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nae 2009

PROCEEDINGS

The 6th International Conference on Numerical Analysis in Engineering

AMPENAN
CAKRANEGARA
MATARAM
Sweda
NARMADA

The JAYAKARTA Lombok Hotel, May 15th-16th, 2009 Lombok Island, Mataram City,
West Nusa Tenggara Province - INDONESIA

IC STAR
International Center for Science, Technology and Art
University of Sumatera Utara

Toyohashi University of Technology
(TUT)

JSME dan JSME - ICS
International Chapter for
Indonesia Institut

Universiti Kebangsaan Malaysia
(UKM)

Inter University Research Center
Engineering Sciences (IURC-ES)
Bandung Institute of Technology (ITB)

CAD line STUDIO

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CHAIRMAN'S MESSAGES

Presented Turing the 6th Int. Conf. NAE 2009 Opening Session

Friday, 15 May 2009

Prof. Dr. Bustami Syam
Chairman, Organizing Committee
The 6th International Conference on NAE 2009
Director, International Center for Science, Technology, and Art (IC-STAR)
University of Sumatera Utara

NAE Motto: To Meet Old Friends and Make New Friends.

Assalamualaikum Warahmatullahi Wabarakatuh

Ladies and Gentlemen,

Distinguished guests and participants,

Good Mornings!

On Behalf of the Organizing Committee, Welcome to Lombok Island, Mataram City and to the 6th International Conference on NAE 2009.

First of all, we would like to take this opportunity to promote the NAE site to all participants. As you are aware that NAE conference site moves from one place to another in the Indonesia archiplago: Medan (2000, 2001), Batam (2003), Yogyakarta (2005), Padang (2007), and now at Lombok Island, Mataram City. The venue of the conference is dedicated by International Advisory Board based on several considerations such as International access, conference facilities, scenic beauty and culture, recreatonal facilities, etc. To all participants please fell free to acomódate your valuable time alter conference to experience the scenic beauty of Senggigi Beach and uniue culture of the local people in the pursuit of enriching your very human touch to God's creations, especially in mutual understanding of the differences in culture and way of life.

Lombok island is located east of Bali. Lombok geographically is almost the same size as Bali and, just as there are popular tourist areas on Bali, so Lombok offers a variety of destinations to suit difieren tholiday makers'tastes. Tropical climate with warm and humid weather all year round. Temperature range from 21 Celsius to 32 Celsius. Wet season starts from November to May and dry season start from May-October. The best time to come is in the month of May when the weather is just perfect with bright daylight and green scenery.

Population is about 2,5 million. The local inhabitants of Lombok are called Sasaks who make up 70% of the population are the predominant group with Balinese, Chinese, Arabian, and Javanese and other ethnics groups making up the rest. Bahasa Indonesia is the National Language, but English is widely spoken. Lombok has three main districts with three capital cities: Mataram in the west, Praya in central and Selong in east Lombok. The majority of commerce is in the capital city of Mataram in west Lombok.

Gentlemen!

Today, we are gathering here in Lombok Island, to follow our NAE tradition that we have nested since year 2000 in Medan noting as the first International eventof our activities. We have committed to continue this tradition every two years. We relieve that alter two years of our hardwork on research we may share and dessiminate them in such a friendships weaher of NAE event.

Due to the retirement of Prof. Homma Hiroomi from TUT, Toyohashi Japan, we would like to arrange a special plenary session dedicated for him as one of the founders of NAE conference.

Thus, on behalf of the Organizing Committees, we would like to Express a warm welcome to all delegates and participants to the 6th International Conference on Numarical Analysis in Engineering (NAE 2009). It is a great honor for the International Center for Science, Technology, and Art (IC-STAR) University of Sumatera Utara (USU) to host the conference here in Lombok Island, Mataram City.

I believe that this Conference is an important forum for the exchange of information and research results among us, who come from different countries, different educational and research institutes, and different research interest. But we are one in the same room today for all of us have a same tool to achieve our goals, i.e. numerical methods. Thus, I hope that the contacts established during the Conference may bind us in one vision. A vision of achieving better tomorrow together. Wish that we may strengthen close relationship hmong NAE members, develop more joint research poject, and very importantly we have a strong commitment to support the NAE events forever.

In closing, I would like to thank the Rectors of University of Sumatera Utara (USU) and University of Mataram (UNRAM), collegues in University Kebangsaan Malaysia (UKM), CADline Studio, and the Management of Jayakarta Lombok Hotel for supporting this conference. I would also like to thank all International Advisory Board for their contribution in reviewing the abstracts and manuscript. Last but not least, special thanks goes to all NAE OC members for their hard work and patience.

WASSALAMUALAIKUM WARAHMATULLAHI WABARAKATUH

THANK YOU!

1. CONFERENCE ORGANIZATION

Honorary Executive Committee

- **Prof. dr. Fasli Jalal, Ph.D**
  Director of DGHE, the Department of National Education, Republic of Indonesia
- **Prof. Chairuddin P. Lubis, DTM&H, Sp. A(K)**
  Rector, University of Sumatera Utara (USU)
- **Prof. Dr. Ir. Satryo Soemantri Brodjonegoro**
  Visiting Professor, TUT Japan
- **Prof. Ir. Mansur Ma'shum, Ph.D**
  Rector, University of Mataram
- **Prof. Dr. Ir. Djoko Santoso**
  Rector, Institute of Technology Bandung
- **Prof. Dr. Ir. Djoko Suharto**
  Institute of Technology Bandung

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Toyohashi University of Technology, Toyohashi, Japan

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Inter-University Center, Institut Teknologi Bandung, Bandung, Indonesia

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Xinjiang Engineering College, Xinjiang, China

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Chulalongkorn University, Bangkok, Thailand

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Universitas Sumatera Utara, Medan, Indonesia

Prof. Yasuhiro Kanto
Toyohashi University of Technology, Toyohashi, Japan

Prof. Ahmad Kamal Arifin
University of Kebangsaan Malaysia, Bangi, Malaysia

Prof. Jamasri, Ph.D
University of Gadjah Mada, Yogyakarta, Indonesia

Assoc. Prof. Ichsan S. Putra
Institute of Technology Bandung, Bandung, Indonesia

Organizing Committee

- Chairperson:
  - Bustami Syam
  - (Director IC-STAR USU, Indonesia)
- Co-Chairperson:
  - Masanori Kikuchi (SUT, Japan)
  - Ahmad Kamal Ariffin (UKM, Malaysia)
  - Ichsan S. Putra (ITB, Bandung)
- Regular Conference Coordinators:
  - Samsul Rizal (UNSYIAH)
  - Ikhwansyah Isranuri (USU)
  - Sabar Nababan (UNRAM)
  - Taufiq Bin Nur (USU)
- Student Conference Coordinators:
  - M. Sabri (UKM)
  - Heru Santoso (UGM)
  - Tulus (USU)
- Secretary:
  - Ikhwansyah Isranuri (USU, Indonesia)
- Program Coordinator:
  - Hendri Nurdin; Batu Mahadi Siregar; Zulfikar
- Secretariat & Treasurer:
  - Lely Savira Harahap
- Supporting Staffs:
  - M. Sabri (UKM), Farid Triawan (Tokyo Tech, Japan),
  - Eliza A. Rahayu, Rahmayani Siregar, Eva Mugdhiyana, Suita Sari
- Local Supporting Staffs:
  (University of Mataram's Students)

2. CONFERENCE SCOPES

The conference covers, but not limited to, the following topics:

- Fracture Behaviors
- FEM in Forming Process
- Computational Mechanics
- Static and Dynamic Problems
- Noise and Vibration Control in Engineering
- The Atomic/Molecular Dynamics
- Analysis of Machine Element Design
- Computational Method in Chemical Engineering
- FEM Application in Geotechnical and Structural Engineering
- Numerical and Experimental Fracture Mechanics
- Numerical Analysis Tools for Web-Based Applications
- Computational Methods in Thermo and Fluid Mechanics
- Artificial Intelligence Application in Engineering, such as Expert System, Pattern Recognition, Neural Network Genetic Algorithm, etc.
- Metal and Polymeric Foams
- Experimental Solid and Fluid Mechanics

3. CONFERENCE INFORMATION

3.1. Conference Venue

The Jayakarta Lombok Hotel
Jl. Raya Senggigi Km. 4 Senggigi, Lombok, 83351, NTB, PO Box 1112 Mataram

3.2. Function Areas

The various function of the conference will take place at the following locations:

- **Pre-Registration**
  Hotel Lobby (First Floor), located near senggigi room, The Jayakarta Lombok Hotel
  Thursday, 14 May 2009, 04.30-06.00 p.m.
- **Welcome Party [Dinner]**
  Senggigi Room, The Jayakarta Lombok Hotel
  Thursday, 14 May 2009, 07.00-10.00 p.m.
- **Registration**
  Senggigi Room (First Floor).
  Friday, 15 May 2009, 08.00-09.00 a.m.
- **Secretariat**
  Couttage Sea View.
  (See Important Contat Numbers in this booklet).
- **Opening Ceremony & Keynote Speeches**
  Senggigi Room (First Floor)
  Friday, 15 May 2009, 09.00 a.m - 12.30 p.m.
- **Technical Sessions (Regular and Student Conference)**
  Senggigi Room, Mataram Room, and Gili Trawangan Room. The Jayakarta Lombok Hotel.
- **Coffee/Tea Break**
  Senggigi Room, Mataram Room, and Gili Trawangan Room. The Jayakarta Lombok Hotel.
- **Lunch**
  - Suranadi Restaurant, The Jayakarta Lombok Hotel.
- **Banquet/Dinner**
  Pool Side, The Jayakarta Lombok Hotel
  Friday, 16 May 2009, 07.00 – 10.00 p.m.

- **Closing Ceremony**
  Senggigi Room (First Floor)
  Saturday, 16 May 2009, 03.00 - 03.30 p.m.

3.3 **Language**

The official language of the Conference is English.

4. INSTRUCTIONS FOR CHAIRPERSONS AND SPEAKERS

- All chairpersons and speakers are requested to meet in their respective session room at least 10 minutes prior to the commencement of each session.
- A total of 50 minutes is given for keynote speakers in plenary session: 30 minutes for presentation and 20 minutes for discussions.
- A total of 30 minutes is given for keynote speakers in technical session: 20 minutes for presentation and 10 minutes for discussions.
- A total of 20 minutes is given for technical papers: 15 minutes for presentation and 5 minutes for questions and answers.
- Please keep your presentation within the time limits stated.
- Speakers, who are not using their own notebook computer, are advised to submit their presentation materials stored either in CD-ROM or USB Flash Disk to the Secretariat Room at least 30 minutes before presentation.

5. PROGRAM HIGHLIGHT

Table 5.1 shows you the NAE2009 activities. The Opening Ceremony schedule is described in Table 5.2

Table 5.1 NAE2009 Program Activities

Thursday, 14 May 2009	
TIME	**ACTIVITIES**
4:30 – 6:00 PM	Pre-Registration
7:00 – 11:00 PM	Welcome Party/Dinner
Day – 1: Friday, 15 May 2009	
TIME	**ACTIVITIES**
8:00 - 9:00 AM	Registration
9:00 - 9:50 AM	**Opening Ceremony**
9:50 - 10:20 AM	**Keynote Speeches #1**
10:20 - 10:40 AM	Coffee/Tea Break
10:40 - 11:30 AM	**Keynote Speeches #2**
11:30 AM - 12:20 PM	**Keynote Speeches #3**
12:20 – 13:40 PM	Lunch Break
13:40 – 15:30 PM	**Technical session**
15:30 – 15:50 PM	Coffee/Tea Break
15:50 – 17:40 PM	**Technical session**
19:00 – 21:00 PM	Dinner
Day – 2: Saturday, 16 May 2009	
TIME	**ACTIVITIES**
8:30 – 10:20 AM	**Technical session**
10:20 – 10:40 AM	Coffee/Tea Break
10:40 AM – 12:40 PM	**Technical session**
12:40 – 13:40 PM	Lunch Break
13:40 – 15:50 PM	**Technical session**
15:50 – 16:00 PM	Coffee/Tea Break
16:00 – 17:00 PM	Closing Ceremony + Group Photo
	Cultural tour (arranged upon request)

Table 5.2 NAE2009 **Opening Ceremony Activities**

Friday, 15 May 2009 *Senggigi Room, The Jayakarta Lombok Hotel*		
Time [AM]	**Activities**	
9.00 – 9.10	Chairman's Messages	**Prof. Dr. Bustami Syam** *NAE2009 Chairman*
9.10 – 9.20	A Ceremony for the retirement of Prof. Dr. Hiroomi Homma from TUT, Japan. He is one of the Founders of the NAE conference	to be arranged by the NAE Chairman
9.20 – 9.40	The Founder of NAE Conference Messages	**Prof. Dr. Hiroomi Homma** *Toyohashi University of Technology (TUT), Japan*
9.40 – 9.50	Welcome Address and Opening Remarks on Behalf of Honorary Executive Committee	**Prof. Chairuddin P. Lubis, DTM&H, Sp.A (K)** *Rector, University of Sumatera Utara (USU), Medan, Indonesia*
9:50 - 10:20	**Keynote Speeches:** Discrete Dislocation Dynamics Approach to Dynamic Fracture Toughness under Short Pulse Loads	**Prof. Dr. Hiroomi Homma** Moderator: **Prof. Dr. Ahmad Kamal Ariffin Mohd. Ihsan** *Universiti Kebangsaan Malaysia (UKM), Malaysia*
10:20 - 10:40	**Coffee/Tea Break**	

6. KEYNOTE SPEECHES

In the 6th International Conference on NAE2009, we hold two types of keynote speeches. One is held in PLENARY SESSION (after opening ceremony), and another one is held in TECHNICAL SESSION, on 16 May 2009. The plenary session is situated at Senggigi Room, First Floor; the Technical Sessions is accommodated at Senggigi Room, Mataram Room, and Gili Trawangan Room.

The one held in the plenary session is especially dedicated to the retirement of Prof. Dr. Homma Hiroomi from Toyohashi University of Technology (TUT), Japan. He is one of the founders of the NAE.

6.1. Keynote Speakers and Moderator in Plenary Session

The keynote speakers for plenary sessions are:

Key note Speaker #1 : Prof. Dr. Hiroomi Homma
Toyohashi University of Technology, Japan
Key note Speaker #2 : Prof. Dr. Liu Gui Rong
Centre for Advanced Computations In Engineering Science, National University of Singapore, Singapore
Key note Speaker #3 : Prof. Dr. Yasuhiro Kanto
Ibaraki University, Japan
Moderator : Prof. Dr. Kiyohiro Miyagi
University of the Ryukyus, Japan

Title of Paper and Its Abstract

The 1st keynote speech:

Discrete Dislocation Dynamics Approach to Dynamic Fracture Toughness under Short Pulse Loads*

Hiroomi HOMMA and Huu Nhan TRAN*****

** International Cooperation Center for Engineering, Education Development, Toyohashi University of Technology, Hibarigaoka, Tempaku-cho, Toyohashi 441-8580, Japan. E-mail: hh-homma@dc4.so-net.ne.jp

***Department of Mechanical Engineering, Toyohashi University of Technology, 1-1 Hibarigaoka, Tempaku-cho, Toyohashi 441-8580, Japan, E-mail: thnhanbkoto@homma-tut.jp

Mode I crack initiation properties under stress intensity pulses with durations of 20 to 100 μs are investigated by experiments and discrete dislocation dynamics. The cleavage and the dimple fracture initiation are numerically analyzed under the considerations of the pile-up of dislocations against an obstacle ahead of the crack tip and of a void volume fraction at the inner ligament between a main crack and a dominant void. In the experiment, under very short pulse loads with the duration of less than 50 μs, the dynamic fracture toughness, dynamic fracture toughness K_{Id} remarkably increases. The numerical results are compared with the experimental ones in reasonable agreement in both cases of the cleavage and the dimple fracture. These numerical results can provide one physical meaning of the minimum time or incubation time criterion.

Key words*:* discrete dislocation dynamics, cleavage fracture, short pulse load.

The 2nd keynote speech:

A Weakened Weak (W2) Form Based on G Space Theory for A Unified Formulation of Compatible and Incompatible Displacement Numerical Methods

G. R. Liu[1,2]
[1]Centre for Advanced Computations in Engineering Science, Department of Mechanical Engineering, National University of Singapore, 9 Engineering Drive 1, Singapore 117576
[2] Singapore-MIT Alliance (SMA), E4-04-10, 4 Engineering Drive 3, Singapore, 117576

This paper introduces a weakened weak form (W2) using a generalized gradient smoothing technique for a unified formulation of a wide class of compatible and incompatible displacement methods including settings of the finite element methods (FEM) and mesh free methods of special properties including the upper bound properties. A G space is first defined to include discontinuous functions allowing the use of much more types of methods/techniques to create shape functions for numerical models; Properties and a set of important inequalities for G spaces are then proven in theory and analyzed in detail. We prove that the numerical methods developed based on the W2 formulation will be spatially stable, and convergent to exact solutions. We then present examples of some of the possible W2 models, and show the major properties of these models: 1) it is variationally consistent in a conventional sense, if the solution is sought in a H space (compatible cases); 2) it passes the standard patch test when the solution is sought in a G space with discontinuous functions (incompatible cases); 3) the stiffness of the discretized model is reduced compared to the FEM model and even the exact model, allowing us to obtain upper bound solutions with respect to both the FEM and the exact solutions; 4) the W2 models are less sensitive to the quality of the mesh, and triangular meshes can be used without any accuracy problems. These properties and theories have been confirmed numerically via examples solved using a number of W2 models including compatible and incompatible cases.

Keywords: Numerical methods, meshfree methods, FEM, solution bound; variational principle

The 3rd keynote speech:

XFEM Formulation of a Hermitian Type Triangular Element only with Corner Nodes

Yasuhiro Kanto

Department of Mechanical Engineering, Ibaraki University, 4-12-1, Nakanarusawa-cho, Hitachi, 314-8511 JAPAN. Phone/Fax.: +81-294-38-5027. E-mail: kanto@mx.ibaraki.ac.jp

A new Hermitian type triangular element with corner nodes is proposed to improve the accuracy of simple triangular elements for complicated shaped problems. In this paper, XFEM formulation of this new element is briefly described. Some numerical examples of solid mechanics problems are also demonstrated.

Keywords: XFEM, Triangular Element, Gradient Degrees of Freedom, Corner Nodes.

6.2. Keynote Speakers in Technical Session

At the beginning of each TECHNICAL SESSION we hold keynote speeches, as shown in Table 6.1.

Table 6.1 List of keynote speakers for technical sessions

Prof. Dr. Kikuchi Masanori	Mechanical Engineering Department, Tokyo University of Science, Japan.
Muhammad Mat Noor, M.Sc.	Faculty of Mechanical Engineering, Universiti Malaysia Pahang, Malaysia.
Dr. Eng. Agus Setyo Muntohar, M.Eng.Sc	Universitas Muhammadiyah Yogyakarta, Indonesia.
Prof. Dr. Rosli Abu Bakar	Faculty of Mechanical Engineering, Universiti Malaysia Pahang, Malaysia.
Ir. Budi Santosa, Ph.D	Institut Teknologi Sepuluh Nopember (ITS) Surabaya, Indonesia.
R. Zadghaffari, M.Sc.	Sahand University of Technology, P.O. Box 51335/1996, Tabriz, Iran
Prof. Dr. Satryo Soemantri	ICCEED, Toyohashi University of Technology, Japan. Institut Teknologi Bandung, Indonesia.
Prof. Dr. Kiyohiro Miyagi	University of the Ryukyus, Japan
The Jaya Suteja, ST., M.Sc.	University of Surabaya, Indonesia
Hoklie	University Al-Azhar Indonesia (UAI), Indonesia.

6.3. Reviewer for Student Conference

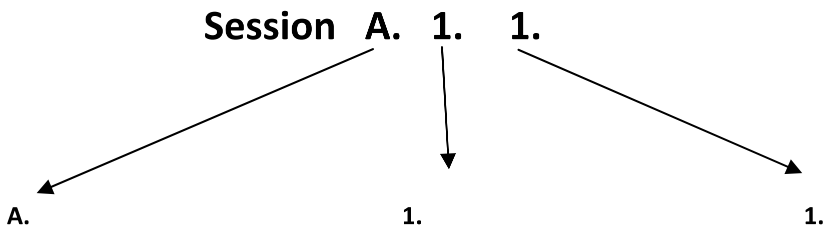
For student conference reviewers as show in Table 6.2 will be in charge for reviewing and judging the presentation performance and material of student.

Table 6.2 List of Reviewers

Prof. Dr. Kikuchi Masanori	Tokyo University of Science, Tokyo, Japan
Prof. Dr. Ahmad Kamal Arifin	University of Kebangsaan Malaysia

7. TECHNICAL SESSION

Table 7.1 shows the matrix of the presentation schedule for technical session. The detailed schedule is shown in Table 7.2. The guideline for your easily reading the table is depicted in Fig. 7.1.



The “A” tells you that this session is located in Sati III Room (Regular Conference) and “B” is located in Basa III Room (Student Conference).

The “1” constitutes the presentation scopes. For example: Analysis Of Machine Element Design: Numerical And Experimental Study

The “1” here indicates the day of activity conducted.

Fig. 7.1 Technical session code

Table 7.1 Presentation Schedule in Technical Session (Day-1)

Day-1 (Friday, 15 May 2009)		
Technical Session		
TIME	ACTIVITIES	
	Senggigi Room (Regular Conference)	**Mataram Room (Regular Conference)**
13:40 - 15:30	Session A .1. 1: FRACTURE BEHAVIORS ; THE ATOMIC / MOLECULAR DYNAMICS ; FEM APLICATION Chairperson: Prof. Homma Hiromi	Session A. 2. 1: ARTIFICIAL INTELLIGENCE APLICATION IN ENGINEERING ; Chairperson: Prof. Ahmad Kamal Arifin
15:30 – 15:50	**COFFEE/TEA BREAK**	
15:50 - 17:40	Session A. 3. 1: FEM APPLICATION IN GEOTECHNICAL; Chairperson: Ir. Budi Santosa, MS., Ph.D.	Session A. 4. 1: COMPUTATIONAL METHODS IN THERMO AND FLUID MECHANICS Chairperson: Prof. Miyagi Kiyohiro
7:00 - 11:00	**BANQUET DINNER**	

Table 7.2 Presentation Schedule in Technical Session (Day-2)

Day-2 (Saturday, 16 May 2009)		
Technical Session		
TIME	ACTIVITIES	
	Senggigi Room (Regular Conference)	**Mataram Room (Regular Conference)**
8:30-10:20	Session A. 5. 2: COMPUTATIONAL METHODS IN ELECTRICAL AND ELECTRONIC APPLICATION Chairperson: Dr. Bambang Agus Kironoto	Session A. 6. 2: COMPUTATIONAL METHOD IN CHEMICAL ENGINEERING Chairperson: Dr. Syifaul Huzni, M.Sc.
10:20-10:40	COFFEE/TEA BREAK	
10:40-12:40	Session A. 7. 2: FEM APPLICATION; COMPUTATIONAL MECHANICS; Chairperson: Prof. Dr. Yasuhiro Kanto	Session A. 8. 2: ANALYSIS OF MACHINE ELEMENT DESIGN; NUMERICAL & EXPERIMENTAL FRACTURE MECHANICS; Chairperson: Prof. Ahmad Kamal Arifin
12:40-13:40 .	LUNCH BREAK	
13:40-15:30	Session A. 9. 2: ARTIFICIAL INTELLIGENCE APLICATION IN ENGINEERING; COMPUTATIONAL METHODE Chairperson: Dr. Amna Abdurrahman	Session B. 1. 2: COMPUTATIONAL METHODE Chairperson: Dr.Eng. Agus Setyo Muntohar Reviewer : 1. Prof. Dr. Kikuchi Masanori 2. Prof. Dr. Ahmad Kamal Arifin
3:30-3:50	**COFFEE/TEA BREAK**	
4:00-4:30	**CLOSING CEREMONY / GROUP PHOTO**	

Table 7.3 Detailed of Presentation Schedule in Technical Session

AFTERNOON SESSION	DAY 1 – FRIDAY, 15 May 2009	
	VENUE A (Regular Conference): Senggigi Room (First Floor)	VENUE B (Regular Conference): Mataram Room (First Floor)
13.40-15.30	Session A .1. 1: **FRACTURE BEHAVIORS ; THE ATOMIC / MOLECULAR DYNAMICS ; FEM APLICATION** Chairperson: Prof. Dr. Homma Hiromi	Session A. 2. 1: **ARTIFICIAL INTELLIGENCE APLICATION IN ENGINEERING ;** Chairperson: Prof. Ahmad Kamal Arifin
Keynote Speaker	1. Fatigue Crack Growth Simulation In 3-D Field using S-FEM ***Masanori Kikuchi, Yoshitaka Wada and Yulong Li***	1. Tool Life Analysis by Partial Swarm Optimization ***M.M.Noor, K.Kadirgama, M.M.Rahman, M.S.M.Sani, M.R.M.Rejab, A.K.Ariffin***
	2. A Finite Element Investigation of the Residual Stress and Deformation in Sliding Contact between Cylinders. ***Rifky Ismail, M. Tauviqirrahman, Jamari, and D.J. Schipper*** 3. Finite Element Modeling of Tire-Road Contact ***M. Sabri, A. K. Ariffin & M. J. M. Nor*** 4. Static and Dynamic Load Calculation for Piping Stress Analysis on Electrical Power Generation ***Yusri Heni N. A.*** 5. Pore Water Pressure Change Of A Homogenous Slope During Rainfall Infiltration ***Agus Setyo Muntohar and Hung-Jiun Liao***	2. Sustainable Product Development for Car Lifting Equipment using Virtual Reality ***Willyanto Anggono, Ian Hardianto Siahaan, R.M. Moch. Trah Isworo Nugroho, Satria Arief Budi*** 3. Solving the Multiobjective Transportation Problem using Fuzzy Compromise Programming ***Parwadi Moengin*** 4. Optimum Method Solution for Determining Brake Distance Design ***Ian Hardianto Siahaan, Amelia Sugondo, and Willyanto Anggono*** 5. Surface Rougness Analysis in End Milling with Response Ant Colony Optimization ***K.Kadirgama, M.M.Noor, M.M.Rahman, M.S.M.Sani, A.K.Ariffin***

AFTERNOON SESSION		DAY 1 – FRIDAY, 15 May 2009
	VENUE A (Regular Conference): Senggigi Room (First Floor)	VENUE B (Regular Conference): Mataram Room (First Floor)
15.50 – 17.40	Session A. 3.1: **FEM APPLICATION IN GEOTECHNICAL;** Chairperson: Ir. Budi Santosa, MS., Ph.D.	Session A. 4.1: **COMPUTATIONAL METHODS IN THERMO AND FLUID MECHANICS** Chairperson: Prof. Dr. Miyagi Kiyohiro
Keynote Speaker	1. Lateral Movement of the Tie-Back Wall in Alluvial Soil ***Agus Setyo Muntohar, Hung-Jiun, Liao***	1. Numerical Investigation of In-Cylinder Pressure Characteristic of Port Injection Compressed Natural Gas Engine Model **Rosli Abu Bakar and Semin**
	2. Numerical Analysis of Time Dependent Laterally Loaded Pile in Clay ***Jasim M Abbas, Zamri Hj Chik, Mohd Raihan Taha, Qassun S. M Shafiqu*** 3. Numerical Modelling on Shallow Water 2D Equations Applied on Flow Around a Cylinder ***Bambang Yulistianto*** 4. A Design Approach of Shallow Foundation Based on Rigid Plastic Analysis ***Husna Asmaul*** 5. Gravitational Pump Design Based on Runge-Kutta Method ***J. Aminuddin***	2. The k-ε Turbulence Model for Predicting Turbulence Characteristics in Rough Uniform Open Channel Flow ***Bambang Agus Kironoto*** 3. Sustainable Technology for Improving Autoclave Performance using Finite Element Application ***Willyanto Anggono, Ian Hardianto Siahaan, Andree Kadana Tirta, Satria Arief Budi*** 4. Verification of A VOF–Based Simulation for Thin Liquid Film Flow Applications **S. Balachandran, N.H. Shuaib,** **H. Hasini, M.Z. Yusoff** 5. Trends of Engine Speed On Engine Performance Of Four Cylinder Direct Injection Hydrogen Engine **M. M. Rahman, Mohammed K. Mohammed, Rosli A. Bakar, M.M. Noor and K. Kadirgama**

MORNING SESSION	DAY 2 – SATURDAY, 16 May 2009	
	VENUE A (Regular Conference): SenggigiRoom (First Floor)	VENUE B (Regular Conference): Mataram Room (First Floor)
08.30-10.20	Session A. 5. 2: **COMPUTATIONAL METHODS IN ELECTRICAL AND ELECTRONIC APPLICATION** Chairperson: Dr. Bambang Agus Kironoto	Session A. 6. 2: **COMPUTATIONAL METHOD IN CHEMICAL ENGINEERING** Chairperson: Dr. Syifaul Huzni, M.Sc.
Keynote Speaker	1. Kernel Adatron for Multiclass Support Vector Machine ***Budi Santosa***	1. Evaluation of Drag Force Effect on Hold-Up in A Gas-Liquid Stirred Tank Reactor ***R. Zadghaffari***
	2. Numerical Method for Constructing Optimal Bids by Electricity Generators in Deregulated Electricity Market ***Vladimir Kazakov*** 3. Analysis Throughput Multi-code Multicarrier CDMA S-ALOHA To Support Various Data Rate ***Indri Neforawati and Hoga Saragih*** 4. Churn Prediction in Telecommunication using Kernel Adatron ***Budi Santosa*** 5. Local Short-Term Wind Speed Prediction in the Region Nganjuk (East-Java) using Neural Network ***Ali Musyafa, Binti Cholifah, Imam Robandi***	2. Cathodic Protection Simulation for Pipe-Lines Structure with Ribbon Sacrificial Anode ***Safuadi, Syarizal Fonna, M. Ridha, Israr, A. K. Ariffin and A. R. Daud*** 3. Prediction of Wax Deposition in Pipeline by CFD Techniques ***Hoda seyedinezhad, Farmarz Hormozi*** 4. Corrosion Analysis using BEM by Considering Polarization Curve of Steel ***Syarizal Fonna, Safuadi, Israr, M. Ridha, and A. K. Ariffin*** 5. Implementation of Parallel Computational tools for the Curing Simulation of Thermoset Composites Using the One Dimension Age Algorithm ***Amna Abdurrahman, Ahmad Kamal bin Zulkifle, Norma Alias, and Ishak Hashim***

DAY 2 – SATURDAY, 16 May 2009 (continue)		
	VENUE A (Regular Conference): Senggigi Room (First Floor)	VENUE B (Regular Conference): Mataram Room (First Floor)
10.40-12.40	Session A. 7. 2: **FEM APPLICATION; COMPUTATIONAL MECHANICS;** Chairperson: Prof. Dr. Yasuhiro Kanto	Session A. 8. 2: **ANALYSIS OF MACHINE ELEMENT DESIGN;** Chairperson: Prof. Ahmad Kamal Arifin
Keynote Speaker	1. On the Edge-effect of Stress Concentration Factor in Thin Plate with Two Holes ***Satryo Soemantri***	1. Shock and Elastic Waves on Dynamic Compaction Process of Two Layered Powder Media in the Dies **Kiyohiro Miyagi, Yukio Sano, Takuo Hayashi, Toshiyasu Sueyoshi**
	2. 3D Visualization of Wire Radiation Pattern using NEC2++ Antenna Radiation Generator ***Ridwan Montezari, Ignatius Dwi Mandaris, Lisandro Damian N Perez Meyer, Soemarni Mardjoeki, R. Harry Harjadi, Harry Ramza*** 3. Sound Profile Measurement for Brackish Water ***Sunardi, Anton Yudhana, Jafri Din, Saberi Mawi*** 4. Simulation for Predicting Thermal Effect in the Eye's Tissues Following A theraphy using Laser Retinal Photocoagulator ***AMT Nasution, NAP Ningtyas*** 5. Numerical Analysis of Harmonic Propagation and Distortion Caused by a Nonlinear Load in Balance Distribution Network ***Sabar Nababan***	2. Stress Distribution Analysis of Stress Corrosion Cracking Specimen using Ansys ***Syifaul Huzni, M. Ikhsan, M. Ridha & A. Kamal Ariffin*** 3. Crack Initiation and Propagation in Nylon 6 Sphere under Various Impact Velocities ***Sutikno and H. Homma*** 4. Optimization of the simple plate using high cycle multiaxial fatigue criteria ***A.E Ismail[1], A.K Ariffin, S. Abdullah*** 5. Influence of Magnetic Field on Noise Reduction: Experimental Study on Automotive Noise Silencer ***Ikhwansyah Isranuri, Eka Sunitra***

DAY 2 – SATURDAY, 16 May 2009 (continue)		
	VENUE A (Regular Conference): Senggigi Room (First Floor)	VENUE B (Student Conference): Mataram Room (First Floor)
13.40 – 15.30	Session A. 9. 2: **ARTIFICIAL INTELLIGENCE APLICATION IN ENGINEERING; COMPUTATIONAL METHODE** Chairperson: Dr. Amna Abdurrahman	Session B. 1. 2: **COMPUTATIONAL METHODE** Chairperson: Dr.Eng. Agus Setyo Muntohar, M.Eng.Sc. Reviewers : 1. Prof. Dr. Kikuchi Masanori 2. Prof. Dr. Ahmad Kamal Arifin
Keynote Speaker	1. Application of Fuzzy Multiple Attribute Group Dicision Making Method in Stretcher Concept Selection ***The Jaya Suteja***	1. Genetic Algorithms Approach for Multiobjective Stock Portfolio Optimization Problem ***Hoklie and Lavi Rizki Zuhal***
	2. Application Augmented Lagrange Multiplier Method In the Collaborative Optimization of Engineering Product Design ***Yuwono B. Pratiknyo*** 3. Analysis of Tapered Velocity and Tapered Coupling Couplers ***Ary Syahriar*** 4. Impact Response of Traffic Cones with Different Lower Base Structures ***Bustami Syam, Weriono, Rahmawati, Samsul Rizal, Basuki Wirjosentono***	2. Symmetrical and Unsymmetrical Flow Separation in Supersonic Ideal Contour Nozzles ***Bagus H. Jihad, Dedi Priadi, Tresna P. Soemardi, Eddy S. Siradj*** 3. Comparison Eigenvalue of Planar Waveguide Characteristic Equation using Analytical Approach and Method of Line ***Wibi Noviardi*** 4. Switch Characteristic in Silica Directional Couplers ***Disra Agifral, Syifa'ul Barir, and Ary Syahriar*** 5. Design and Analysis of Supersonic Axysimmetric Minimum Length Nozzle (MLN) As Rocket Nozzle ***Bagus H. Jihad, Dedi Priadi, Tresna P. Soemardi, Eddy S. Siradj*** *6.* Stress Distribution Simulation in Non-Standardized Motor Cycle Helmet Subjected impact Loading ***Izwar Lubis, Bustami Syam, Samsul Rizal, Tugiman***

8. COLLECTION OF ABSTRACTS

The collection of abstract is arranged in the accordance with the schedule of detailed technical sessions depicted in Table 7.2. Since the full papers will be peer reviewed and published after presentation, this collection of abstract may help participants to understand the paper work to be presented by other participants. The collection of abstract and the collection of as received papers are also provided in digital form and are attached as part of conference kits.

8.1 FRACTURE BEHAVIORS ; THE ATOMIC / MOLECULAR DYNAMICS ; FEM APLICATION (A.1.1)

1. Fatigue Crack Growth Simulation In 3-D. Field Using S-FEM

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Fatigue crack growth under mixed mode loading conditions is simulated using S-version FEM. By using S-FEM technique, only local mesh should be re-meshed for new crack configuration, and it becomes easy to simulate crack growth. By combining with auto-meshing technique, local mesh easily re-meshed and curved crack path is modeled easily. Fully automatic crack growth simulation system in 3-dimensional problem is developed. Using this system, a basic slant surface crack problem is solved, and it is shown that surface crack grows under pure mode I condition, which is similar to 2-dimensional problem. It is also shown that this system is available for complicated structures, for example, surface crack at inner surface of pipe. Finally, interaction effect of two surface cracks is evaluated.

Keywords: Fatigue, Surface Crack, S-FEM, Interaction Effect

2. The Finite Element Study of Static Contact on Multilayered Solids

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Faculty of Engineering, University of Diponegoro, Semarang[2)]

The static contact problem of an elastic sphere indenting an elastic-perfectly plastic substrate having three layers is analyzed using the finite element method and compared with a purely elastic analytical solution. The case of multilayered solid is investigated and solutions for the contact pressure, von Mises surface and subsurface stresses and strains are presented for several indentation depth. The solid substrate is covered with 3 layers where the first layer is considered to be elastic-plastic material while the second and third layer are considered to be elastic-perfectly material. The small interference performs good agreement with the Hertz equation while the higher interference, when the threshold of plasticity is reached, performs different result. The pressure distribution deviates considerably from the Hertzian case. Thereafter, as the system is subjected to higher interference, the elastic-plastic deformation initiates in the finite element model.

Keywords: finite element analysis, static contact, multilayered solid

3. Finite Element Modeling of Tire-Road Contact

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This paper presents the finite elemen method (FEM) to analyze tire and road interaction. Excitation of vibration, rolling resistance, traction, and noise generation are all attributes of the interaction between tyres and road. The geometry and the displacement fields of the tire inner surface are described by Bezier polynomials. The contact constraints, including force constraints and displacement constraints, are directly enforced into the governing equations to reduce the number of unknown variables. It is shown that the footprint shape and the stress distribution in the belts predicted by the present method are very close to the results by Ritz type numerical method.

Keywords: tire-road interaction, displacement, Bezier Polynomial

4. Static And Dynamic Load Calculation for Piping Stress Analysis on Electrical Power Generation

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Structure integrity of the piping system on installation of electrical power generation is big and complex construction system. This piping system must be able to restrain all working loads of static load and dynamic load. Capability of piping system to restrain working load so that it doesn't generate failure, known as piping system flexibility, and done by piping stress analysis. This analysis need to be done to ensure that piping system at safe operating condition. Standard calculation for static and dynamic load for stress analysis of piping system on electrical power generation can be used ASME B.31.1. Power Piping. Static load consists of live load and dead load , thermal expansion , construction effect , internal and external pressure, and position of support and anchor. Dynamic load in piping system coming from earthquake , wind , relief valve, water hammer etc. Computer code which used for calculation of static and dinamic load at stress analysis of piping system are CAESAR II , Autopipe, PS CAEPIPE. Case study was done for piping stress analysis of PLTU LABUAN 300 MWe to piping system from outlet boiler superheater to inlet high pressure turbine (HPT) to sustain load, thermal expansion load and occasional load. For occasional load from wind is not considered because the location of piping system inside of the building. Occasional load from earthqueke is considered due to zone earthquake district V of Labuan location that has earthquake factor 0.25 g. Result of stress analysis of PLTU Labuan indicates that basic design of piping system at the area of outlet superheater boiler to high pressure turbin has not considered earthquake load factor. At piping system line of outlet superheater to inlet HPT for condition of 0.25g stress happened as result of occasional load at x direction is 289.27 % and at z direction is 300.83 %. Changes of position and restrain support type and minimum pipe thickness 42 m at diameter pipe 273.050 mm were proven to be able to cope earthquake factor 0.25 g in order to meet requirement for earthquake district zone V of Labuan location. This methode can be used by BAPETEN to conduct verification of piping stress calculation of the primary pipe line such as main steam line of nuclear power plant construction from NPP aplicant or licensee.

Keywords: Static and Dynamic Load, Piping Stress Analysis.

5. PORE WATER PRESSURE CHANGE OF A HOMOGENOUS SLOPE DURING RAINFALL INFILTRATION

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Transient seepage analyses of rainfall infiltration were carried out by means of the two-dimensional finite element program SEEP/W. The finite element mesh used in these analyses is shown in Fig. 6. It represents an infinite slope having an inclination of 458 and it consists of 12 m deep weathered soil overlying impermeable bedrock. The groundwater table is located at the bedrock-weathered soil interface and is parallel to the slope. Infinite elements are used at the vertical boundaries of the mesh to simulate infinite slope conditions. The top boundary is subjected to a rainfall intensity that is equal to the saturated permeability of the weathered soil to ensure downward infiltration into the weathered soil layer.

The lowersection, near the base of the slope, is completely saturated with pore water pressures close to atmospheric pressure (conventionally 0 kPa). In part, this is due to the flow along the interface, which builds up down slope as it receives input from the upper slope sections. Pore water pressure profiles were found to follow the theoretical hydrostatic lines. This is considered to be due to matric suction recovery in the unsaturated portion of the soil layer and a consequence of the conditions reaching a state of equilibrium below the groundwater table.

In the final phase of the storm, the saturated layer rises towards the surface within the lower section of the slope.

Keywords: shallow slope failure, rain infiltration, Green-Ampt model, infinite slope, typhoon, normalized rainfall intensity, normalized accumulated rainfall

8.2 ARTIFICIAL INTELLIGENCE APLICATION IN ENGINEERING (A.2.1)

1. Tool Life Analysis by Partial Swarm Optimisation

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Tool life is one of the main factors to be considered in CNC milling machine. Prediction model and optimum values are very important for the machinist to save number of cutting tools and reduce machining time. The aim of the this paper is to develop the tool life prediction model for P20 tool steel with aid of statistical method and to determine the optimisation values using partial swarm optimisation (PSO) for coated carbide cutting tool under different cutting conditions. By using response surface method, first and second order models were developed with 95% confidence level. The tool life model was developed in terms of cutting speed, feed rate, axial depth and radial depth. In general, the results obtained from the mathematical model are in good agreement with that obtained from the experiment data's. It was found that the feed rate, cutting speed, axial depth and radial depth played a major role to determine the tool life. On the other hand, the tool life increases with the reduction of cutting speed and feed rate. For end-milling of P20 tool steel, the optimum cutting speed, feed rate, axial depth and radial depth obtained from PSO are of 100 m/s, 0.1 mm/rev, 1.9596 mm and 2 mm respectively. The optimized tool life of 40.52 min was obtained using the above mentioned parameters.

Keywords: End-milling, Tool life, response surface method, partial swarm optimisation, cutting speed, feed rate, depth of cut.

2. Sustainable Product Development For Car Lifting Equipment Using Virtual Reality

Willyanto Anggono[1], Ian Hardianto Siahaan[2], R.M. Moch. Trah Isworo Nugroho[3], Satria Arief Budi[4]

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Sustainable development is an integral concept for achieving quality of limits, interdependence, fundamentals and equity. Virtual reality means existing or resulting in essence or effect though not in actual fact, form, or name. Machine design is always interesting for most people, it is also becoming more and more popular now a days. Showing the performance of a machine design during the design phase is possible to do using 3D Max and ANSYS software.

Car lifting equipment is a device to lift a car for several workshop purposes as replace oil, fix car's break, overhaul engine, periodical maintenance and many others. Conventional car lifting equipment design needs a lot of cost, time, and materials because it needs doing the real test to understand the performance of the car lifting equipment design. The primary target of this research is to search and decide which mechanism is the most suitable for this machine and also the virtual reality to show it's performance during the design phase.

In this research, sustainable product development using virtual reality with 3D Max and ANSYS software is used rather than conventional design. The goal of this research is to show the performance of the machine during the design phase using 3D Max and ANSYS software.

Finally, car lifting equipment has been designed in this research using 3D Max and ANSYS software as a solution of sustainable product development. Designing car lifting equipment using 3D Max and ANSYS virtual reality software can reduce materials, cost and time of product development. Virtual reality using 3D Max and ANSYS software is a sustainable technology for sustainable product development in the car lifting equipment design.

Keywords: Sustainable Product Development, Virtual Reality, Car Lifting Equipment.

3. Solving the Multiobjective Linear Transportation Problem Using Fuzzy Compromise Programming

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The aim of this paper is to present a fuzzy compromise programming approach to multiobjective transportation linear problems. A characteristic feature of the approach proposed is that various objectives are synthetically considered with the marginal evaluation for individual objectives and the global evaluation for all objectives. The decision-maker's preference is taken into account by his/her assigning the weights of objectives. With the global evaluation for all objectives, a compromise programming model is formulated. Using ordinary optimization technique, we solve the fuzzy compromise programming model to obtain a non-dominated compromise solution at which the synthetic membership degree of the global evaluation for all objectives is maximum. A numerical example is given to demonstrate the efficiency of the proposed fuzzy compromise programming approach.

Keywords: multiobjective transportation linear problem, fuzzy compromise programming

4. Optimum Method Solution for Determining Brake Distance Design

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Fuzzy logic is a powerful method for mapping space input into space output. Between space input and output there is a black box for mapping input towards suitable output. Although many ways works with the black box, fuzzy logic will give powerful solution. The purpose of the research is looking for relation parameters between velocity and brake pressure of vehicle model that can be control to determine optimum brake distance of vehicle model by using rules base of fuzzy logic with verbose format. The step of research methodology are: determining space input variable of fuzzy logic i.e. : velocity and brake pressure, using fuzzy operator, using implication function, composing space fuzzy output of brake distance, and then processing of defuzzification. The result of this research has given optimum brake distance of model vehicle. Where as the maximum of velocity = 112 km/h and brake pressure (P_{brake}) = 80 bars will give minimum brake distance = 24.90 meters, if brake pressure ≤ 22.8 bars will give maximum braking distance = 52.30 meters. The conclusion is model vehicle with brake pressure 20 bars $<P_{brake}<$ 80 bars will give brake distance: 24.90 meters$< S_{brake}<$ 52.30 meters in working velocity.

Keywords: Verbose, fuzzy logic, defuzzification

5. Surface Roughness Analysis in End Milling with Response Ant Colony Optimization

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The increase of consumer needs for quality metal cutting related products (more precise tolerances and better product surface roughness) has driven the metal cutting industry to continuously improve quality control of metal cutting processes. Within these metal cutting processes, the end-milling process is one of the most fundamental metal removal operations used in the manufacturing industry. Surface roughness also affects several functional attributes of part such as contact causing surface friction, wearing, light reflection, heat transmission ability of distributing holding and lubricant, coating, or resisting fatigue. Therefore, the desired finish surface is usually specified and the appropriate processes are select to reach the required quality.This paper presents the optimization of the surface roughness when milling Mould Aluminium alloys (AA6061-T6) with Response Ant Colony Optimization (RACO). The approach is based on Response Surface Method (RSM) and Ant colony Optimization (ACO). In this work, the objectives were to find the optimized parameters and find out the most dominant variables (cutting speed, federate, axial depth and radial depth). The first order model indicates that the feedrate is the most significant factors effecting surface roughness. The optimised minimum and maximum values that predicted by RACO were 0.36 µm and 1.37 µm.

Keywords: Response Surface Method, Ant colony optimisation, Surface roughness, Optimised

8.3 FEM APPLICATION IN GEOTECHNICAL (A.3.1)

1. Lateral Movement Of The Tie-Back Wall In Alluvial Soil

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Typically, excavations in urban environment are supported by diaphragm walls with internal braces or tieback anchors. The large working space inside the excavation provided by a tieback anchor system has a significant construction advantage. This paper aims to review the soil stiffness parameters of the alluvial Taipei soil for tie-back diaphragm wall based on back analysis of case study. The case history of The Taipei County Administration Center (TCAC) was studied in this paper. Excavation of the basement was supported with a 1.2 m thick tied-back diaphragm wall with panel depths of 38 m. The deformation analysis was carried out using available finite element code PLAXIS. The soil was modeled as Mohr-Coulomb model, while the wall and anchors were simulated using elasto-plastic model. The simulation results show that the maximum horizontal movement occurred at around the bottom of wall. After excavation was finalized (at the Stage 8), the wall movement reach extreme deformation at the bottom of excavation that is 53.54 mm (0.27% He). The lateral movement of the wall decrease with increasing the soil elasticity parameter. It was concluded that the soil stiffness parameter (E) was estimated satisfactorily based on the E and SPT-N relationship, E = 4336 ~ 6109N. Based on the finite element simulation, the stiffness parameter of the soils ranges from 22 MPa to178 MPa.

Keywords: Anchors; Diaphragm wall; Alluvial Soils, Lateral-movement, Finite Element Method

2. Numerical Analysis of Time Dependent Laterally Loaded Pile in Clay

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A numerical analyses of lateral load single vertical pile conducted on a two-dimensional finite element approach. The pile structural and soil mass material modeled by linear elastic and Mohr-Coulomb models, respectively. While time-dependent process is simulated using Boit's equation of consolidation. The scope of this study is to improve understanding of the effect of time factor and intensity of applied loadings to the lateral pile response embedded on cohesive soil. It concludes that the lateral pile displacement is effect by the time after loading and the intensity of lateral loading applied. Lateral pile deformation occurred at high load that increase the possibility the surrounded soil collapse especially near to the surface.

Keywords: Single pile, consolidation, lateral response, finite element method.

3. Numerical Modelling on Shallow Water 2D Equations Applied On Flow Around a Cylinder

Bambang Yulistiyanto

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The Shallow-water two-dimensional equations are obtained by time averaging the Navier-Stokes equations and integrating these over the flow depth. Consequently, the diffusion-dispersion terms are appeared, containing turbulent and "dispersion" stresses. These developed equations were used to simulate flow fields around a cylinder mounted in the fixed bed, open channel flow.

A special emphasis was placed in elaborating the diffusion-dispersion terms. Turbulent stresses are expressed with the eddy viscosity concept; dispersion stresses are evaluated using velocity distributions along and across the curved streamlines. The differential equations are solved using MacCormack scheme.

The numerical simulation was done for two runs; the expected alteration of the flow field around the cylinder is evident, notably the wake behind the cylinder. In order to check the numerical simulations, flow measurements data were performed. The velocity vectors upstream from the cylinder and along its sides are in reasonably good agreement. However, very close to the cylinder, the simulation sometimes under predicts the velocities. Downstream from the cylinder, agreement is satisfactory both inside and outside the wake. The flow depths at the center line both upstream and downstream from the cylinder are also in good agreement, however along the cylinder circumference, the simulated flow depths are lower than the observed ones. If the dispersion coefficients are neglected, the simulation results wakes behind the cylinder where the upper and lower wakes appeared and alternately separated from the cylinder formed periodic flow structures.

Keywords: Shallow-water 2D equations, numerical simulation, flow fields around a cylinder

4. A Design Approach of Shallow Foundation Based on Rigid Plastic Analysis

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A numerical procedure was employed in this study to assess ultimate bearing capacity of sandy soil foundation. It is compared with conventional method of Prandtl and Terzaghi formulas. The applicability of conventional methods was found to depend highly on agreement of the assumed failure mode with the actual behaviour. No need of assumption for feasible failure modes is great advantage of RPFEM to conventional methods. Employment of non-associated flow rule for constituve equation was also noted. The dilation angle also seems to have a significant influence on the magnitude of ultimate bearing capacity on sandy soil.

Keywords: Shallow foundation, Rigid plastic analysis, Failure mode, Ultimate bearing capacity, Sandy soil.

5. Gravitational Pump Design Based on Runge-Kutta Methods

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The gravitational pump is the name of pump that we plane. It assumed be working based on fluid mechanics principle without useful of mechanics and electric energies. The work principle of the plan of the gravitational pump analyzed using Runge-Kutta methods as one of numerical methods. A Runge-Kutta method was used to modeling of the fluid flow in gravitational pump. The results of these analyses indicate that the gravitational pump capability to get up the water about 10 liter/1.5707 second at 10 meter of high and 0,094248 meter2 of pipe wide.

Keywords: the plan of the gravitational pump, fluid flow, Runge-Kutta methods

8.4 COMPUTATIONAL METHODS IN THERMO AND FLUID MECHANICS (A.4.1)

1. Numerical Investigation of In-Cylinder Pressure Characteristic of Port Injection Compressed Natural Gas Engine Model

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The numerical investigation of in-cylinder pressure performance profile of port injection compressed natural gas (CNG) engine has been investigated using computational model simulation in this paper. In this research, the computational model simulation and numerical investigation of engine model is using GT-POWER software. The engine is running in variations engine speeds from 500 until 4000 rpm. The engine research is focused in investigation the correlation of characteristic in-cylinder pressure performance profile in every engine speed cases. The output data is collected from the results plots in post processing of the software. The numerical in-cylinder pressure results of the CNG engine compared

to diesel engine are shown in this paper. The results are shown that the characters of pressure versus crank angle and in-cylinder pressure versus engine speed of CNG engine is lower than base diesel engine.

Keywords: CNG engine, GT-Power, In-cylinder pressure, Numerical investigation

2. The *k*-ε Turbulence Model For Predicting Turbulence Characteristics in Rough Uniform Open Channel Flow

Bambang Agus Kironoto

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As reported in many literatures, the *k*-ε turbulence model has been widely used and can predict quite well the characteristics of turbulence in jets and boundary layers, as well as in closed and in open-channel flows. In this study, the *k*-ε turbulence model is used to predict the turbulence characteristics in rough uniform 2D open channel flow. The existence of free surface, which represents the most important aspect in the application of the *k* - ε turbulence model, is considered carefully in the model. The *k*-ε turbulence model is based on the classical *k* - ε turbulence model proposed by Launder and Spalding (1974), and with a numerical scheme proposed by Patankar and Spalding (1970).

To evaluate the reliability of the *k*-ε turbulence model in uniform open channel flow, eigth sets of experimental laboratory data of rough uniform 2D open channel flow, *i.e*., the mean point-velocity, eddy viscosity, mixing length, and Reynolds shear stress data, previously measured by Kironoto and Graf (1994), are used to compare with the ones computed by using the *k* - ε turbulence model.

The agreement between the measured data of mean point-velocity, eddy viscosity, and mixing length as well as of the Reynolds shear stress and those computed by using the *k* - ε turbulence model is very satisfactory, although slight deviations occur close the free water surface.

Keywords: *k*-ε turbulence model, open channel flow, experimental laboratory data

3. Sustainable Technology for Improving Autoclave Performance using Finite Element Application

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Sustainable technology is a part of broader concept of sustainable product development and sustainable development is an integral concept for achieving quality of limits, interdependence, fundamentals and equity. Autoclave is a strong, pressurized, steam-heated vessel, as for laboratory experiments, sterilization, or steaming. In general, this vessel contains of a view parts, they are the body which is the cylinder part of the tank, the heads which are used as the closure of the tank, the nozzle which are used as the fluid inlet and outlet port, and the saddle which are use to support body/tank of autoclave. The existing condition in this research, autoclave used to steam animal food materials and operated at 4 Bars pressured. The locking mechanisms are using 4 bolts to lock the door of the autoclave. The design of the autoclave can be operated up to 7 Bars. The bigger pressure operating condition, the faster processing happened.

Based on the existing condition, the goal of this research are finding and solving leakage problem in the area between door (head) and cylindrical shell when the autoclave operates at the pressure more than 4 Bars. The leakage starts when this autoclave operated at 4 Bars pressured. The bigger leakage happened when the autoclave operates at the bigger pressure (7 Bars).

ANSYS software based on the finite element method is used in this research. Based on the simulation result after re-design obtained, this autoclave can operates safely without leakage up to 7 Bars. Designing the mechanical product using ANSYS software can reduce materials, cost and time of the product development. ANSYS software based on finite element method is a sustainable technology for sustainable product development because simulation technology using ANSYS software can perform the performance of the machine during the design phase and reduce materials, cost and time of the product development.

Keywords: Sustainable Technology, Autoclave, Finite Element Method.

4. Verification of a VOF–based simulation for thin liquid film flow applications

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This paper describes the application of the built-in Volume-of-Fluid (VOF) model in the commercial Computational Fluid Dynamics (CFD) software FLUENT™ for the simulation of a thin liquid film flowing into a two-dimensional rectangular cavity and the verification of its accuracy. As the VOF model is based on the field volume fraction calculations and surface reconstruction methods, in which a free surface is not explicitly tracked, the aim was to verify that a reconstructed surface obtained by VOF simulation is representative of a real surface. For this purpose, various cases of a thin liquid film flowing into rectangular cavities were simulated and the resulting surface profiles analyzed in terms of the normal velocity of the constructed surface, which should be zero in a real surface. Both the cases of small and large surface tension coefficients were simulated and the results showed that the VOF model is capable of to generate surface profiles with reasonably accurate normal velocity condition for the cases with small or no surface tension. For high surface tension values, the existence of spurious interface velocity as previously reported in the literature was confirmed. Comparisons of the VOF-calculated surface profiles with the ones obtained using the explicit surface tracking algorithms such as the Boundary Element Method (BEM) reported in the literature showed that the VOF model is able to produce the expected profiles of thin liquid film flowing a two-dimensional rectangular cavity and thus can be considered for simulation of other applications involving thin liquid film flows, provided the grid refinement based on the volume fraction gradient is applied.

Keywords: Thin film flows; Volume of Fluid (VOF); Computational Fluid Dynamics (CFD

5. Trends of Engine Speed On Engine Performance Of Four Cylinder Direct Injection Hydrogen Engine

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This paper explores the effect of engine speed on performance of four cylinder direct injection hydrogen fueled engine. GT-Power was utilized to develop the model for direct injection engine. Air-fuel ratio was varied from rich limit (AFR=27.464) to a lean limit (AFR=171.65). The rotational speed of the engine was varied from 1000 to 6000 rpm. It can be seen from the obtained results that the engine speed are greatly influence on the brake mean effective pressure (BMEP), brake specific fuel consumption (BSFC). It can be seen that the decreases of BMEP with increases of engine speed, however, increases the brake specific fuel consumption. For rich mixtures (low AFR), BMEP decreases almost linearly, then decreases it with a non-linear manner. It can be observed that the brake thermal efficiency increases nearby the richest condition and then decreases with increases of engine speed. The optimum minimum value of BSFC occurred within a range of AFR from 38.144 ($\varphi = 0.9$) to 49.0428 ($\varphi = 0.7$) for the selected range of speed. It can be seen that higher volumetric efficiency emphasizes that direct injection of hydrogen is a strong candidate solution to solve the problem of the low volumetric efficiencies of hydrogen engine. Maximum brake torque speed for hydrogen engine occurs at lower speed compared with gasoline. The present contribution suggests the direct injection fuel supply system as a strong candidate for solving the power and abnormal combustion problems.

Keywords: direct injection, hydrogen fuel, engine speed, toque, power, volumetric efficiency.

8.5 COMPUTATIONAL METHODS IN ELECTRICAL AND ELECTRONIC APPLICATION (A.5.2)

1. Kernel Adatron Method for Multiclass Support Vector Machine

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In this paper, Kernel Adatron, is used to deal with solving support vector machines (SVM) problem for multiclass classification cases. Using one-against-rest (OAR) and one-against-one (OAO) approches, several binary svm classifiers are constructed and combined to solve multiclass classification problems. For each binary SVM classifier, kernel adatron is applied to solve dual Lagrange SVM optimization problem to find the optimal or at least near optimal solution which is Lagrange multipliers, in the feature space through kernel map. Experiments are done on four real world data sets. The results show one-agaisnt-rest produces better results than one-agaisnt-one in terms of computing time and generalization error. In addition, applying Kernel Adatron method on muticlass SVM produces comparable results to the standard quadratic programming SVM in terms of generalization error.

Keywords: Generalization error, One against rest, One against one, Multiclass, SVM, Computing time

2. Optimal Bids by Electricity Generators in Deregulated Electricity Market

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We consider electricity trading at wholesale market similar to Australian NEM (1), (2) that includes a network of linked regional markets. Generators submit a set of price-volume bids to market operator for every 30 minutes interval of next trading day. Operator uses these bids and realized demands to solve the optimal dispatch problem (nonlinear programming problem with mixed constraints), which determines what generator is dispatched and what prices are paid in different regional markets. Prices are non linear and non contiguous functions of price bids and demands. At the time generator constructs its bid it knows earlier bids by other generators and today's demands.
Tomorrow demands and tomorrow bids by other producers are not known. We formulate generators' bidding problem as a stochastic optimal control problem. It is linear on state variables (probability density function of the dispatched regional generations and inter-regional flows). We derive the conditions of optimality in the form of maximum principle for this problem and construct numerical method for solving it.

3. Analysis Throughput Multi-code Multicarrier CDMA S-ALOHA To Support Various Data Rate

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This paper proposed integrated systems consisting of multi-code multicarrier code-division multiple accesses (MC-MC-CDMA) with random access scheme Slotted ALOHA (S-ALOHA), named multi-code multicarrier CDMA S-ALOHA, respectively. The performance analysis of both systems is stated as throughput. Multi-code multicarrier CDMA S-ALOHA is proposed to improve performance of multi-code CDMA or multicarrier CDMA.

In multi-code multicarrier CDMA S-ALOHA, allowing each user to transmit multiple orthogonal codes, so the proposed MC-MC-CDMA S-ALOHA system can support various data rate, as required by next generation standard. In MC-MC-CDMA S-ALOHA the initial data is serial to parallel converted to a number of lower rate data streams. Each stream which consists of part of initial data called sub-packet will be code to a number of multiple orthogonal code then modulated using specific spreading code for each user, and all sub stream signal are transmitted in parallel on different sub carrier.

The combination of multi-code scheme and multi-carrier code division multiple access (MC-CDMA) and ALOHA, called MC-MC-CDMA S-ALOHA, with dual medium, is proposed and analyzed in AWGN channel. Each medium has different characteristics in data rate transmission. The high-rate bit transmitted data user is serial to parallel converted into low-rate bit streams and assigned with multiple-orthogonal code. Each low-rate bit stream is transmitted over L orthogonal sub-carrier.

In this paper, we divide interference into different types depending on codes and sub-carriers in this system and carry out our analysis to obtain the BER and throughput taking into account all these types.

The performance of the system is improved as the number of assigned codes and sub-carriers increases and also the results show that the proposed MC-MC-CDMA S-ALOHA system outperforms both multi-carrier CDMA S-ALOHA and multi-code CDMA S-ALOHA in fixed bandwidth allocation.

Result show that both systems have higher throughput for high bit rate signal transmission than multi-code CDMA S-ALOHA or multicarrier CDMA S-ALOHA. MC-MC CDMA S-ALOHA. It is also shown that the throughput of both systems improve as the number of code and sub carriers, while the increase of sub packet length degrades the throughput of both systems.

Keywords: Multiple-access protocols, CDMA, S-ALOHA, Multicode Multicarrier CDMA S-ALOHA.

4. Churn Prediction in Telecommunication using Kernel Adatron

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This study focuses on one of the most critical issues to plague the mobile telecommunications industry today: the loss of a valuable subscriber to a competitor, also defined as churn. As new competitors arise fierce competition can not be avoided, therefore churn management becomes a major focus of mobile provider to retain subscribers. To make this retaining program work effective and efficient, first the mobile service provider must be able to predict which of subscribers may be at-risk of changing services and then make those subscribers the focus of customer retention efforts. Hence, the goal of this study is to develop churn prediction models using data mining techniques such as decision tree and Support vector machine with the case one of telecommunication in Indonesia. These models are built from Flexy Classy subscribers historical data. In order to find the best model, performance comparison between models needs to be done and analyzed using a confusion matrix

5. Local Short-Term Wind Speed Prediction in the region Nganjuk (East Java) Using Neural Network

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Prediction of wind speed is important for wind energy assessment, trends towards the sustainable energy, and other green-power sources, like wind energy, is now largely increased. An accurate wind speed forecast plays an important role for a wind power plant. This paper will report an effort to establish a wind speed forecasting model in the region of Nganjuk (East Java). The model is based on real-time measurement data, i.e wind speed, temperature, humidity, as weel as intensity of solar radiation. Forecast of wind speed at a time is accomplished by considering the measurements data at previous time. An artificial neural network algorithm is used to accomplish these forecasting tasks, and implemented under Matlab.

Fluctuation in wind power production, also difficult for owners of wind power plant. This paper discribes a Neural Network forcasting models that focus on one –ahead-forcast that can be useful in half-clock-ahead next time. The wind speed in a near future depents on the values of other meteorolical variables in previus times. The values are obtained from a real time measurement with several sensors; wind speed, air temperature, humidity, wind direction and solar radiation.

From the simulation, a similarity in model-output compared to the real process-output is obtained. The respective obtained *Root Mean Square Error* (RMSE) and *Variance Accounted For* (VAF) are 0.011776 and 100.00, respectively. Validation is then accomplished, and results the respective RSME and VAF of 0.9030 and 36.9999 . These values indicates that the proposed model shows a good performance, which can predict the wind speed for the next 20 hours.

Keywords: Wind Speed ,Wind Power, Wind Power Forecasting, Neural Network.

8.6 COMPUTATIONAL METHOD IN CHEMICAL ENGINEERING (A.6.2)

1. Evaluation of drag force effect on hold-up in a gas-liquid stirred tank reactor

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A comprehensive computational method based on the Eulerian-Eulerian approach was presented for gas-liquid flows in a mechanically stirred vessel. Separate submodels were developed to investigate the influence of the drag coefficient on bubble due to the interaction between bubbles and turbulence. A new model was used for the definition of drag coefficient and a detailed simulation method was used to estimate the interphase drag force. A standard k - e turbulent model was used and the impeller rotation was modelled by the Multiple Reference Frame approach. Simulation results compared with previous drag models and the experimental measurements [1]. The results indicate that the new model was able to predict the influence of turbulent intensity on drag coefficient and the distribution of gas holdup. The computational model and the proposed correlation for drag in turbulent flow would be useful for simulation gas holdup distribution and flow regimes in stirred vessels.

Keywords: Stirred Tank, Drag force, CFD, MRF

2. Cathodic Protection Simulation for Pipe-Lines Structure with Ribbon Sacrificial Anode

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It is important to maintain the effectiveness of the cathodic protection system for the pipelines structure, which is to lengthen the lifetime of the system. However, nowadays the evaluation of the effectiveness of the system only could be perform after the system applied in field. This study is conducted on 2-dimensional boundary element method to evaluate the effectiveness of the cathodic protection system for pipe-lines structure using ribbon sacrificial anode. Two factors i.e. the soil conductivity, and the displacement, between pipe-lines and anode, are analyzed by using the method. In this method, the potential in the domain is modeled by Laplace's equation. The anode and cathode areas are represented by each polarization curves. Boundary element method is applied to solve the Laplace's equation to obtain any current density in the whole surface of the pipe. The pipe and anode are modeled into 2-dimensional model. The numerical analysis result shows that the current density values on the surface of the pipe are subject to change when the relevant factors are changed. Therefore, the effectiveness of the protection system can be evaluated before the system applied.

Keywords: Cathodic protection, BEM, pipe-lines structure, ribbon sacrificial anode, polarization curve

3. Prediction of Wax Deposition in Pipeline by CFD Techniques

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Waxy crude oil contains high molecular weight paraffin, which is mostly in the range from C15-C75. When the inner pipe wall temperature is below the cloud point of crude oil, paraffin component suspend in flow and start to form an incipient gel at the cold surface. This phenomenal can lead to a serious operational problem. The solubility of paraffin molecules is highly dependent on the fluid temperature, therefore, when radial temperature gradient occurs in the pipe, a radial concentration gradient will also develop. This concentration gradient is the driving force for the dissolved paraffin molecules to be transported towards the pipe wall where the dissolved wax concentration is lower. In this paper we consider deposition of waxy crude oil in laminar flow regime. An enthalpy-porosity technique is used for modeling the solidification process. The gel region is treated as a porous zone with porosity equal to the liquid fraction.The solution of the coupled momentum, energy and species balance equations of wax components for each specific level is solved through a finite volume method (CFD); also the calculations of pressure-velocity have been done through SIMPLE algorithm. We use both molecular diffusion (density gradient is driving force) and thermal diffusion (temperature gradient is driving force) in diffusion flux expression. In our calculaltions, we consider a 2D-axisymmetric pipe geometry. The rate of change for deposition thickness is considered by time and position. The result compared with experimental data is agreeable.

Key words: waxy crude oil, cfd, deposition

4. Corrosion Analysis using BEM by Considering Polarization Curve of Steel

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The corrosion of reinforced concrete structure is needed to be detected early to prevent a severe damage of failure such as collapse of buildings or bridges. The conventional technique such as potential mapping for diagnosing of reinforced concrete corrosion structure has been used widely in the field. However, the method still has limitation such as less accuracy, laborious and time-consuming. This study is conducted to develop Boundary Element Method (BEM) by considering polarization curves of anode and cathode for mapping the potential and current density profiles on the surface of concrete structure. In this method, the potential in the concrete domain is modeled by Laplace's equation. The anode and cathode areas are represented by each polarization curves. The potential and current density are obtained by solving the Laplace's equation using BEM. The study shows that the BEM successfully solved the Laplace's equation in order to obtain potential and current density values on domain surface. The results also give a good agreement with the previous researcher.

Keywords: Corrosion, BEM, polarization curve, reinforced concrete, potential, current density

5. Implementation of Parallel Computational Tools for the Curing Simulation of Thermoset Composites Using the One Dimension Age Algorithm

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This paper presents a simulation to determine the temperature profiles of a thick thermoset composites during its curing processes employing parallel computation . The two-dimensional model of heat transfer is solved by using finite difference numerical schemes. In the process, the same physical and thermal properties of materials used by D.C. Blest et al. are employed. The temperature is calculated through a judicious formulation and application of the one dimension Alternating Group Explicit (AGE) iterative method. A fourth-order Runge Kutta method is applied for the cure. The AGE scheme proves to be a viable iterative method with respect to stability, efficiency and rate of convergence.

Keywords: Simulation, curing simulation, composite, ADI method, AGE algorithm, parallel algorithm; parallel computing.

8.7 FEM APPLICATION; COMPUTATIONAL MECHANICS (A.7.2)

1. On the Edge-effect of Stress Concentration Factor in Thin Plate with Two Holes

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This study shows that the stress concentration factor is determined by the edge-effect, and an accurate approach has been described to explain such phenomena. A finite element analysis has been performed using ANSYS 9.0 which gives animportant information regarding the magnitude of stress concentration factor for various condition. The information should be useful for the engineering designer to provide a safe and cost effective structural and mechanical configuration.

Keywords: stress concentration factor, finite element analysis, stress pattern

2. 3D Visualization of Wire Radiation Pattern using NEC2++ Antenna Radiation Generator

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This paper performed the 3 dimensions of antenna radiation pattern [1] using NEC2++ application. NEC2++ functioned as data of the radiation pattern processor of antenna. Data processing worked based on the certain parameter [2]. The parameters that are meant to be the ground plane, voltage, wire conductivity, frequency and gain, afterwards NEC2++ will count gain to the corner of the elevation and azimuth certain. The Delphi 7.0 language program is used as the data processing program from NEC2++ that would be visualized by OpenGL Technology.

Keywords: NEC2++, Wire radiation pattern, Antenna, Delphi 7.0.

3. Sound Profile Measurement for Brackish Water

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The objective of this research is to formulate a characterization of underwater sound profile level for brackish water. Breeding farm size are 25 m x 100 m and 2 m of depth. Total of 6 paddle wheels are available in the breeding farm in order to circulate of water. Sound profile has been measured to investigate the relative amplitude at 9 points of measurement with depth dependence (0 m = water surface, 0.5 m, 1 m). Points 2, 4, 7, and 9 are near from paddle wheel, while points 1, 3, 6, and 8 are far from paddle wheel. Point 5 is placed in the center of four paddle wheels.

The sound pressure level has been measured by using Cetacean hydrophone C304 which the range frequency is 0.007 KHz to 250 KHz. The output of hydrophone on lower frequency as an actually the range for general fish has been analyzed by using SpectraPlus. Relative amplitude (dB) at frequency dependence (10, 20, 30, 40, 50 Hz) and depth dependence has been analyzed at any points of measurement. Graph of relative amplitude versus frequency using depth dependence can be plotted and analyzed too.

Decreasing trend of relative amplitude has been occurred with increasing frequency from 10 until 40 Hz, amplitude will decrease 5 dB for increasing 10 Hz of frequency. This trend occurred in the all of depth and in the all of measurement point. Otherwise, at frequency 50 Hz, amplitude in the all of depth and point of measurement increase than at 40 Hz. Average of amplitude for measurement points which near from paddle wheel at depth 0 and 0.5 meter less than measurement points which far from paddle wheel for all of frequency. Otherwise, at depth 1 meter only which have no consistence value of amplitude. In other facts, various depths have no significantly correlation with amplitude.

Keywords: Sound profile, relative amplitude, brackish water, Sea bass

4. Simulation for Predicting Thermal Effect in the Eye's Tissue following a Therapy using Laser Retinal Photocoagulator

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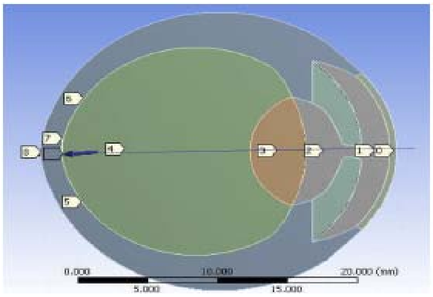
Retinal Photocoagulator is a kind of laser-therapy instrument which normally used to treat the diabetic retinopathy. A retinopathy is condition of non-inflammatory damage to the retina, which may caused total blindness to the sufferer. Some laser sources such as Argon-, krypton-, diode-, or Nd:YAG lasers are commonly used in this kind of therapy [1,2].

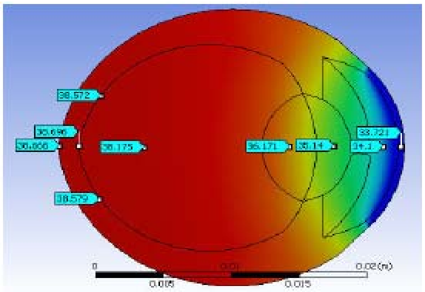
Light dose for a prescribed laser retinal therapy need to be carefully calculated in order to anticipate potential hazards that follows a given therapy. This dose distribution is affected by many factors, among others are ones related to laser beam parameters. The power density, exposure time, and focal spot are several important parameters which may affect the temperature inside the eye tissues.

Thermal effect accompanying a laser beam exposition can be well simulated by using a correct and proper mathematical model of the normal and healthy eye. Simulation is accomplished by implementing the finite element method (FEM). An anatomical model of eye is created by using graphic software of AutoCAD. The heat flows equation in eye can be satifiyingly modelled by using the *Pennes bioheat equation*. The model is then labelled with tissue properties as given in [4], and being exported to the ANSYS Workbench 11.0. Each of the eye's constructing tissues are then characterized in different nodes and elements. Values of boundary conditions and control parameters are then applied, as given in [3].

Variation of applied laser beam parameters, i.e. power density and exposure of 100 - 200 W m-2 (step 20 W m-2) as well as exposure time of 1 µs, 50 µs, 100 µs, 1 ms, 50 ms, and 100 ms are implemented. Exposure point on retina by a laser beam is indicated by an arrow in Figure-1. Temperature changes before and after laser beam expositions are being observed in the indicated points as shown in Figure-2.

Results show that under normal (unexposed condition) the temperature distribution obtained from cornea to sclera is in the range of 33.7oC – 38.7oC. These results are in the range of ones obtained by Ng et al. [3]. A significant temperature rising in tissues of the neighbouring exposed site is observed, as laser beam implemented to retina (shown in Figure-3). This proposed analysis is believed to give benefits to the laseroptalmologist to be able to predict the potential detrimental affects, which accompanying the prescribed therapy. A better insight into these retinal thermal distribution will be helpful to minimize the side-effects of the therapy to the patients.





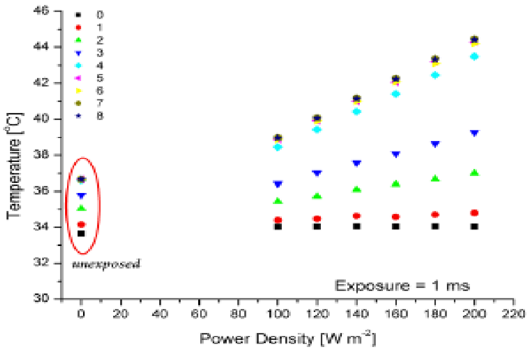


Figure1, Figure-2, and Figure-3 (respectively from links, right, and bottom)

5. Numerical Analysis Of Harmonic Propagation And Distorsion Caused By a NonLinear Load in Balaced Distribution Network

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It is very useful to monitor and maintain a good power quality in an electric power system especially on the distribution network. This paper describes a numerical methods for calculation the propagation and distortion of harmonic caused by a nonlinear load such as Adjustable Speed Drives (ASD) in a balance distribution network. ASD injects harmonic current into the network, which causes voltage distortion problems. Usually, the harmonic current, harmonic voltage, and Total Harmonic Distortion (THD) are used as indices of power quality in harmonic case. They can be calculated at every buses of a distribution network, as objective of this research. Another aims is to evaluate VTHD in every buses according to its limitation in IEEE Standard 519-1992. This research uses harmonic current spectrum of an ASD as sources and power flow study in ETAP Powerstation. Final conclusion of this work will be compared with the IEEE test's and ETAP Powerstation as a validation. The IEEE Test System 13-buses, a balance industrial system, was used as a case study. This work uses the Matlab software in m-file and the ETAP.

Keywords: harmonic, propagation, THD, nonlinear load, balance distribution network

8.8 ANALYSIS OF MACHINE ELEMENT DESIGN; NUMERICAL & EXPERIMENTAL FRACTURE MECHANICS (A.8.2)

1. Shock and Elastic Waves on Dynamic Compaction Process of Two Layered Powder Media in the Die

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The dynamic compaction processes of copper powder which was filled in layers into a die and subjected to solid punch impaction were studied experimentally in order to assess the effect of different initial density distributions of the powder on the compaction process and green density distribution, especially in terms of shock and elastic waves induced and propagated by punch impaction. The compaction experiments were performed for layer arrangement. In the first situation the upper layer had a low uniform initial density distribution than the lower layer and in the second this order was reversed. The compaction processes observed and analyzed differed considerably, but the green density distributions had only a slight difference.

The compaction process obtained for the first situation of layer arrangement agreed qualitatively with the theoretical prediction reported previously by the authors. The compaction process for the second situation agreed with the theoretical result so far as the inceptive process occurred mainly from the low initial density layer. However, the subsequent process differed, especially with respect to the number of shock waves propagating through the medium.

Keywords: High Velocity Compaction, Shock Wave, Elastic Wave, Particle Movement

2. Stress Distribution Analysis of Stress Corrosion Cracking Specimen using Ansys

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Preliminary result obtained from stress corrosion cracking (SCC) investigation of swaged socket is presented in this paper. Commercial finite element based software, ANSYS release 9.0, is used to analyze stress distribution on SCC specimen. Two types of mesh, i.e. fixed mesh with different mesh size and adaptive mesh are applied in this work to study the effect of mesh size and arrangement on stress distribution of SCC specimen.
The study performed on five type of SCC specimen i.e. C-ring specimen, tensile test specimen, pre-crack cantilever beam specimen, U-bend specimen and wedge open loading specimen. Numerical result obtained from this study shows that mesh size contribute a significant effect to the stress distribution for all type of SCC specimens.

Keywords: stress corrosion cracking, finite element analysis, adaptive mesh

3. Crack Initiation and Propagation in Nylon 6 Sphere under Various Impact Velocities

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In this research, fragmentation of a Nylon 6 sphere colliding onto a rigid wall is simulated by discrete element method (DEM). Spring constants in normal and tangential direction are used as inter-element connection in DEM. The spring constants are determined by the method considering only two elements in arbitrary orientation, which was developed by one of the authors. Contact forces between the sphere and the rigid wall is generated by applying the penalty method. Initiation and propagation of crack in the Nylon 6 sphere is then evaluated. The crack or fragmentation patterns in the sphere are analyzed under various impact velocities. The crack is initiated in the contact area and the crack propagates inside the sphere. From the numerical results, crack in the sphere is initiated at the critical impact velocity and the sphere is completely ruptured at a certain impact velocity. Mohr Coulomb failure criterion is used for the crack initiation and propagation. To assure the accuracy of DEM simulation results, the same problems are analyzed by LS-DYNA and both the results are compared with each other. As compared to the analytical solution, the results by LS-DYNA show slightly shorter contact duration than results by the DEM simulation. In general, however, the DEM simulation results showed good agreement with LS-DYNA and analytical solution.

4. Optimization of the simple plate using high cycle multiaxial fatigue criteria

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This paper presents the application of several high cycle multiaxial fatigue criteria in design optimizations of the simple mechanical part. These criteria were simplified mathematically and coded into the ANSYS finite element software using Ansys Parametric Design Language (APDL). The elemental stress obtained using these criteria were compared with Von-Mises criterion. Optimization process was carried out according to these criteria. From the simulation results, it is found that the Dang-Van criterion is the most reliable criterion to be used in the design optimization especially under high cycle multiaxial fatigue conditions.

Keywords: High cycle fatigue criteria, ANSYS, finite element analysis, design optimization, APDL

5. Influence of Magnetic Field on Noise Reduction: Experimental Study on Automotive Noise Silencer

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The topic of this study is focused on reducing the noise of silencer by using magnet's force. There have been many studies on how to reduce the noise of produced by the silencer of vehicle conducted by the experts using various approaching such as by changing the form of construction or by changing the material. In this research, it conducted a study on how to reduce the noise produced by the silencer of a vehicle such as automotive using magnet force and to examine the influence of magnet force to reduce the noise produced by the silencer of an automotive. The experimental was performed in laboratory using the laboratory equipment such as engine tune-up tester (Okuda Koki ea-800a*)*, sound level meter, flux meter and multi meter. Data of noise was obtained through the hemispherical method with the distance of one meter from the silencer and divided into four points, i.e. point-a, point-b, point-c and point-d. The noise measurement was done in the pivots of X^+, X^-, Y^+, and Z^- at each point by sound level meter. The temperature and the velocity of exhaust gas flow were measured on all the four points. The data obtained were analyzed and the result shows that the magnetic field can influence the level of noise level. The highest reduction of noise level i.e. 3.99 % occurred in specimen silencer by using one Ampere electric current when the position of magnet was on selected point-a (i.e. in-let position of silencer).

***Key words*:** Noise silencer, magnet's force, sound level meter, exhaust gas flow, flux meter.

8.9 ARTIFICIAL INTELLIGENCE APPLICATION IN ENGINEERING; COMPUTATIONAL METHODE (A.9.2)

1. Application of Fuzzy Multiple Attribute Group Decision Making Method in Stretcher Concept Selection

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One of crucial phases in product design and development is concept selection phase. The best concept resulted in this phase will be developed and embodied to fulfill the customer need. In most cases, the importance weight of each criterion used in concept selection and the performance rate of each concept alternative with respect to each criterion are determined based on the competence and intuition of some decision makers. Therefore, they are subjective, imprecise, and vague.

In this paper, the best concept selection of stretcher is determined by applying Fuzzy Multiple Attribute Decision Making as the aggregation method of performance ratings with respect to all criteria for each alternative and Technique for Order Preference by Similarity to Ideal Solution as the ranking method of alternatives according to the overall aggregated performance ratings. Three stretcher concept alternatives are evaluated to select the best stretcher concept alternative. The criteria used in the stretcher concept selection are lightness, compactness, tight bond, strong join, reasonable price, easiness to use, easiness to identify blood, and easiness to hold. In addition, the decision makers who give opinion related to the importance weight and performance rate are designer, manufacturer, and lead user.

By applying the fuzzy multiple attribute group decision making, the concept selection process is more effective and objective.

Keywords: fuzzy multiple attribute group decision, stretcher, concept selection

2. Application Augmented Lagrange Multiplier Method In the Collaborative Optimization of Engineering Product Design

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Collaborative optimization is a popular multidisciplinary design and optimization framework. Collaborative optimization provides added design flexibility by using a system-level optimizer to act on an overall design objective subject to the subsystem compatibility constraints. In engineering design process, optimization is performed to reduce time, cost, and to improve quality and accuracy of the design. All of these are essential to produce more and more competitive products. The objectives of the optimization process in this research are to implement a collaborative optimization in the engineering product design especially automotive design.

Implementations of collaborative optimization are computationally expensive due to large number of iterations required to seek attainment of the compatibility constraint, which enforce equality of shared variables. In this paper, we solve this problem with Augmented Lagrange Methods. The design of the automotive design covers some aspects. All these aspects need to be formulated in mathematical equation to obtain the optimum design. The strategy of the design optimization takes automotive dimensions and weight as the design variable, performance as the objective function and Newton second law (NSL) as the equality constraint.

The strategy developed in this study can be used to help the initial design stage in obtaining the optimum initial dimension of automotive design. Software resulted for early optimization process of automotive design can be further developed widely for other application.

***Keyword**:* design, collaborative, optimization, MDO, ALM

3. Analysis of Tapered Velocity and Tapered Coupling Couplers

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A simple design method to suppress the sidelobes in the directional coupler-type light power splitters is presented. Couplers with variable differences along the guide axis and the evolution of propagation constant between the waveguides are investigated, and the optimum profiles of the variation of the propagation-constant difference are designed for desired given power responses. A number of filter functions are used to model a coupler with relax length requirements but fulfilling the sidelobes standard. It is found that Hamming filter function offers the best sidelobe and maximum length constrain.

4. Impact Response of Traffic Cones wth Different Lower Base Structures

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Traffic cones are commonly seen on roads or parking lots placed to direct motorcycles or car users to a certain direction with the aims to have a smooth traffic condition. With their attractive looks with bright orange color and cone-like structure they must be easily understood by the road users that they are not supposed to be hit. However, many traffic cones which are now available commercially in many hardware stores are not stable enough to carry impact load bumped intentionally or unintentionally by road users. Important parameters to be considered in designing the cones are forms of the lower (base) structure and the body of the cones. In this study, the upper portion of the commercially traffic cone were cut and connected to different types of base structure, i.e. rubber and concrete base. The lower and the upper structures were mechanically joined with rubber strips using threaded joints. The new structures were tested using swing pendulum and then clarified with finite element simulation. It was found that both rubber and concrete base structures improved the stability of the traffic cones.

Key words : *traffic cones, lower and upper structure stability, finite element simulation*

8.10 COMPUTATIONAL METHODE (B.1.2)

1. Genetic Algorithms Approach for Multiobjective Stock Portfolio Optimization Problem

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Portfolio optimization is an important research field in modern finance. The most important characteristic within this optimization problem is the risk of the returns. The problem usually has two criteria: expected return is to be maximized, while the risk is to be minimized. Multi objective portfolio optimization problem is the portfolio process of the highest expected return among the various financial commodities of the capital market to meet the objectives. In this paper, we propose to identify expected return (mean profit) and risk using historical data of stock prices. Historical data of various financial commodities for the last five years from Jakarta Stock Exchange for Jakarta Islamic Index Stock are used in this research. The downside values of the variance of each stock we obtained using parametric and historical simulation methodology are considered to be the identified risk. The values of expected return and risk of each stock will be used as inputs into a fitness function in Genetic Algorithm. Performance evaluation is done by examining the parameters of GA, such as mutation probability and population size. This approach may be used by the fund manager as an advanced alternative in composing the portfolio.

Keywords: Multi Objective Portfolio Optimization, Genetic Algorithms, Fitness Function, Expected Return, Risk

2. Symmetrical and Unsymmetrical Flow Separation in Supersonic Nozzles

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Flow separation in supersonic nozzles was investigated to determine the characteristics and cause of unstable and unsymmetrical flow behavior which occurs at low chamber pressures, and to resolve the reasons for the difference between separation correlations for contoured nozzles as opposed to those for conical nozzles. The flow structure in several contoured and straight-walled, two-dimensional nozzles were examined by means of CFD. Symmetrical, unsymmetrical and unstable separation in contoured and conical two-Dimensional (2-D) nozzles was investigated.

These studies indicate that separation in nozzles is a two-part problem; of which one part is a Jet-entrainment problem to determine the local back pressure in the immediate vicinity of separation, and the other part is the conventional boundary-layer separation problem for supersonic flow. Unstable and unsymmetrical separation in 2-D nozzles is shown to be a consequence of the combined effects of entrainment, and of the shock and flow-turning angles associated with separation.

Keywords: flow separation, symmetric, unsymmetric, supersonic nozzle, CFD

3. Comparison Eigenvalue of Planar Waveguide Characteristic Equation using Analytical Approach and Method of Line

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In planar waveguides that have simple structure, wave should be defined as two dimension shape for easy to analyze. Planar waveguide contains dielectric. Simple structure, it contains three layers. Core in the middle and two claddings surround the core upside and downside. Core and cladding has their own refractive index n_1 and n_2 where n_1 should be larger than n_2. Assume that light propagate to z direction in the core with width h. Boundary condition used to find solution of wave equation. For beginning, Deriving Helmholtz equation guides to reach characteristic equation of planar waveguide. Solution of this characteristic equation can be found by using bisection method. By that we get the effective refractive index n_{eff} as eigenvalue.

There is Method of Line (MOL), another approach to find eigenvalue of planar waveguide characteristic equation. To analyze planar waveguide with method of lines, splitting wave equation area which perpendicular with propagation direction that is x with lines, so it will become some parts with difference of every lines is Δx. The comparison of both result hoped have a same value to prove that the both approach succeed.

4. Switch Characteristic in Silica Directional Couplers

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Directional couplers can also made in single mode optical fiber form. The fiber is first mounted in a silica or glass block which has a curved groove cut in it, and the block is then polished down until the fiber core is just exposed. Two such blocks are then placed together so that the polished area are in contact. The main differences from the integrated optic device are that the coupling is non-uniform because the spacing between the fiber cores varies with distance, and that the fiber version is not switchable. Switch characteristic is a movement of power from one waveguide into another waveguide which parallel with it. In this paper we will see the comparison coupling coefficient as a function of a distance between two waveguides, interchange of modal power between the two guides as a function of propagation distance under phase matched conditions, and also we will see the switch characteristic of directional couplers. Bisection method is the numerical analysis which applied to get the effective refractive index of fiber optic.

Keywords: Directional Couplers, Switch Characteristic, Coupling Coefficient, Bisection Method

5. Design and Analysis of Supersonic Axysimmetric Minimum Length Nozzle (MLN)

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The assumption of irrotational, inviscid flow is an appropriate simplification since a favorable pressure gradient is typical within nozzles. The axisymmetric solution differs from the classical 2-D solution because it takes into account for the squared radial dimension in the area calculation. The classical 2-D solution increases the cross-sectional area of the nozzle on a 2-D plane. The 2-D method translates into an area ratio that it larger than the one intended for the desired exit Mach number when the classic 2-D solution is rotated about its axis. The axisymmetric solution resolves this issue.

The contour where built compared to theoretical isentropic area ratios for the selected fluid and desired Mach number. The accuracy of the nozzle to produce the desired exit Mach number was also checked. The flow fields of the nozzles created were checked with Computational Fluid Dynamics (CFD). CFD predictions were used to verify the isentropic flow assumption and that the working fluid reached the user-defined desired exit Mach number. Good agreement in area ratio and exit Mach number were achieved, verifying that the nozzle is accurate.

Keywords: MLN, supersonic, nozzle, axysimmetric nozzle, CFD

6. Stress Distribution Simulation in Non-Standardized Motor Cycle Helmet Subjected impact Loading

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Human skull with its internal organ, i.e., the brain, is very susceptible to fail when it is subjected to impact loading resulted from for example a traffic accident. To reduce the brain damage rate from such kind of accident many countries have enforced a very strict rule and technical specification for the helmet manufacturers and strict regulations for the motorcycle riders. However, in many developing countries the specification and rules are still not well implemented. In the hardware store we still can buy non-standardized type of helmets in which the helmet specification plate is not available. In the current study, the non-standardized helmets both half-and-full faced motorcycle helmets were studied. The helmets were subjected to impact loading in various direction. Respones of the helmets are data for use to analyze whether the helmets endangers the riders, or not. MSC/NASTRAN 4.5 software is used for the simulation The helmets are modeled by using the AutoCAD and simulated by using MSC/NSTRAN 4.5 software. The results of simulation inform that the greatest stress is in the half-face riding helmet without foam, while the least stress is in the full-face riding helmet with foam. Based on the simulation of both kinds, we understand that the full-face riding helmet with foam can minimize the stress. So, by thickening the foam in the helmet, the load of impact in the helmet can minimize the stress which propagates to the skull.

Keywords: Sttress districution, non-standardized helmet, and impact load.

9. THE LOMBOK ISLAND (GENERAL INFORMATION)

9.1. Geography & Climate

Lombok island is located east of Bali. Lombok geographically is almost the same size as Bali and, just as there are popular tourist areas on Bali, so Lombok offers a variety of destinations to suit different holidaymakers' tastes.

Tropical climate with warm and humid weather all yearround. Temperature range from 21 Celsius to 32 Celsius. Wet season starts from November to May and dry season start from May-October.

The best time to come is in the month of May when the weather is just perfect with bright daylight and green scenery.

9.2. People & Religion

Population is about 2,5 million. The local inhabitants of Lombok are called Sasaks who make up 70% of the population are the predominant group with Balinese, Chinese, Arabian, and Javanese and other ethnics groups making up the rest. Bahasa Indonesia is the National Language, but English is widely spoken.

Lombok has three main districts with three capital cities: Mataram in the west, Praya in central and Selong in east Lombok. The majority of commerce is in the capital city of Mataram in west Lombok.

Islam is the majority religion, but all other religions are practiced freely. Every Friday around 12.30 noon, Muslims go to the mosques just like Christians go to church on Sunday.

If you are planning on traveling around the island and visiting small villages it is more respectable to wear slacks or knee length shorts, a shirt with sleeves or a sarong. If you happened to be here during Ramadan, which is the Muslim month of fasting from sunrise to sunset, please do not to eat, drink or smoke out in the open public during this month long fast. Even though the people don't seem bothered in the common tourist areas like, Senggigi and the Gili islands, it is better to respect the people and not eat or smoke openly.

Wetu Telu

Wetu telu is an unique religion that that blends Islam - Animism and is only found in north Lombok. It roots stem from the village of Bayan in the north. The people who practice this still consider themselves Muslims but they have their own rituals in addition to the normal Muslim ones. One such ceremony is Nyiu, that takes place 1000 days after someone dies. The relatives of the deceased offer material things like clothing, toothbrushes, food, dishes, mattresses, etc. so the deceased will be pleased in heaven.

9.3. Money & Local Currencies

When changing money there are many money changers in Lombok. The best rates are usually in Senggigi.
Money changers prefer new, clean large bills and will accept smaller denominations at a lower rate.
If you have traveler’s checks the rate will be less than bank notes.

Be sure to count your money before you leave money changers.
You can also check local banks but the rate is slightly lower than outside. Re-count the money in front of the money changer reception is a must, as usually there's a quick tricky way how they can steal your money. A suggestion when changing money. If you plan on making small purchases be sure to carry small denominations with you because many sellers do not have change. The Rupiah come in denominations of 100,000, 50,000, 10,000, 5,000, 1,000, and 500, 100 in coin.

9.4. Vehicle Rentals

Don't miss Lombok's beautiful scenery. If you choose to rent a car or motorcycles and drive yourself, you must have an International Driving License.

Renting a car is a good alternative to get around Lombok, either self driving or with driver so you can relax and enjoy the view. (Tip driver pocket money for meals if you stop for lunch or dinner). If you are pleased with service, tip (Rp. 20,000 minimum). If you collide with anything, or it collides with you, you are responsible for all cost.

Motorcycles are a convenient and inexpensive way to get around the Island, but Tourists are frequently injured in motorbike accident. If you rent a bike, drive slowly and very defensively. Helmets are required by law but those provided by rental agencies offer little protection.

9.5. Business Hours

Indonesian work in the morning to avoid the heat of the day. If you need to visit a government office, arrive between 08 AM and 11:30 AM. This also apply to banks and private businesses. Government offices close early on Fridays and Saturdays. Generally offices are open 07:30AM - 3 PM Monday - Thursday, 07:00AM - noon on Friday. Banks and Government Offices are closed on Saturday and Sunday.

9.6. Cell Phone

Cellular phone in Indonesia is GSM. If you have brought your cellular hand phone, you can purchase prepaid calling cards to make outgoing calls at lower cost than calling on your home SIM. Shops which sell these cards are prolific. Major service providers are: Telkomsel, Satelindo and XL Ritel. Look for signs and banners with those markings.

9.7. Health and Medical Info

Most hotels have on call doctors. For what it is known by Australian as "Bali Belly", Iomotil and Imodium eliminate Symptoms, but not infections. A fever along with the symptoms requires doctor prescribed antibiotics. Drink as much as liquid as possible. For discomfort, diarrhea, and cramping, drink strong, hot tea; avoid fruits and spicy food. Drink only bottled water or boiled water (air putih).

Peel the fruit before eating; avoid raw vegetables except at reputable restaurants. Ice in restaurants is safe. Protect yourself from the intense equatorial sun. Use sun block and hat. Sexually transmitted diseases are increasing in Indonesia. Local sex workers have multiple partners from all over the world. Act responsibly and use condoms, available over the counter at pharmacies.

9.8. Things To Take Back Home

Wanting to take back something from Lombok? Lombok has great woven textiles like songkets and ikats that can be used as a sarong, wall hanging, table cloth and more. The design woven is special to each weaver and it is passed down through the generations before. There is a traditional hand weaving village in Puyung, central Lombok. You can even try on a traditional Sasak costume.

PASAR SENI
ART MARKET

Banyumulek (West Lombok), Penujak (Central Lombok) and Masbagik (East Lombok) are famous villages in Lombok for making pottery. Lombok pottery has gained popularity and is shipped throughout the world. There is a wide range of selections and it can custom made to your liking. We hope to develop the economy of the area by directly meet them with serious buyer from all over the world.

There are many traditional handicrafts you could take back as a souvenir i.e. wooden masks, baskets made out of ketak grass, wooden boxes designed with bits of shells, or other things made from bamboo or rattan.

9.9. Going Native - The Lombok Way

Greetings and Civilities

Sasak does not have greetings such as "Good Morning". A Sasak approaching a friend might ask, in the local language, " How are you?, How's your family?" simply as a form of greeting. Locals will frequently ask foreigners like this in English (it may be their only English!) as a greeting. Don't get annoyed - they are just trying to be polite. A smile and a "hello", or greeting in Indonesian, is a polite and adequate response.

Castes

Unlike the Muslims in general, the Sasak in Northern and west Lombok have a caste system. There are four caste castes, the highest being Datu for men and Denek Bini for women, the second Raden for men, and Denda for women, the third Buling and the fourth Jajar Karang. In Central and East Lombok, Lalu for men and Lale for women.

Traditional Culture

Traditional law (adat) is still fundamental to the way of life on Lombok today, particularly customs relating to courting and marriage rituals and circumcision ceremonies. In western Lombok you can see Balinese ceremonies and temples with colorful procession and decorative offerings. Sasak ceremonies are often less visible, though you may see colorful procession as well. Ask around and you can probably find when and where festivals and celebrations are being held.

Circumcision

The laws of Islam require that all boys be circumcised (Nyunatang), and in Indonesia this usually done somewhere between ages of 6 to 11 years old. Much pomp and circumstance mark this occasion on Lombok. The boys are carried through the village streets on painted wooden horses or lions with tails of palm fronds.

Marriage Rituals

Young couple in Lombok have a choice of three rituals; the first is an arranged marriage, the second a union between cousins, and the third elopement. The first two are uncomplicated: the parents of the prospective bridal couple meet to discuss the bride's dowry and sort out any religious differences. Having handled the business arrangements, the ceremony called "sorong serah" is performed.

The third method is far more complicated and dramatic. Theoretically a young girl is forbidden to marry a man of a lower caste, but this rule can be broken through kidnapping and eloping. As a result, eloping is still a widespread practice on Lombok, despite the fact that in most instances the parents of the couple know what's afoot.

Originally it was used as a means of eluding other competitors for the girl's hand or in order to avoid family friction, but it also minimized the heavy expenses of a wedding ceremony. The rules of this ritual are laid down and must be followed step by step. After the girl is spirited away by the boy, he required to report to the Kepala Desa (Chief of the Village). The Kepala Desa then notifies the girl's family through the head of their village. A delegation from the boy's family visits the girl's parent, and between them they settle on a price for the bride, a fine (uang adat) which is distributed among members of the bride's family in recompense for losing her.

Traditional dowries are worked out according to the caste differences; the lower his caste and the higher hers, the more he has to pay. Once this has been settled the wedding begins. Generally the bride and the groom dressed in ceremonial clothes, carried through the village's street, accompanied with sounds of traditional music (gamelan) mingle with the shouts and laughter of the guests as the couple are swooped up and down and around on their way to the wedding place. Throughout the whole ceremony, the bride must look downcast and unhappy at the prospect of leaving her family.

Travelers without a grasp of Bahasa can get by, but some knowledge of it enhances an understanding of the island and could also be valuable an an emergency. Check out the Learning Bahasa Indonesia page to understand most common used phrases.

Food

In the main Tourist area; Senggigi, Gili Islands and Kuta Beach Lombok, numbers of Tourist's Restaurant available serving Western food, Indonesian and Chinese food. In Mataram and in some remote area on Lombok, Indonesian food, Padang food and Chinese food are dominating. Rumah Makan (eating place) can be found easily in Mataram, Ampenan and in most main street. Sasak Food uses white rice as staple, served with vegetable curries or soup, chicken, beef, fishes, hot chilli and no pork. In Bahasa Indonesia, the word Lombok means Chilli paper and it used liberally in local cooking. The famous sasak food are:

Ayam Taliwang, fried or grilled wild young chicken with chilli sauce is originally from Taliwang Sumbawa, but it has become a Lombok speciality.

Sate Ikan Tanjung, one of the tastiest food on Lombok, originally coming from a village called Tanjung - Northern Lombok. Pieces of fresh snapper or tuna mixed with coconut milk, lemongrass, garlic, chilli paper, spices, wrapped onto sate stick and grilled. Try them on your way back from a day tour from waterfall or gili Islands.

Ares, a dish made from the pith of banana tree stem, with coconut juice, garlic and spices.

Pelecing Kangkung, very popular on Lombok as a daily dishes to eat together with plain rice. Cooked water convolvulus (kangkung), mixed with a sauce made with chilli, fish paste (terasi), tomato salt and lime.

9.10. LOMBOK'S ART AND HANDICRAFTS

INTRODUCTION TO LOMBOK CRAFTS

On Lombok there is more crafts than art. The main crafts of Lombok are practical items made for everyday use, but showing great skills and finish, traditional techniques and natural, locals materials.

Villages specialize in certain crafts, and it's interesting to travel to a number of them, seeing hand weaving in one village, basket ware in another and pottery in third.

TRADITIONAL HAND WEAVING

Two main villages on Lombok that known for it's traditional weaving factory are; **Sukarara** (Central Lombok) and **Pringgasela** (East Lombok). Typical of sarongs and tenun ikat are produced here. The sarong is not only a comfortable article of clothing but can serve as a sheet, towel and multitude of other uses. **Songket**, is one of the most complicated hand weaving that usually done by women from generation to generation. The process can take over a month to reach one piece of songket.

Some expensive songket combines silver or gold strings to give a touch of natural, shiny motif. Other kind of hand weaving is called **Ikat Weaving**, usually done by men.

LOMBOK POTTERY

Lombok pots have become widely known. Three major villages that are famous with their pottery production are: **Banyumulek, Masbagik and Penujak.**

These villages had their own style and methods which were further developed and improved under the aid plan from new Zealand Government on 1991. Most of Lombok pottery are handmade and using very simple tools and methods - no machinery used but very creative. Check out the newest article related to the long process of making the pottery on our special page: **Lombok's Unique Pottery**.

From there, you can browse through our online catalogues, contains fine selections of Lombok Earthenware Pottery - collected from three major villages on Lombok.

LOMBOK LIMESTONE

This product can be categorized newcomers compare to other Lombok's art and crafts. Not widely known, but has becoming very popular nowadays. Many big hotels design their lobby wall or give some touch of arts with this product. Unlike lombok pottery, white stone carving does not using any coloring technique, or complicated steps of work.

The basic materials is the natural solid rocks/sands stone, which further developed into basic shapes and then carved into final shapes with sands paper and finished by special liquid to protect the natural color from moistures and weather.

LOMBOK WOODEN MASK, BOXES AND PRIMITIVE CARVINGS

Many of this product can be found in some art galleries in Bali's Legian St, or Ubud. They are well marketed in Bali, and often claim as original Bali's art. Two main villages in Lombok where they mainly produce those items are; **Labuapi** and **Rungkang Jangkuk.**

LOMBOK PEARLS

Lombok and Sumbawa's seashore are potential and pollution-free for Oyster Farm. Many Japanese investors are involved in developing sea pearls and black pearls. Sekotong, East Lombok, and North West of Lombok are the places where most sea pearls comes from.

9.11. TRAVEL TIPS & USEFUL INFORMATION

A1. CUSTOM REGULATIONS

You must have at least 6 (six) months validity of passport to enter Indonesia.
Visa On Arrival (VOA) can be obtain at Mataram Airport.

According to customs regulations, one adult is allowed to bring into Indonesia a maximum of one liter of alcoholic beverages, 200 cigarettes, 50 cigars or 1000 grams of tobacco, and reasonable amount of perfume.

Photographic, video and filming equipment radios, typewriters, and cars are admitted provide they are recorded in your passport on entry and taken out of the country on departure.

Narcotic, firearm and ammunition, TV set, and Chinese medicine are strictly prohibited.
Fresh fruit, plants and animals must be passed by Quarantine Office.

A2. TRAVELING ALL OVER LOMBOK

Visitor can explore the tiny island by using various kind of transportation such as: Chartered/Car Hire, Taxi, Bus, Bemo/Angkot (local's public transportation) and Motorcycle.

Taxis operated from all major hotels and airport with rate varying according to destination. Taxi companies in Lombok are **Lombok Taxi** (627000), **Lendang Express** (634444) and **Airport Taxi**. Taxis are metered and charged accordingly to distances.

Public Transportation or known locally as "Bemo", a non-AC minivan (in yellow colour) are available in major town i.e: Mataram, Ampenan and Cakranegara, founded in every corner of the island with quite inexpensive price. They take and drop off local passenger and often load over capacity, without travel insurance coverage. For those who prefer to travel more privately, car-hire option or charter or motorbike rental may be the choice. The prices, however, do not always included insurance. And they vary depending upon the type of vehicle and the duration of hiring. Petrol pomp and service stations are available at every large town. In emergency there are always road side kiosks fuels out of drums at a bit dearer price.

If you rent a car (self drive), you may find the rental fare are much more expensive than in Bali because of limited car available on Lombok. While driving yourself, please take out most care since the traffic rules may be some what different from those observed in your country. Indonesian and any other Asian Countries uses "right side steering system"

An international drivers license is required, but one can apply for temporary permit in Lombok and go for test driver in tourist driving license office in Jalan Langko Mataram Lombok.
It is compulsory to wear a crash helmet while you ere on the road on a motorbike. Helmets are available at motorbike hire outlets. Small horse drawn carts called Cidomo serve as convenient transportation during off hours and off the beaten track.

B. TRAVEL TIPS

1. Peel the fruit before eating; avoid raw vegetables except at reputable restaurants. Ice in restaurants is safe.

2. Drink always from bottled water and eat well done cooking food, unless when eating at recommended restaurants/cafes or hotel's outlet.

3. Street or beach vendors are often pushing too hard on selling and most visitors feel inconvenient. Never try to look at any of their item/s even they might be interesting to you, even this could be fun for those who want to learn about bargaining tactic. For most visitors this is hassling.

4. Protect yourself from the intense equatorial sun. Use sun block and hat.

5. Sexually transmitted diseases are increasing in Indonesia. Local sex workers have multiple partners from all over the world. Act responsibly and use condoms, available over the counter at pharmacies.

6. Due to the limited number of flights to Lombok, during the peak season we highly recommend you to make flight booking far in advanced. Don't forget to ask your local tour operator to re-confirm your ticket minimum 24 hours in advanced to ensure yourself to get seats.

10. IMPORTANT CONTACT NUMBERS

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	The Jayakarta Lombok Hotel, Lombok Island	Mataram City	+62-370 693045
OTHER NUMBERS	Local Information Number		108
	Police		110
	Hospital/Ambulance		118
	Fire Fighters		113
	Operator for International Calls		107
	Yellow Pages		+62-21-79178108

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2ND CALL FOR PAPERS - 6th International Conference on Numerical Analysis in Engineering (nae2009) in Lombok island, West Nusa Tenggara Province, Indonesia

Posted: Feb 16, 2009 3:21 AM

Plain Text Reply

Dear prospective participants,

We are pleased to inform you that International Center for Science, Technology, and Art - University of Sumatera Utara (IC STAR USU), Medan - Indonesia is going to hold the 6th International Conference on Numerical Analysis in Engineering (nae2009) in Lombok island, West Nusa Tenggara Province, Mataram - Indonesia.

DAY/DATE
Friday-Saturday
May 15-16th, 2009

VENUE
Sheraton Senggigi Beach Resort
Jalan Raya Senggigi Km. 8 Senggigi Lombok - INDONESIA
Phone: +62-0370-693333; Fax.: +62-0370-693241
Website: http://www.sheraton.com/senggigi

DEADLINES
Abstract by 15 March 2009
Notification of Acceptance by 01 April 2009
Final Papers by 15 April 2009

ORGANIZER
Local Organizing Committee (LOC)
6th Int'l. Conference on Numerical Analysis in Engineering (nae2009)

International Center for Science, Technology, and Art - University of Sumatera Utara (IC-STAR USU)
Gedung Biro Rektor USU, 2nd Floor, Jalan Dr. T. Mansyur No. 9
Kampus USU Medan 20155 - INDONESIA
Phone/Fax.: +62-61-8211057
E-mail : icstar_usu@yahoo.com; bustamisyam@yahoo.com
Webpage : http://www.usu.ac.id/nae2009

As you are aware that nae2009 also accomodates student presentations in separate rooms; Reviewers will evaluate their presentation and the best presenters will be awarded.
So, here we are pleased invite you to join the conference and highly appreciate if you could help us to promote nae2009 among teaching staffs, students, or researchers in your institution.
Come and join us; you will meet old friends and make new friends and networking.

****

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We are looking forward to hearing from you regarding this matter soon.
Thank you very much for your kind attention and cooperation

****

It will be highly appreciated if you can circulate these calls for papers to your colleagues.

Sincerely,

****

Prof. Dr. Bustami Syam
Chairperson, Local Organizing Committee (LOC)

6th Int'l. Conference on Numerical Analysis in Engineering (nae2009)
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Jalan Dr. T. Mansyur No. 9 Kampus USU Medan 20155 - INDONESIA
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nae 2009

The 6th International Conference on Numerical Analysis in Engineering

CERTIFICATE

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Willyanto Anggono

Has succesfully participated in

The 6th International Conference on Numerical Analysis in Engineering 2009

as

Presenter

This event was held at

The JAYAKARTA Lombok Hotel,
May 15th -16th, 2009 Lombok Island, Mataram City, West Nusa Tenggara Province - INDONESIA

Local Organizing Committee

PROF. DR. BUSTAMI SYAM
Chairman

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Toyohashi University of Technology (TUT)

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CAD line STUDIO

SUSTAINABLE TECHNOLOGY FOR IMPROVING AUTOCLAVE PERFORMANCE USING FINITE ELEMENT APPLICATION

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Product Innovation and Development Centre Petra Christian University[1, 2, 3, 4]
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Abstract

Sustainable technology is a part of broader concept of sustainable product development and sustainable development is an integral concept for achieving quality of limits, interdependence, fundamentals and equity. Autoclave is a strong, pressurized, steam-heated vessel, as for laboratory experiments, sterilization, or steaming. In general, this vessel contains of a view parts, they are the body which is the cylinder part of the tank, the heads which are used as the closure of the tank, the nozzle which are used as the fluid inlet and outlet port, and the saddle which are use to support body/tank of autoclave. The existing condition in this research, autoclave used to steam animal food materials and operated at 4 Bars pressured. The locking mechanisms are using 4 bolts to lock the door of the autoclave. The design of the autoclave can be operated up to 7 Bars. The bigger pressure operating condition, the faster processing happened.

Based on the existing condition, the goal of this research are finding and solving leakage problem in the area between door (head) and cylindrical shell when the autoclave operates at the pressure more than 4 Bars. The leakage starts when this autoclave operated at 4 Bars pressured. The bigger leakage happened when the autoclave operates at the bigger pressure (7 Bars).

ANSYS software based on the finite element method is used in this research. Based on the simulation result after re-design obtained, this autoclave can operates safely without leakage up to 7 Bars. Designing the mechanical product using ANSYS software can reduce materials, cost and time of the product development. ANSYS software based on finite element method is a sustainable technology for sustainable product development because simulation technology using ANSYS software can perform the performance of the machine during the design phase and reduce materials, cost and time of the product development.

Keywords: Sustainable Technology, Autoclave, Finite Element Method.

1. Introduction

Sustainable technology is a part of the broader concept of sustainable product development (Weenen, 2002) and virtual reality means existing or resulting in essence or effect though not in actual fact, form, or name (Anggono, 2006). Understanding the mechanical design is very hard to do because it is very hard to visualize the mechanical design product and the performance of the mechanical product during design phase.

Product design is always interesting to most of the people. It is also becoming more and more popular now a days. To predict the performance of the mechanical product during design phase is possible to do using Finite Element Method technology (ANSYS Software). Virtual reality technology using ANSYS software can perform the performance of the mechanical product during the design phase (Anggono, 2004).

Autoclave is a strong, pressurized, steam-heated vessel, as for laboratory experiments, sterilization, or steaming. In general, this vessel contains of a view parts, they are the body which is the cylinder part of the tank, the heads which are used as the closure of the tank, the nozzle which are used as the fluid inlet and outlet port, and the saddle which are use to support body/tank of autoclave. The existing condition in this research, autoclave used to steam animal food materials and operated at 4 Bars pressured. The locking mechanisms are using 4 bolts to lock the door of the autoclave. The design of the autoclave can be operated up to 7 Bars. The bigger pressure operating condition, the faster processing happened.

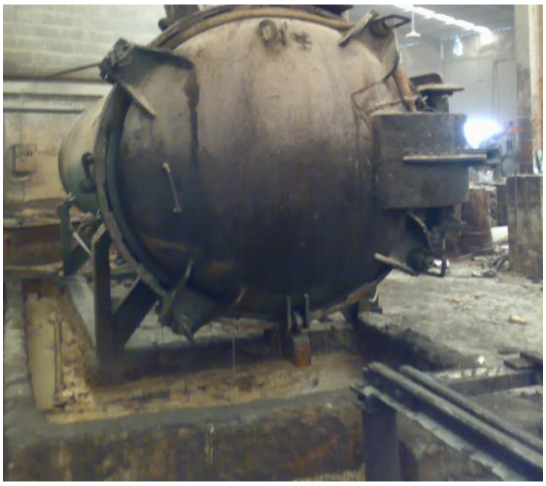


Figure 1. Autoclave using four key bolts

Based on the existing condition, the goal of this research are finding and solving leakage problem in the area between door (head) and cylindrical shell when the autoclave operates at the pressure more than 4 Bars. The leakage starts when this autoclave operated at 4 Bars pressured. The bigger leakage happened when the autoclave operates at the bigger pressure (7 Bars).

2. Theoretical Background

The Finite Element Method (FEM), also called FEA (Finite Element Analysis), is actually an approximate mathematical method for solving problems which can be determined by differential equations.

The main idea of FEM is to break a complicated problem with irregular edge conditions into small pieces (elements) of a finite size. Each piece is considered to be part of the main problem, thus connected to the other pieces via the global state information (i.e. deformation) of the element nodes, which are common nodes with the neighborhood elements.

For the small element itself, the internal physical laws (i.e. Hooks law for elastic deformation problems) can be calculated. The global problem can be transformed into a matrix of simple element equations which are connected by the condition, that common nodes undergo the same change of global state. Forces which act on the edge of the global thing can be simplified as acting at discreet nodes. This all together gives a big system of mostly linear equations which can be easily solved by computer.

The result is the change of global state for each node (i.e. the new node coordinates after the deforming of structures. Having this, further information for the small elements itself can be obtained, i.e. the element stresses in each direction (Budynas, 1999).

In general, autoclave contains of a view parts, they are the body which is the cylinder part of the tank, the heads cover which are used as the closure of the tank, the nozzle which are used as the fluid inlet and outlet port and the saddle which are used for support the autoclave body.

Working machine parts in general are subjected to multi axial loading, resulting in multi axial stress and strain. To utilize the data derived from one-dimensional magnitudes. We denote the effective stress and strain as effective stress and effective strain, respectively.

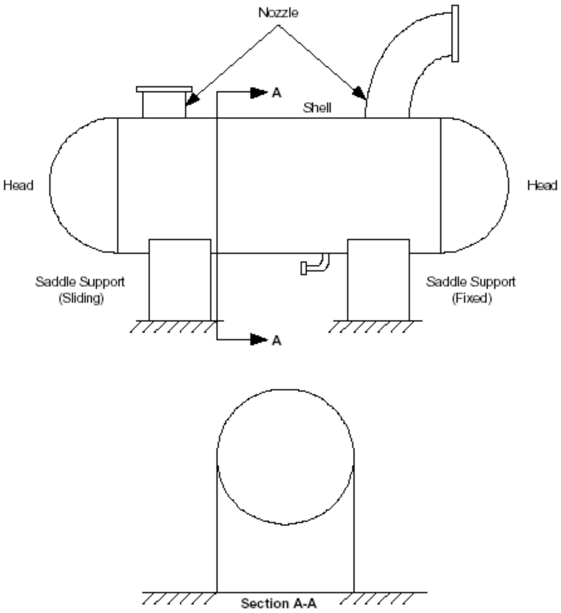

Nozzle
A
Shell
Head
Head
Saddle Support (Sliding)
Saddle Support (Fixed)
A
Section A-A

Figure 2. Autoclave terminology

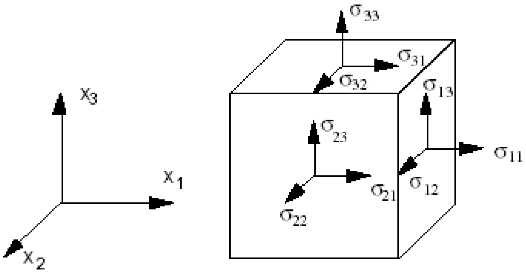

σ33
σ31
σ32
σ13
σ23
σ11
σ21
σ12
σ22
X3
X1
X2

Figure 3. Three dimension stress diagram.

There are several known methods to derive effective stress and strain. Those presented here are based on von Mises theory and were chosen for their applicability to machine design. In the material failure by von Mises theory, failure by yielding occurs when, at any point in the body, the elastic strain energy absorbed by the unit volume as a result of its change in shape, distortion energy by the combined stress becomes equal to that associated with yielding in a simple tension test.

The complex state of stress gets more or less compared with a uni-axial stress.

Von Mises effective stress:

$$((\sigma_{11} - \sigma_{22})^2 + (\sigma_{22} - \sigma_{33})^2 + (\sigma_{33} - \sigma_{11})^2 + 6(\sigma_{12}^2 + \sigma_{23}^2 + \sigma_{13}^2))^{1/2} \quad (1)$$

Von Mises effective strain is defined by:

$$((\varepsilon_1+\varepsilon_2)^2 + (\varepsilon_2+\varepsilon_3)^2 + (\varepsilon_3+\varepsilon_1)^2)^{1/2} / ((1+\upsilon)\, 2^{1/2}) \quad (2)$$

To be familiar with some element types and potential element types to fulfill the needs in this problem that can be used in ANSYS software are needed before using the ANSYS program to solve the problem. The suitable element type that can be used to solve the problem is SOLID95 3-D 20-Node Structural Solid (ANSYS Inc., 2002).

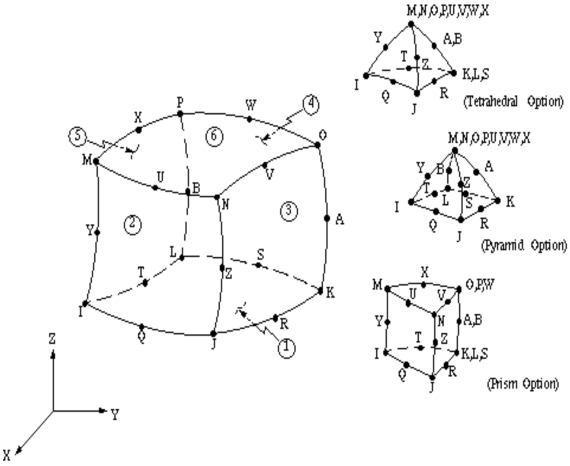

M,N,O,P,U,V,W,X
Y
A,B
T
Z
K,L,S
I
Q
R
J
(Tetrahedral Option)
M,N,O,P,U,V,W,X
(Pyramid Option)
O,P,W
A,B
K,L,S
(Prism Option)
Z
Y
X

Figure 4. SOLID95 element type 3-D 20-node structural solid

SOLID95 can tolerate irregular shapes without as much loss of accuracy. SOLID95 elements have compatible displacement shapes and are well suited to model curved boundaries. The element is defined by 20 nodes having three degrees of freedom per node: translations in the nodal x, y, and z directions. The element may have any spatial orientation. The element has plasticity, creep, stress stiffening, large deflection, and large strain capabilities.

3. Research Methodology

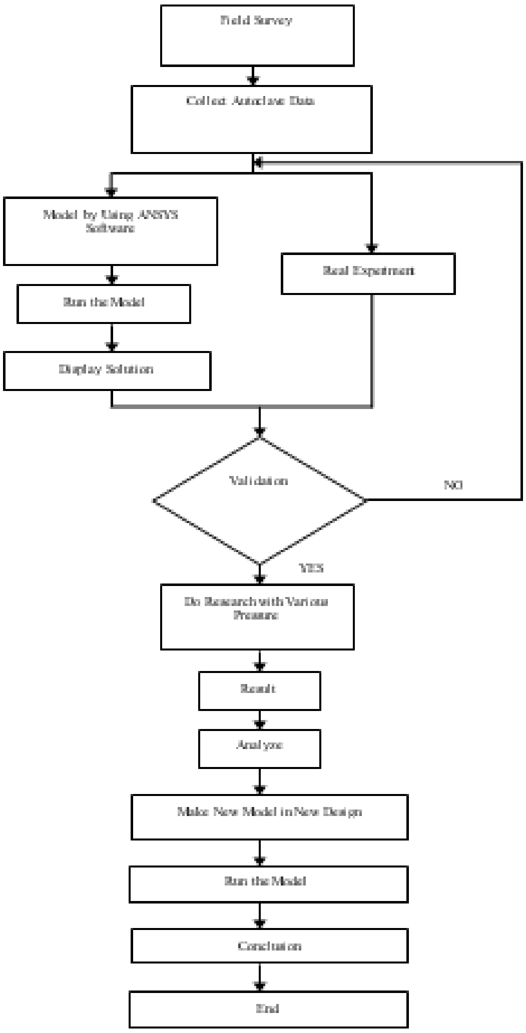

Field Survey
Collect Autoclave Data
Model by Using ANSYS Software
Real Experiment
Run the Model
Display Solution
Validation
NO
YES
Do Research with Various Pressure
Result
Analyze
Make New Model in New Design
Run the Model
Conclusion
End

Figure 5. Research methodology

4. Result and Discussion

The simulation is very important to solve the problem. The simulation is performed using half model of the product because the autoclave is a symmetry product as well and the symmetry feature in ANSYS software can perform the symmetry product using half model. The meshing model for head cover autoclave is shown in figure 6.

After meshing process has finished, then the internal pressure given to the cover head from the 1 Bar until 4 Bars.

Displacement which happened to the head cover is shown in figure 7.

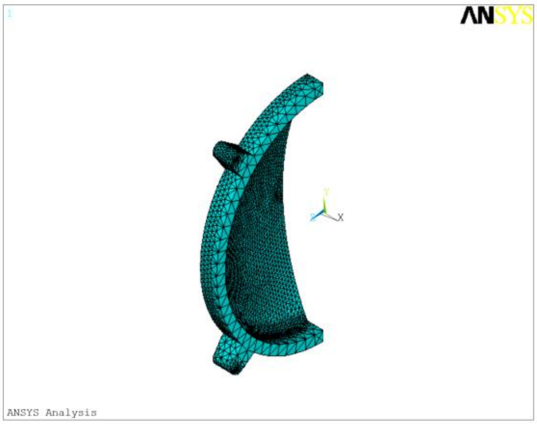

ANSYS
Y
X
ANSYS Analysis

Figure 6. Meshing for the head cover of the model

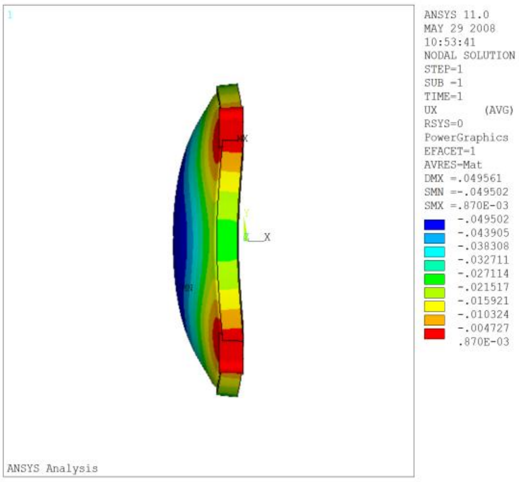


Figure 7. Displacement at the head cover

Based on the simulation result (figure 7), the maximum displacement happened in the middle above the key bolts. The displacement which happened is shown in the 10 nodes observation that taken on the along side section of the cover as shown in the figure 8 and table 1.

Using the same procedure is doing to the body tank model, which symmetric shell used to the body. The meshing for body tank can be seen in figure 9.

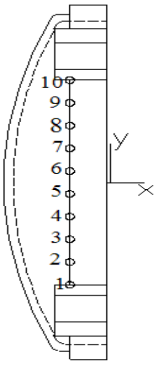


Figure 8. Ten nodes observation at the head cover

Table 1. Displacement which happened at the 10 nodes when apply pressure1 Bar until 4 Bars.

No	Node Number	Displacement (mm)			
		At the 1 bar	At the 2 bar	At the 3 bar	At the 4 bar
1	54999	0.0021184	0.0042369	0.0063553	0.0084737
2	54986	0.0078903	0.015781	0.023671	0.031561
3	54785	0.013483	0.026965	0.040448	0.053931
4	54715	0.018023	0.036046	0.054069	0.072093
5	54823	0.020344	0.040689	0.061033	0.081378
6	1668	0.020344	0.040689	0.061033	0.081378
7	1693	0.018023	0.036046	0.054069	0.072093
8	1720	0.013483	0.026965	0.040448	0.053931
9	1747	0.0078903	0.015781	0.023671	0.031561
10	1778	0.0021184	0.0042369	0.0063553	0.0084737

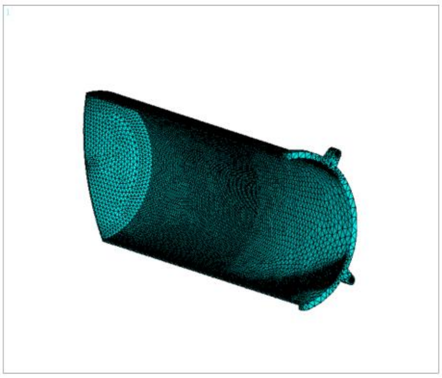


Figure 9. Meshing for the body tank

After meshing process has finished, then the pressure is given to the body tank from 1 Bar until 4 Bars too. Displacement which happened to the body tank is shown in figure 10.

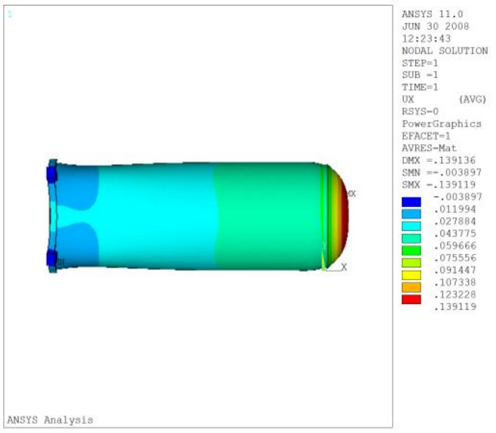


Figure 10. Displacement at the body tank

As shown in figure 10, displacement happened in the side section of the body when pressure was given from 1 Bar until 4 Bars is shown in figure 11 and table 2.

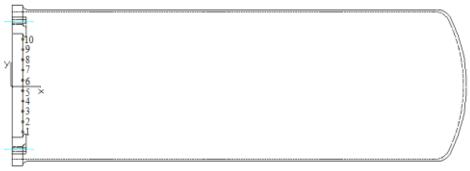


Figure 11. Ten nodes observation at the body tank

Table 2. Displacement which happened at the 10 nodes when apply pressure1 Bar until 4 Bars.

No	Node Number	Displacement (mm)			
		At the 1 bar	At the 2 bar	At the 3 bar	At the 4 bar
1	2727	0.001086	0.021732	0.032598	0.043464
2	2716	0.005798	0.035971	0.053956	0.071941
3	2706	0.023147	0.046294	0.069442	0.092589
4	2696	0.026610	0.053220	0.079830	0.10644
5	2686	0.028420	0.056840	0.085260	0.11368
6	73297	0.028420	0.056840	0.085260	0.11368
7	73287	0.026610	0.053320	0.079830	0.10644
8	73279	0.023147	0.046294	0.069442	0.092589
9	73269	0.005798	0.035971	0.053956	0.071941
10	73260	0.001086	0.021732	0.032598	0.043464

The total displacement value that happened in the all autoclave can be calculated by added displacement value which happened in the head cover and displacement value which happened in the body tank, as shown in figure 12 and table 3.

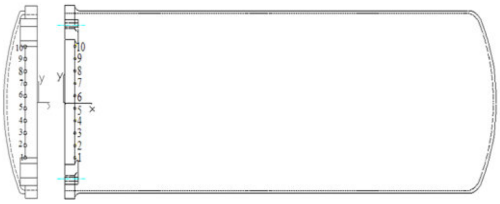
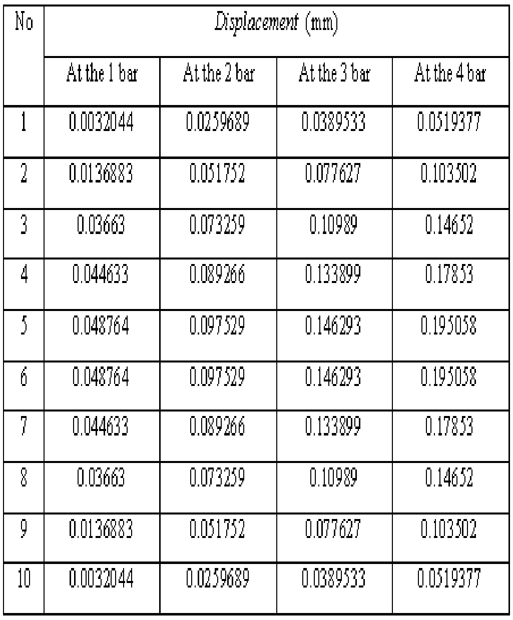


Figure 12. Total displacement at the autoclave

Table 3. Total displacement which happened in the 10 node when apply pressure 1 Bar until 4 Bars.



No	Displacement (mm)			
	At the 1 bar	At the 2 bar	At the 3 bar	At the 4 bar
1	0.0032044	0.0259689	0.0389533	0.0519377
2	0.0136883	0.051752	0.077627	0.103502
3	0.03663	0.073259	0.10989	0.14652
4	0.044633	0.089266	0.133899	0.17853
5	0.048764	0.097529	0.146293	0.195058
6	0.048764	0.097529	0.146293	0.195058
7	0.044633	0.089266	0.133899	0.17853
8	0.03663	0.073259	0.10989	0.14652
9	0.0136883	0.051752	0.077627	0.103502
10	0.0032044	0.0259689	0.0389533	0.0519377

Validation is used to compare the displacement between real experiment result and the result of ANSYS simulation result. Real experiment activity is shown in figure 13.

Working pressure of the autoclave can be seen in pressure gauge which placed behind autoclave body (figure 14).

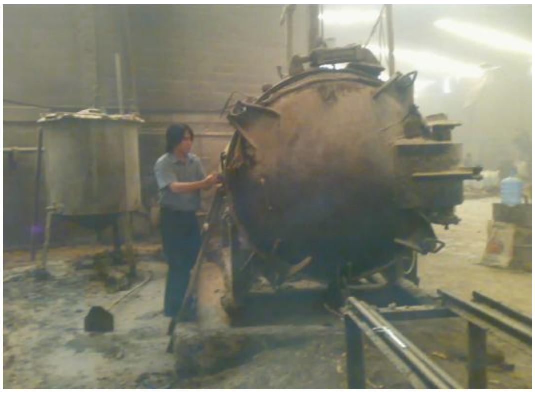


Figure 13. Real experiment activity

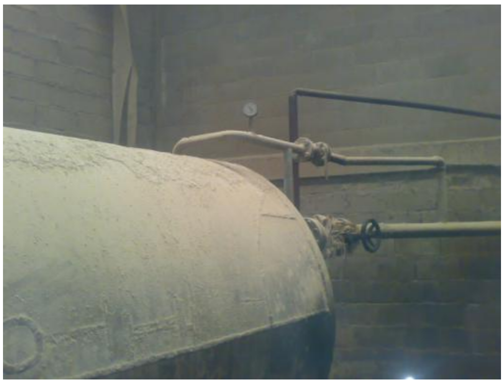
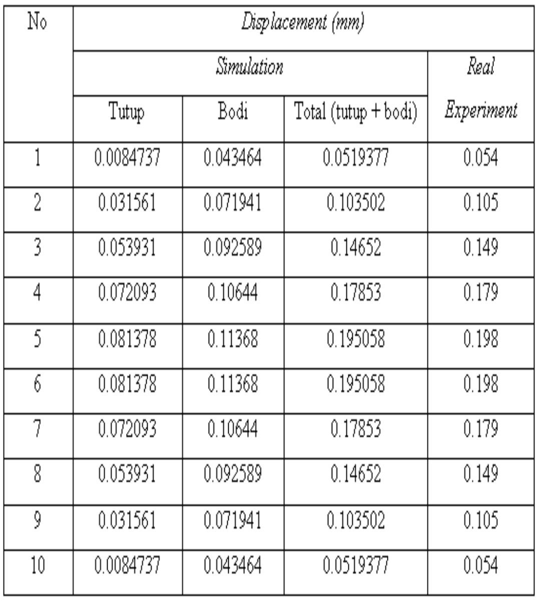


Figure 14. Pressure gauge

Table 4. Comparison between ANSYS result and real experiment



No	Displacement (mm)			
	Simulation			Real Experiment
	Tutup	Bodi	Total (tutup + bodi)	
1	0.0084737	0.043464	0.0519377	0.054
2	0.031561	0.071941	0.103502	0.105
3	0.053931	0.092589	0.14652	0.149
4	0.072093	0.10644	0.17853	0.179
5	0.081378	0.11368	0.195058	0.198
6	0.081378	0.11368	0.195058	0.198
7	0.072093	0.10644	0.17853	0.179
8	0.053931	0.092589	0.14652	0.149
9	0.031561	0.071941	0.103502	0.105
10	0.0084737	0.043464	0.0519377	0.054

The result from ANSYS software simulation and real experiment can be seen in table 4 and the accuracy of ANSYS software simulation is good compare with real experiment (figure 15).

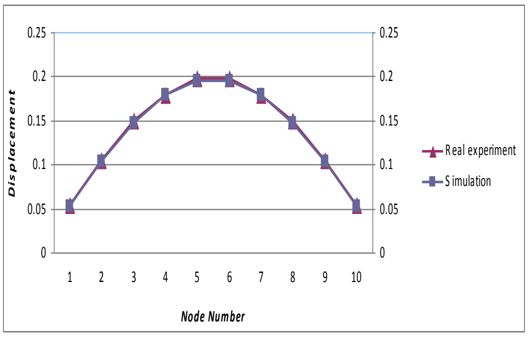


Figure 15. New design of the head cover

After validations process is done from the ANSYS simulation result and the real experiment result, can be known that the reason leakage happened in the side autoclave design. The next step, create a new design where in the new design is not happened leakage again like which happened in the old design when the autoclave was operated in pressure 7 Bars. The new design can we see in figure 16 and figure 17.

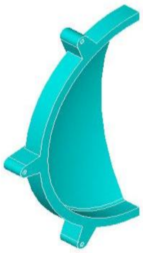


Figure 16. New design of the head cover

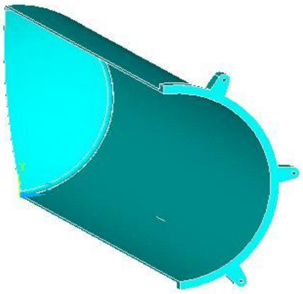


Figure 17. New design of the body tank

In the new design, the same procedure with the old design which symmetric shell used to the head cover and the body tank. The meshing for the head cover can be seen in figure 18.

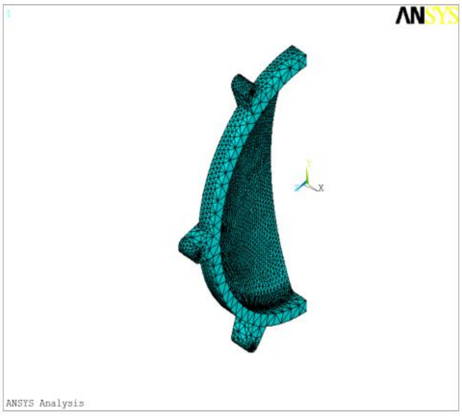
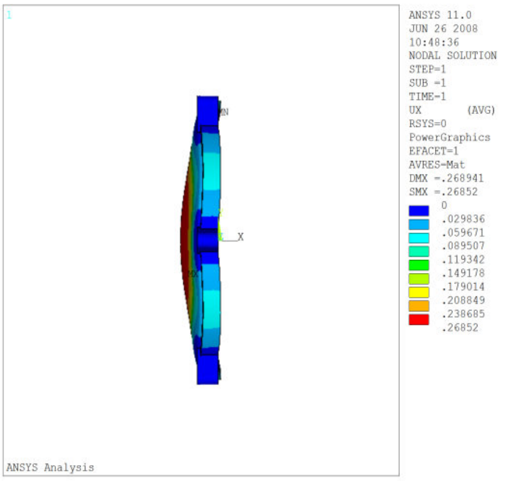

ANSYS
X
ANSYS Analysis

Figure 18. Meshing for the head cover new design

After meshing process has finished then the pressure is given to the head cover at 7 Bars. Displacement which happened can be seen in figure 19.


ANSYS 11.0
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10:48:36
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SUB =1
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RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.268941
SMX =.26852
0
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.059671
.089507
.119342
.149178
.179014
.208849
.238685
.26852
X
ANSYS Analysis

Figure 19. Displacement in the head cover

Using the same procedure is doing to the body tank model, which symmetric shell used to the body. The meshing for body tank can be seen in figure 20.

After meshing process has finished then the pressure is given to the head cover at 7 bars. Displacement which happened can we see in figure 21.

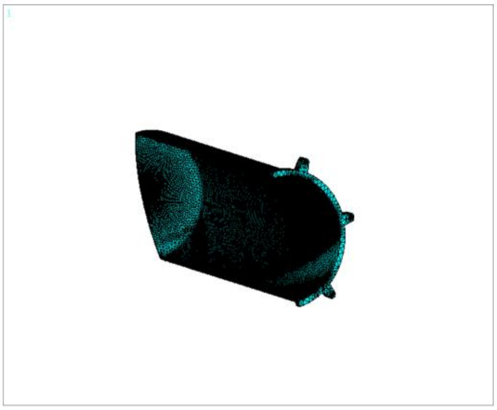

Figure 20. Meshing the body tank

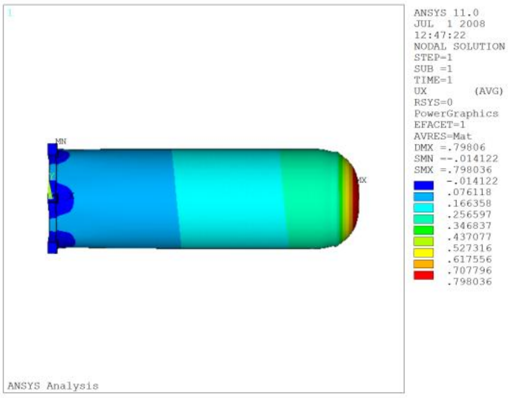

Figure 21. Displacement in the body tank

The total displacement value that happened in the all autoclave can be calculated by added displacement value which happened in the head cover and displacement value which happened in the body tank can be seen in figure 22 and table 5.

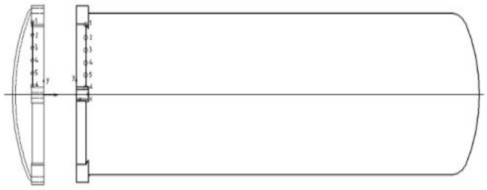

Figure 22. Total displacement at 6 nodes

From table 5 can be seen that the displacement value that happened in the side section of the autoclave new design (0.120237 mm) become smaller than displacement value that happened in the autoclave old design (0.195058 mm).

So in the autoclave new design can operated in pressure 7 Bars and it is safe.

Table 5. Displacement total which happened in the 6 nodes in the new design autoclave. (At working pressure 7 Bars)

No	*Displacement* (mm)		
	Head Cover	Body Tank	Total
1	0.0023790	0.019527	0.021906
2	0.0050861	0.065623	0.070709
3	0.013483	0.089358	0.102841
4	0.023861	0.096376	0.120237
5	0.0068903	0.079001	0.0858913
6	0.0016734	0.022609	0.0242824

Conclusions

The full scale tests (real experiment test) are expensive and require a lot of time, material and money. The full scale tests is not the Sustainable Product Development way of autoclave design. Using Finite Element Method Technology changing material and shape are very easy to do and many other designs can be made easily. Reducing cost, material and time of the design is the most important aspect. Reducing cost, material and time of the mechanical design using virtual reality is a sustainable product development in the mechanical design

Based on the simulation result after re-design obtained, this autoclave can operates safely without leakage up to 7 Bars. Designing the mechanical product using ANSYS software can reduce materials, cost and time of the product development. ANSYS software based on finite element method is a sustainable technology for sustainable product development because simulation technology using ANSYS software can perform the performance of the machine during the design phase and reduce materials, cost and time of the product development.

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