + threadIdx.x;
j = blockIdx.y*TILE_J + threadIdx.y;
i2d = i + j*pitch/sizeof(float);
if (!solid_data[i2d]==0) {

// Read all f's and store in registers
f0now = f0_data[i2d];
f1now = f1_data[i2d];
f2now = f2_data[i2d];
...

// Macroscopic flow props:
ro = f0now + f1now + f2now + f3now + f4now + f5now + f6now + f7now + f8now;
vx = (f1now - f3now + f5now - f6now - f7now + f8now)/ro;
vy = (f2now - f4now + f5now + f6now - f7now - f8now)/ro;

float Ti2d = T0_data[i2d] + T1_data[i2d] + T2_data[i2d] + T3_data[i2d] + T4_data[i2d];
T_data[i2d]= Ti2d;

// Calculate equilibrium f's
```

```

v_sq_term = 1.5f*(vx*vx + vy*vy);
f0eq = ro * faceq1 * (1.f - v_sq_term);
f1eq = ro * faceq2 * (1.f + 3.f*vx + 4.5f*vx*vx - v_sq_term);
f2eq = ro * faceq2 * (1.f + 3.f*vy + 4.5f*vy*vy - v_sq_term);
...
force0 = 3.0*ro*faceq1*(Ti2d-T_mid)*( 0.0*gr)/(T_hot-T_cold);
force1 = 3.0*ro*faceq2*(Ti2d-T_mid)*( 0.0*gr)/(T_hot-T_cold);;
force2 = 3.0*ro*faceq2*(Ti2d-T_mid)*( 1.0*gr)/(T_hot-T_cold);;
...
// Do collisions
f0_data[i2d] = rtau1 * f0now + rtau * f0eq + force0;
f1_data[i2d] = rtau1 * f1now + rtau * f1eq + force1;
f2_data[i2d] = rtau1 * f2now + rtau * f2eq + force2;
...
T0eq = Ti2d * Tfaceq1 * (1.f + 3.0*( 0.0*vx+0.0*vy));
T1eq = Ti2d * Tfaceq2 * (1.f + 3.0*( 1.0*vx+0.0*vy));
....
// Simulate collisions by "relaxing" toward the local equilibrium
T0_data[i2d] = rtauT1 * T0_data[i2d] + rtauT * T0eq;
T1_data[i2d] = rtauT1 * T1_data[i2d] + rtauT * T1eq;
...

```

5. Results and Discussions

The LBM source codes are based on Graham Pullan's LBM codes(Pullan, 2012). The original codes were developed for hydrodynamical simulations. Modifications were done by adding energy distribution functions and incorporating handling of the temperature boundary conditions. The implementation of numerical calculations was done by using the Visual C++ on Intel I5 processors. The Rayleigh (Ra) numbers were varied from 1×10^3 to 1×10^6 and constant Prandtl number $Pr = 0.717$. We used 3 types of grids for all the ranges of Ra numbers. The grids consisted of 320×320 , 640×640 , 960×960 nodes.



Fig. 4a. Isotherm $Ra=10^3$

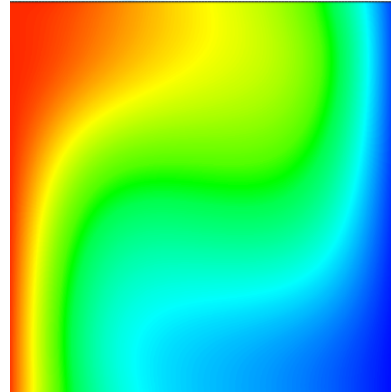


Fig. 4b. Isotherm $Ra=10^4$

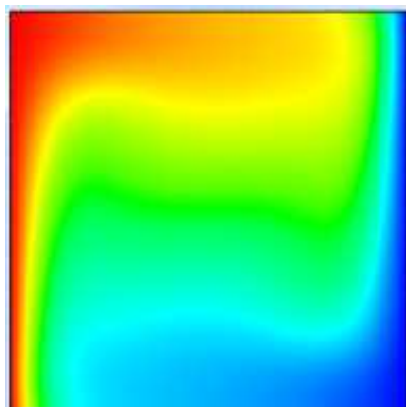


Fig. 4c. Isotherm $Ra=10^5$

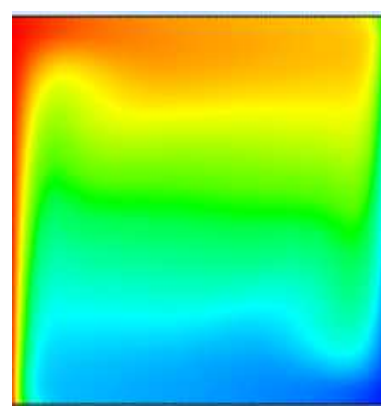


Fig. 4d. Isotherm $Ra=10^6$

The calculation results of the isotherms at steady states for different Ra are shown in Fig. 4a-4d. At low Ra number (10^3), the fluid motion driven by the buoyancy force is slow, leading to the strong diffusion. Consequently, the corresponding isothermals exhibit rather slight difference as compared to those of pure heat conduction between the left and right sides. As the Ra number is increased, the buoyancy force accelerates the circulation of fluid flow and the heat transfer of the natural convection, which is described by Nusselt Number (Nu), is significantly enhanced (figure 5).

Figure 5 shows the comparison of the present Nusselt number calculation with the literature results (Dixit and Babu, 2006; de Vahl Davis, 1983). The experiment data was taken from the empirical formulation of Martynenko and Khramtsov (Martynenko and Khramtsov, 2005). The present results agree well with other numerical results, but slightly different when compared with experiment results for high Ra number.

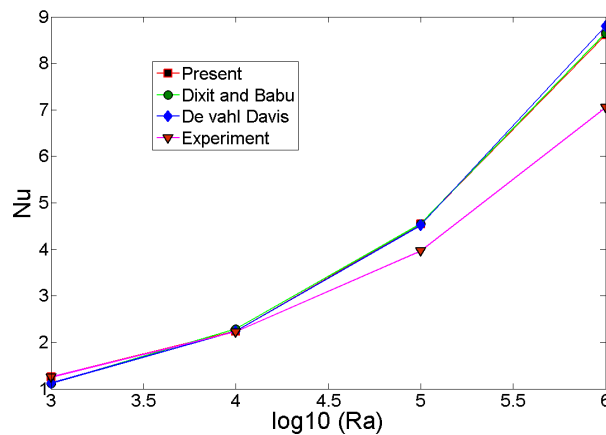


Fig.5. Comparison of the Nusselt Number

Grid independence of the present numerical results have been established for two different Rayleigh numbers, i.e. 10^4 and 10^5 . Table 1 gives the Nusselt numbers on three grids. The maximum change of the Nusselt number is 3.2 % for $Ra=10^4$ and 0.7 % for $Ra=10^5$. Those calculations show that present numerical results are grid independent.

Table 1. Grid independence study

Mesh	320×320	640×640	960×960
Nu ($Ra=10^4$)	2.241	2.244	2.158
Nu ($Ra=10^5$)	4.535	4.503	4.533

The GPU performances are compared with CPU performance $Ra=10^5$ on the three types of grids. For obtaining the steady state, all simulations were run for 30000 time steps. The GPU code performs 1.67, 6.83 and 7.53 times faster than CPU as shown in Table 2. The accelerated processing is more apparent with larger grid sizes as the intensity of arithmetic calculation and data communications in the memory of the GPU also increase, therefore aiding the calculation more and thus reducing the processing time more significantly.

Table 2. Comparison of performance for $Ra=10^5$

Grids	320×320	640×640	960×960
CPU Execution Time (s)	836.80	5129.49	11005.98
GPU Execution Time (s)	500.32	751.03	1461.86
Speed up	1.67	6.83	7.53

6. Conclusions

We have presented the Lattice Boltzmann method for solving natural convection heat transfer on GPU Nvidia GeForce 9600 card. It has been shown that the numerical results of the LBM have a good agreement with the numerical and experimental results reported in the previous studies. The numerical computation on GPU is 1.67 – 7.53 faster than on CPU and the increase in processing speed is dependant the size of the grids.

7. References

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