Fourth Year Project 2002

Seminar Timetable

20th of September 2002

Location and Time	Project Title (Project Number)	Students	Supervisor/s	Session Chair/s
Seminars in S117 – FSAE & Design				
S117 8:50-9:00	**Welcome and Introduction**			
S117 9:00-10:30	**Design/build of a Formula SAE vehicle (25)**	Mark Berginetti Jed Carmen Chris Duffield Danniel Harris Nick Herath Michael Maloney Alex Marchuk Peter Marzec James McPherson David Moloney Alex Munn Warren Roget Mark Rosser Craig Rundle Jason Sutton Sovann Thach Luke Zoontjens	Colin Kestell Manfred Zockel Malcolm Bethune	Mark Berginetti Jed Carmen Chris Duffield Danniel Harris Nick Herath Michael Maloney Alex Marchuk Peter Marzec James McPherson David Moloney Alex Munn Warren Roget Mark Rosser Craig Rundle Jason Sutton Sovann Thach Luke Zoontjens
10:35-10:50	**COFFEE BREAK**			

Seminars in S117 – FSAE & Design				
S117 10:50-11:10	**Design, analysis and construction of a synthetic hip joint (28)**	Tim Marshall Grant Nelson Josh Wickham	Colin Kestell Mellick Chahade	Lim Song Chong Siu Mun Leong
S117 11:10-11:25	**Design, analysis and construction of a synthetic spinal segment (26)**	Lim Song Chong Siu Mun Leong	Colin Kestell Mellick Chahade	Matt Maxwell Tracy Rowland
S117 11:25-11:40	**Design, analysis and construction of a synthetic skull / neck joint (27)**	Matthew Scott-Toms Simon Rees	Colin Kestell Mellick Chahade	Jimmy Yeoh Yin Tsui
S117 11:40-11:55	**Development of optimized structural member (29)**	Manfred Kahmann	Anthony Zander	Matthew Scott-Toms Simon Rees
S117 11:55-12:10	**Mechanical Handling of Beer Kegs into a Cellar* (35)**	Andrew Fisher Mark Holt	Byron Martin Fred Zockel	Tim Marshall Grant Nelson Josh Wickham
S117 12:10-12:30	**Vine Maintenance Work Platform* (36)**	Jing Liau Yong Sa Wai Wong	Bruce Beard Byron Martin	Manfred Kahmann
S117 12:30-12:45	**Microwave Weed Controller* (37)**	Matt Maxwell Tracy Rowland	Bruce Beard Byron Martin	Andrew Fisher Mark Holt
S117 12:45-13:00	**World Solar Challenge Car Design (38)**	Jimmy Yeoh Yin Tsui	Gus Nathan Mr Richard Craig	Jing Liau Yong Sa Wai Wong
13:00-14:00	**LUNCH - S127**			

Seminars in S211 – Fluids, Combustion & Aero

S211 8:50-9:00	**Welcome and Introduction**			
S211 9:00-9:15	**Soap-Film Tunnel (3)**	Romlea Bray Lindsay Gordon	Richard Kelso Bassam Dally	Steven Condina Jun Udagawa
S211 9:15-9:30	**Eel-Like Bio-Mimetic Propulsion Device (4)**	Bryce Dolman Tze King Tang	Richard Kelso Gerald Schneider	Huat Lee Ting Benjamin Lik Wei Sung Teng Eik Su
S211 9:30-9:50	**Hot-Air Balloon Burner (5)**	Ming Seong Cheong Tuck Wai Kenneth Kwan Wei Boon Ng	Richard Kelso Peter Lanspeary Graham Nathan	Romlea Bray Lindsay Gordon
S211 9:50-10:05	**Wind Tunnel Flight Simulator (6)**	Rebecca Jones Michael Stacey	Richard Kelso Gerald Schneider	Bryce Dolman Tze King Tang
S211 10:05-10:20	**Assessment of building performance* (8)**	Steven Condina Jun Udagawa	Gus Nathan Cecil Camilleri	Ming Seong Cheong Tuck Wai Kenneth Kwan Wei Boon Ng
S211 10:20-10:40	**Design of a laboratory-scale solar furnace for lime production (7)**	Huat Lee Ting Benjamin Lik Wei Sung Teng Eik Su	Gus Nathan Richard Craig	Rebecca Jones Michael Stacey
10:40-10:50	**COFFEE BREAK**			

Seminars in S211 – Fluids, Combustion & Aero				
S211 10:50-11:05	Experimental investigation of Porous Burner **(9)**	Keen Leong Chew King Huang Bong	Bassam Dally Peter Ashman	Victor Pisaniello Kris Hennessy
S211 11:05-11:25	**Design of a New Innovative Coil (10)**	Han Meng Goh Hui Hoon Ng Wei Khan Siew	Bassam Dally Prof Sam Luxton	Yew Chen Shandy Kiu Robin Leong
S211 11:25-11:40	**Aerodynamic Modification of Wingtips on the RAAF P3 Orion Aircraft (13)**	Adam Greaves Peter Jones	Gerald Schneider Graeme Secker	Yong Taang Tiong Jang Hung Lau
S211 11:40-11:55	**Design and Build of Spray Nozzle for use in Flameless Oxidation Burner (12)**	Yong Taang Tiong Jang Hung Lau	Bassam Dally Gus Nathan	Matthew Hochman Mark Leane Simon Nitschke
S211 11:55-12:15	**The Design and Construction of a Self Sustaining Radial Flow Gas Turbine (42)**	Matthew Hochman Mark Leane Simon Nitschke	Bassam Dally Gus Nathan	Han Meng Goh Hui Hoon Ng Wei Khan Siew
S211 12:15-12:30	**Comparison of indices of indoor air quality for underfloor- and overhead-air distribution systems using computational fluid dynamics (11)**	Benjamin Miners	Prof Luxton Pat Marshalsay	Keen Leong Chew King Huang Bong
S211 12:30-12:45	**Investigation of an Electrically Powered Aircraft (15)**	Victor Pisaniello Kris Hennessy	Gerald Schneider Nesimi Ertugrul	Benjamin Miners
S211 12:45-13:05	**Validation of Physical and Mathematical Modelling Criteria for Advanced Gyro-Therm Burners* (40)**	Yew Chen Shandy Kiu Robin Leong	Gus Nathan Steven Hill	Adam Greaves Peter Jones
13:05-14:00	**LUNCH - S127**			

Seminars in EM324 – Dynamics and Control				
EM324 8:50-9:00	**Welcome and Introduction**			
EM324 9:00-9:15	**Active Mirror Control* (1)**	Adrian Moo Tong Huynh	Ben Cazzolato Anthony Zander	Luke Andrews Ben Koch Buddhika Abeytunga
EM324 9:15-9:30	**Internal Mirror Memory* (30)**	Kian Low Li Teng	Tien-Fu Lu	Sze Chai Cheong Leong Siau Tan
EM324 9:30-9:55	**Robotic Pool Player (2)**	Justin Ghan Will Roberston Alexandra Thornton Tom Radzevicius	Ben Cazzolato	Adrian Moo Tong Huynh
EM324 9:55-10:15	**Mobile robot development (18)**	Luke Andrews Ben Koch Buddhika Abeytunga	Tien-Fu Lu Antoni Blazewicz	Kian Low Li Teng
EM324 10:15-10:35	**Underwater robot project (19)**	Sze Chai Cheong Leong Siau Tan	Tien-Fu Lu Antoni Blazewicz	Justin Ghan Will Roberston Alexandra Thornton Tom Radzevicius
10:35-10:50	**COFFEE BREAK**			

Seminars in EM324 – Dynamics and Control				
EM324 10:50-11:05	**Skidding of motor vehicle on bitumen vs. dirt* (39)**	Simon Martin Suganthan Sumelingam	Chris Hall Anthony Zander Robert Anderson	Ian Register
EM324 11:05-11:20	**Multi-robot collaboration (20)**	Szee Ng Michael Nielson	Tien-Fu Lu	Simon Martin Suganthan Sumelingam
EM324 11:20-11:35	**Micro-mouse Development 1* (17)**	Nathan Juers Tim Griffin	Tien-Fu Lu	Szee Ng Michael Nielson
EM324 11:35-11:50	**Automatic Assembly of MDO Lourve Blades* (21)**	Cheong Leong	Tien-Fu Lu Hong Du (Polyaire)	Boon Siong Tan
EM324 11:50-12:05	**Exhaust stack directivity (31)**	Matt Dewhirst	Colin Hansen	Cheong Leong
EM324 12:05-12:20				
EM324 12:20-12:35	**Plenum Chamber Attenuation (33)**	Benjamin Spezzano	Colin Hansen	Matt Dewhirst
EM324 12:35-12:50	**Flow over towed underwater sonar arrays* (41)**	Boon Siong Tan	Max Bull Antoni Blazewicz	Benjamin Spezzano
12:50-14:00	**LUNCH - S127**			

Seminars in EM316 – Aero / Welding, Joining and Materials

EM316 8:50-9:00	**Welcome and Introduction**			
EM316 9:00-9:20	**Surveillance Camera Platform for a Piper Seneca II Aircraft (14)**	Eng Kiat Liew Rajan Peng Kiat Koo Benny Liang Chern Lim	Gerald Schneider Richard Kelso	Cheah Kin Mwn Ch'ng Kar Keat
EM316 9:20-9:35	**GPS Differential Carrier Phase Measurements for Attitude Determination (34)**	Sam Tuominen Rob Minson	Gerald Schneider Steve Kollias	Yee Ling Siew Mahendran Sinathuraja
EM316 9:35-9:55	**Stress analysis of aircraft wings repaired using friction welding (23)**	Hack Chan Lim Sung Kiang Yeo Chang Wei Leong	Valerie Linton Gerald Schneider	Eng Kiat Liew Rajan Peng Kiat Koo Benny Liang Chern Lim
EM316 9:55-10:10	**Investigation of hydrogen assisted cold cracking in steels (22)**	Cheah Kin Mwn Ch'ng Kar Keat	Ian Brown Valerie Linton	Andrew Rowling
EM316 10:10-10:25	**The influence of third phases on the performance of super duplex stainless steel welds (24)**	Yee Ling Siew Mahendran Sinathuraja	Valerie Linton	Sam Tuominen Rob Minson
EM316 10:25-10:40	**Investigating the effect of water and corrosive substances on fatigue life (16)**	Andrew Rowling	Ian Brown	Hack Chan Lim Sung Kiang Yeo Chang Wei Leong
10:40-10:50	**COFFEE BREAK**			

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GROUP FOUR – Room EM316

GROUP ONE

Room S117

DESIGN / BUILD OF A FORMULA SAE VEHICLE

Authors:
Mark Bergineti, Jed Carmen, Chris Duffield, Daniel Harris, Michael Maloney, Alex Marchuk, Peter Marzec, Alex Munn, Warren Roget, Craig Rundle, Jason Sutton, Luke Zoontjens, Sovann Thach, Nick Herath, Mark Rosser, James McPherson, David Moloney

Supervisors:
Dr Colin Kestell, Mr Malcolm Bethune and Associate Professor Manfred Zockel

The Formula SAE-A (Society of Automotive Engineers, Australasia) competition is for SAE student members to conceive, design, fabricate, and compete with a state of the art 600cc open wheeled racecar. The competition has grown rapidly in the USA to over 110 universities since its inception in the early 1980's. Students must raise sponsorship and operate as a business to finance and manage the project.

For the purpose of this competition, the students are to assume that a manufacturing firm has engaged them to produce a prototype car for evaluation as a production team. The intended sales market is the non-professional weekend autocross racer. These high performance vehicles marry the design and technological characteristics of Formula 1 with the feel and agility of high-powered karts. At the competition, every aspect of the design is evaluated and the vehicular performance is assessed in a multitude of events that take the cars to their limits. The restrictions on the car frame and engine are limited so that the knowledge, creativity, and imagination of the student are challenged.

THE SURROGATE HUMAN HIP PROJECT

Authors:
Timothy Marshall, Grant Nelson and Joshua Wickham

Supervisors:
Dr. Colin Kestell, Dr. Mellick Chehade, Mr David Thompson

This project, as one of several such projects, forms part of the Human Surrogate Program (HSP) as run by the Defence Science Technology Organisation (DSTO) in conjunction with the Royal Adelaide Hospital (RAH) and Adelaide University. The objective of this specific project being the production of a synthetic, biofidelically (mechanically) accurate model of real human hip-joint ligamentous tissues, for use in impact trauma testing and analysis. It has been identified that such synthetic elements may be used in assessing the effects upon the human body of land mine explosions, car crashes, and space exploration amongst others.

Through the seminar presentation process we hope the listeners will gain an insight into the processes that were adopted to satisfy the needs of achieving the ultimate project goals. The presentation will initially address the structure of the hip joint, and the ways it may be assessed using engineering terminology and methodology. The presenters will then discuss issues that arose in testing of cadaverous specimens and the work to be undertaken in the near future.

DESIGN, ANALYSIS AND CONSTRUCTION OF A SYNTHETIC SPINAL SEGMENT

Authors:
Limsong, Chong ;Siumun, Leong

Supervisors:
Dr Colin Kestell, Dr Mellick Chahade, Mr. David Thompson

The Inverteberal disc (IVD) between the spinal column is to facilitate energy absorption and to protect the spinal structures against impact; it also acts as a balance column by keeping the body upright. The energy absorption will also depend on the elasticity and degree of freedom of the IVD. Therefore, an understanding of the mechanical properties of IVD in lumbar spine section L1 and L2 is important, and it could be determined by conducting a simple tensile and compression tests.

An exact synthetic model of functional spinal unit (FSU) will be developed for the testing. The material currently used in the IVD is Rhodorsil RTV585 with 3% of Rhodasil catalyst in the Human Surrogate Program (HSP). By varying the content of Rhodasil catalyst from 3% to 5% of Rhodasil catalyst could provide a different mechanical behaviors of IVD. Therefore, an examination of the result in the cadaver's interverbral disc and synthetic FSU will be performed in order to select a material, which have similar mechanical behaviors as human. Likewise the mechanical properties of intervertebral disc will be analysed by means of Finite Element Analysis (FEA) with ANYSYS software.

Once established an FEA will show how various load conditions might affect a synthetic FSU and whether typical failure scenarios are likely to be reproduced with the synthetic material.

DESIGN, ANALYSIS & CONSTRUCTION OF SYNTHETIC HEAD/NECK JOINT.

Authors:
Matthew Scott-Toms, Simon Rees

Supervisors:
Dr Colin Kestell, Dr Mellick Chahade

An introduction to the Surrogate Project by a member from the group researching the hip joint will be given prior to the commencement of our seminar. This will prevent all three groups repeating similar information about the Surrogate Project. This introduction will provide a background to the Surrogate Project and the overall objectives regarding the use of a Surrogate human.

The seminar will begin by giving an introduction specific to the region of the body we are researching. This will give the audience a background to the anatomy of the region under investigation and the function of the focus of our project, the transverse ligament. The significance of the role of the transverse ligament in relation to the Surrogate will then be discussed.

Following this introduction, the processes involved in reaching the final outcome of the project will be explained. The first procedure to be discussed will be the testing process. Here, the process of obtaining the samples and testing them in the Hounsfield machine will be explained. The results obtained from the testing will then be discussed.

Leading on from the testing results, the material selection process will then be described. This will include how the materials were found and tested.

Finally, the reason for the CT scanning of the ligament will then be explained. This will lead onto a discussion of the creation of a 3-dimensional model and the use of Finite Element Analysis.

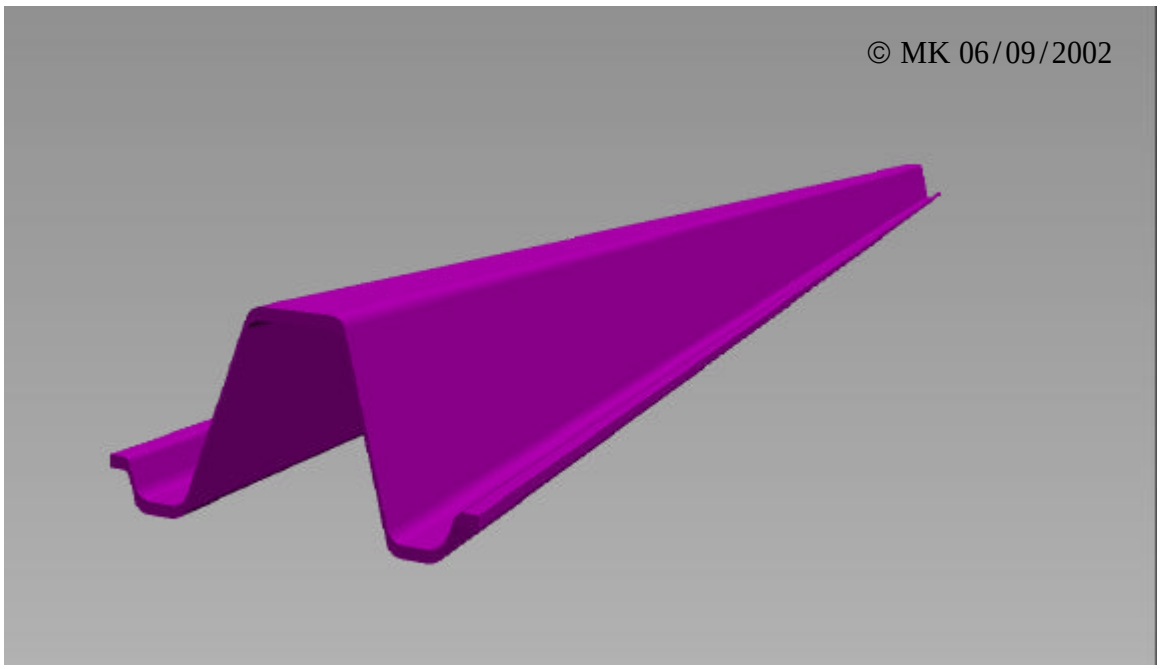
DEVELOPMENT OF AN ELONGATE STRUCTURAL MEMBER

Author:
Manfred Kahmann

Supervisor:
Dr Anthony Zander

This project concerns research, design and development of an optimised elongate structural member for use as a cheap, versatile, environmentally friendly and long lasting replacement for aluminium, steel and timber members. Especially in aggressive environments where these materials have limitations and high maintenance costs. The envisaged use of such a structural member, is as a cost effective means of replacing shaved perma-pine poles, that are used as supports in covered orchards, vineyards and the proposed Solar Tower in the River-land which has just been declared; a 'major project' by the Federal Government. The scope of the project involves detail design and optimisation of the main elongate structural member and of other ancillary components, as well as methods of manufacturing such a structural member.

To date, the solution consists of a modular nestable primary elongate member of 'top hat' cross section comprising layers of fibre reinforced cement, that may be integrally strengthened by means of longitudinal tendons and or discrete localised elements in the form of fibre reinforce plastics and or galvanised iron ties. The proposed method of manufacture involves the combination of two well known casting techniques, nest casting and slip casting, for high volume production. At this stage a number of solutions are being analysed using computer FEM in concurrence with the preparation of scaled physical samples for testing.



MECHANICAL HANDLING OF BEER KEGS INTO A CELLAR

Authors:
Andrew Fisher and Mark Holt

Supervisor:
Mr Byron Martin, Associate Professor Manfred Zockel

Client:
Coopers Brewing Ltd.

This project concerns the movement of kegs of beer into and out of the various hotel cellars around the Adelaide area. Current manual handling practices put the operator at a high risk of body stressing injuries, particularly to the back. Our primary aim is to significantly reduce the likelihood of a keg delivery operator suffering an injury whilst delivering kegs, to the benefit of both the client and the employee, while maintaining an acceptable level of delivery efficiency.

At present, kegs are manually handled from the truck, down onto the ground, then into the cellar or keg room via a ramp. Occasionally there is the need to retrieve full or partially full kegs from the cellar.

In order to best solve the overall problem we are looking at three different solutions, to be implemented according to the specific needs of a particular location;

- A simple pulley device utilising mechanical advantage, to make elevating full kegs easier,
- A ramp and cellar improvement strategy, aimed at hotels with lower delivery quantities, which will improve the safety and ease of delivery at a lower cost,
- An electric conveyor system, intended for selected high volume hotels where the time and effort savings are more significant.

VINE MAINTENANCE PLATFORM

Authors:
Jing Cheng Liau,Wai Siong Wong,and Yong Wee Sa.

Supervisors:
Mr Byron Martin, Mr Bruce Beard

Client:
SOUTHCORP

A vine maintenance work platform is a modern development which integrating essential equipments on a tractor, such as pruner, sprayer, trimmer, and mower.
Developing a design of this kind of multipurpose vine maintenance work platform would improve the efficiency of vine maintenance works; and minimize the soil compaction on the soil.

After survey procedures had been done in the workshop, which allocated at McLaren vineyard, the existing work platform is trailed along a vine path by tractor. We have found that the current maintenance works (pruning, spraying, trimming, and mowing) could be done for ½ or 1 row only in once. Thus, the goal of our project is seeking for an improvement that could reduce the maintenance works and increasing the productivity of vineyard.

As predicted, the platform will face a serious problem in turning (from one row to the other row) because of the huge size of platform body design that could complete maintenance works for a 2-3 rows in each task. So that, the maintenance platform's turning mechanism will be considered. The first consideration will emphasize on wheels selection and follow by combination of linkages. For easy operating, designation of remotely mounted equipment will be carried out. Thus, our target should allow one operator for a maintenance works platform as well. Hydraulic (PTO) mechanism will be applied in 3-point-linkages and supports the remotely mounted maintenance equipments such as sprayer, mower, trimmer and pruner.

The main material that would be used to construct the frame of maintenance work platform is steel alloy. The further study concern of properties of steel alloy will be done in calculation and material analysis. This study will be conducted to calculating maximum support loading of essential equipments on the frame.

Last but not the least, safety factor for operator and estate workers will be considered in details. Nowadays, tractor overturn incidents are becoming ridiculous issue to be drawn on. So, our maintenance platform will be designed focussing the center gravity .By an appropriate center gravity allocated, the balancing problem could be solve easily and thus overcome overturn hazard.

The project success could reduce cost and increase time efficiency. In addition, the work platform will be user friendly, require less maintenance, be more flexible, and manpower savings. The final outcomes of the project are complete of the project tasks on time, and meeting all of the requirements specified by the client.

MICROWAVE WEED CONTROLLER

Authors:
Matthew Maxwell, Tracy Rowland

Supervisors:
Mr Bruce Beard, Mr Byron Martin, Mr Peter Hayes

Weed management is one of the biggest issues within viticulture. Traditional approaches include spraying with herbicides, cultivation, hand weeding, mulching and mowing, each having significant drawbacks. This project looks at replacing these methods with one that uses microwave radiation to kill weeds. The seminar follows the undertaking of a feasibility study with respect to theory, practice, cost and safety.

Theoretically, microwave radiation can cause sufficient damage to kill plant life.

Testing has been undertaken to confirm this and to discover relationships between power output, exposure time and kill-rate.

Safety is a very important issue. A safe level of microwave power density is $100 W/m^2$, which can be maintained using shielding.

The cost of a microwave solution must be comparable to current weed control methods. This cost is dependent on variables including equipment, power usage and labour.
There are two main viable methods of applying microwaves to the weeds.

1 A mobile applicator moving along the rows, reducing equipment costs
2 Incorporate sensors to aim directly at weeds, reducing power consumption.

The first option is the most practical. The running cost for the amount of energy required far surpasses those for existing weed control.

Despite having many advantages over traditional methods, microwave weed control is currently not economically viable. Improved power generation technology in the future could change this.

WORLD SOLAR CHALLENGE CAR DESIGN

Authors:
Jimmy Yeoh Wei Jin, Yin Tsui

Supervisors:
Dr. Gus Nathan, Mr. Richard Craig

The seminar will mainly cover the introduction to the World Solar Challenge event, its brief history as well as give the audience a concise walkthrough of the project being undertaken. For the main part of the presentation, a short literature review of the past top placing solar cars will be discussed. This includes our positive comments as well as pointing out some appropriate critics.

Following that our recent research development in major systems of the design will be discussed. Major components like vehicle architecture, power train, electrical systems and mechanical systems will be addressed. Next we will talk about the advancements in technology that have been considered. Various types of solar cells and batteries, their pros and cons as well as cost issues will also be discussed. The final part of the seminar will contain the realistic goals that we have, what we aim to achieve by the end of this year and how are we going to make this year's work useful to next year's project group.

A general time scale of the entire project will also be explain before the end of the seminar. This hopes to give the audience a basic idea of how the project is going to evolve in the years to come.

GROUP TWO

Room S211

SOAP-FILM TUNNEL

Authors:
Romlea Bray and Lindsay Gordon

Supervisor:
Dr Richard Kelso, Dr Bassam Dally

EEL-LIKE BIO-MIMETIC PROPULSION DEVICE

Author:
Bryce Dolman, Tze King Tang

Supervisor :
Dr Richard Kelso

DEVELOPMENT OF CRINKLE BURNER FOR HOT AIR BALLOONS

Authors:
Cheong M.S., Kwan K.T.W. and Ng W.B.

Supervisors:
Dr Richard Kelso, Dr Peter Lanspeary, Associate Professor Graham Nathan

WIND TUNNEL FLIGHT SIMULATOR

Authors:
Rebecca Jones & Michael Stacey

Supervisor:
Dr Richard Kelso

The aim of this project is to design and build a portable flight trainer to allow a person to remotely control an aircraft within a wind tunnel. This simulator will be used for undergraduate laboratories and promotional exhibits.

A wind tunnel has been constructed specifically for the purpose of this project. It has been designed with two sections, an inlet and an expansion, for ease of transportation. A variable speed controller is used to control the speed of the fan, simulating the thrust that would be provided by the propellers of the plane. Two model planes have been purchased and assembled. A control system has been installed within one of the models to control its movement during flight. The plane is tethered at the end of the wind tunnel by a thin line attached above its center of gravity. The line is part of a pulley system that enables the plane to move vertically, demonstrating the effect of the lift produced by the plane.

The flight simulator successfully demonstrates the theory of flight taught in Aeronautical Engineering. It will provide a valuable learning experience for students, and an interactive display for the public.

ASSESSMENT OF BUILDING PERFORMANCE

Authors:
Steven Condina, Jun Udagawa

Supervisors:
Associate Professor Graham Nathan, Dr Cecil Camilleri

Yalumba Wine Company have recently built a new display building down in Coonawarra, which is located in the south east of South Australia. The architectural design of the building was to create a display and wine sales building, which was environmentally friendly and energy efficient. The choice to design an energy efficient building is in response to Yalumba's adoption of the Greenhouse Challenge, which aims to reduce greenhouse gas emissions. The engineering design of the building aimed to find more energy efficient mechanical systems than those that are conventionally used in other such buildings and to use passive energy to enhance comfort rather than fossil fuels.

Heating the building in the most energy efficient and cheapest way possible is a major requirement since temperature in that region is fairly cold most of the year round. The system used is a fan coil unit in which it uses the hot water from the hot water system. The water is passed through a coil and a fan passes room temperature air over the coils. Through convection heat is transferred from the hot water to the air.

The aim of this project is to evaluate the energy efficiency of the new display building. The project will involve monitoring of indoor and outdoor temperatures and an assessment of the energy requirement and comfort of the new building will be conducted. It will also involve comparison of the performance with other buildings.

DESIGN OF A LABORATORY-SCALE SOLAR FURNACE FOR LIME PRODUCTION

Authors:
Huat Lee TING, Benjamin SUNG, Teng Eik SU

Supervisors:
A/Prof. Gus Nathan, Mr. Richard Craig

The aim of this project is to research, design and develop a laboratory-scale solar heating furnace. Solar energy is preferred to replace the combustion heating method, because this can effectively reduce the emission of undesirable greenhouse gases.

For calcination process to occur, the limestone requires temperature of 1200°C. This furnace is to be able to perform such calcinations directly or to simulate the process with comparable heat loads and temperatures. Concentrated solar energy is to be simulated with a xenon short-arc lamp, which can provide a high-energy spectrum that is similar to sun. For the furnace insulation, a ceramic fiber is used to replace the traditional insulation bricks due to its lower mass and lower specific heat properties. Ceramic fiber rope will be used as the sealing material. Pipes with cooling water flowing through them, are used to simulate the thermal load. Rotary system is designed to rotate the limestone spheres so that their entire surface can be exposed to equal amount of heat from the lamp source. A weighing system is designed to measure the completeness of the calcination process of the limestone.

Safety issue is also very important to be considered in the design process. An external cage will be constructed to prevent an operator from having direct contact with the 130°C external furnace wall.

EXPERIMENTAL INVESTIGATION OF POROUS BURNER

Authors:
Keen Leong Chew, King Huang Bong

Supervisors:
Dr Bassam Dally, Dr Peter Ashman

In a porous radiant burner (PRB), air and fuel is burned as it flows through a porous ceramic matrix. The PRB can sustain combustion at air-fuel ratios much leaner than are possible in conventional free-standing flames. At ultra-lean air-fuel ratios, flame temperature in the bed is approximately 1000 to 1300°C. This offers the advantages of efficient heat transfer from the porous bed, and very low concentrations of NOx and CO in the exhaust.

The aim of this project is to determine the operating envelope of the PRB when fired with commercial propane (L.P.Gas). The operating envelope will be expressed in terms of parameters such as the flow speed of reactants, air-fuel ratio, initial temperature of reactants and flame propagation speed. Comparison with the natural gas fired PRB may then indicate the effect of fuel characteristics on PRB performance. The results of the experiments will be compared with one-dimensional numerical simulations run on the chemical simulation package, CHEMKIN.

DESIGN OF A NEW INNOVATIVE COIL

Authors:
Hui Hoon Ng, Han Meng Goh & Wei Khan Siew

Supervisors:
Dr Bassam Dally, Dr Peter Lanspeary & Prof Sam Luxton

Heat exchangers are useful devices in Thermo-fluid field and play significant role in many industries. Fin-and-tube heat exchangers are commonly used as radiators for motor vehicle engines, and as condensers, evaporators or dehumidifiers in air-conditioning systems. The design of heat exchangers entail in it many facets of engineering such as heat transfer, fluid mechanics and material science. An efficient design needs to achieve certain engineering objectives such as energy savings and hence environmental considerations and inevitably economic competitiveness.

Aim of the project is to improve the rate of heat transfer in fin-and-tube heat exchangers, without increasing the pressure drop across the fins. Reducing the pressure drop is expected to have energy savings, improved efficiency and eventually cost reduction. The investigation includes:

(a) flow visualisation experiments with scale models in water tunnel
(b) numerical simulation of heat and fluid flow.

The scale models permit the testing of several tube cross-section shapes, tube arrangements (in-line and staggered), and varying fins spacing. The purpose of flow visualisation is to make a qualitative measurement of the effect of flow separation on heat transfer. In this study, numerical simulation provides quantitative estimates of heat transfer. The experimental results will be validated with the numerical simulation.

RE-MODIFICATION OF P-3C ORION WING TIPS

Authors:
Peter Jones & Adam Greaves

Supervisor:
Dr. Gerald Schneider

The Royal Australian Air Force has a fleet of 22 P-3C Orions based at Edinburgh. During the period of 1989-1999 the RAAF upgraded the Electronic Support Measures kit on the Orion fleet in order to give the aircraft improved electronic surveillance capabilities in order to detect submarines, lost sea-goers etc.

Our power point presentation will introduce the drag and vibration problems associated the PA 5140 wing tips along with the solution approach that our group defined early in the year. This presentation will firstly explain the difficulties involved in modifying the wing tips, as three sets of requirements must be met simultaneously including aerodynamic, structural and electromagnetic.

The presentation will demonstrate how we are in the process of converging to a final alternative design for the wing tips. The method of convergence involves quantitative (theoretical) research into all types of drag and drag reduction techniques along with qualitative (experimental) methods, which includes the use of the wind tunnel to perform flow visualization and measure the drag on a model of the wing tip.

The production of the model by use of Solid Edge and the workshop Computer Numerical Control (CNC) machine to produce a wooden, scale model of the wing tips will also be explained along with the complications in correlating data measured from scale models to the real wing tips in flight.

Finally we will demonstrate how our new alternative designs will reduce the drag and be acceptable for the Orion fleet.

DESIGN AND BUILD OF SPRAY NOZZLE FOR USE IN FLAMELESS OXIDATION BURNER

Authors:
Y.T. Tiong, J.H. Lau

Supervisors:
Dr. Bassam Dally, Dr. Peter Lanspeary

The objectives of this project are to design, build and test a fuel atomizer for an existing jet-in-hot-coflow (JHC) burner. The JHC burner is of interest because it can operate in Flameless Oxidation condition and is applicable in most industrial burner. Flameless Oxidation, also called Mild Combustion, emits lower concentrations of NOx (nitrogen oxides) and other pollutants than conventional flames. In industrial furnaces, flameless oxidation is achieved by recirculating a proportion of the flue gas back into the furnace. In the laboratory, a similar effect is obtained by using a natural-gas/hydrogen burner to preheat and remove oxygen from the air. Preheating the air to about 1300K, which is much higher than fuel self-ignition temperature, makes it possible to sustain combustion at as low as 3%, 6% and 9% of oxygen concentrations.

In the atomizer designed for the JHC burner, a spray nozzle injects liquid methanol into a nitrogen counter-flow, and the nitrogen carries the atomized fuel into the JHC burner. Methanol is supplied from a pressurized tank. The initial experiments will test the atomizer and will ensure that its performance is satisfactory. These will be followed by combustions tests with the JHC burner, first to verify that stable combustion can be achieved, and then to measure temperature at four axial locations, 4mm, 30mm, 60mm and 120mm, in the methanol flame.

THE DESIGN AND CONSTRUCTION OF A SELF SUSTAINING RADIAL FLOW GAS TURBINE

Authors:
Matthew Hochman, Mark Leane, Simon Nitschke

Supervisors:
Dr Bassam Dally, Associate Professor Graham Nathan

This project started with the objective to validate the physical and mathematical modelling criteria for advanced Gyro-Therm burners. An experimental investigation has been undertaken within a rotary kiln using an acid-alkali modelling methods developed by the Fuel and Combustion Technology Pty Ltd (FCT) in Australia.

Three different burners such as a multi-channel burner (MCB) and two Gyro-Therm burners with different nozzle diameters were used in the modelling. The Gyro-Therm burners nozzles were designed based on the prototype burner used in a trial at the International Flame Research Foundation (IFRF). The burners were designed to suit four different scaling criteria such as the Thring-Newby, Modified Thring-Newby, Craya-Curtet and Geometric.

Two different secondary air temperatures were examined in the trials and were simulated in the model. A clear acrylic rotary kiln was built to a simple geometric scale of the prototype rotary kiln used in the IFRF trial. In the experiment, the effects by varying some parameters such as the Reynolds number, insertion length, centre-body ratios and excess air are analysed. The flow patterns and the flame length produced in the experiments by the different varying parameters were compared to the actual results obtained from the IFRF trials which were done by Jordan Parham in 2001.

COMPARISON OF INDICES OF INDOOR AIR QUALITY FOR UNDERFLOOR- AND OVERHEAD-AIR DISTRIBUTION SYSTEMS USING COMPUTATIONAL FLUID DYNAMICS (CFD)

Author:
Benjamin Miners

Supervisors:
Dr Bassam Dally, Professor Sam Luxton, Dr Patrick Marshallsay

It has been proposed that the delivery of conditioned air via an underfloor plenum (underfloor air delivery; UFAD) offers advantages compared to overhead air delivery (OHAD) in terms of numerous indices of indoor air quality. Despite these claims, there has been no direct comparison of the performance of UFAD and OHAD systems for the same space.

CFD offers advantages over experimental systems for simulating fluid flows and this technique is finding increased acceptance for the study of room airflows. The primary aim of this project was to compare UFAD and OHAD systems for a model room with respect to vertical air temperature and velocity gradients and energy requirement using CFD. The CFD software package CFX-5.5 (AEA Technology), PC version, was used for performing simulations for a cubic room, of dimensions 3.2m x 3.2m x 2.7m, for an air conditioning system operating in cooling mode.

The initial model employed a heated floor at 30ºC. Although CFD simulations provided the expected temperature and velocity profiles for OHAD, the characteristic displacement ventilation-like gradients expected for UFAD were not observed for inlet air velocities in the range 0.25 to 1.25 m/s. The model was subsequently modified to allow for variable heat load, and simulations suggest that displacement ventilation-like temperature gradient is dependent on heat load. Simulations are continuing in order to identify conditions under which UFAD may be effective.

INVESTIGATION OF AN ELECTRICALLY POWERED AIRCRAFT

Authors:
Kris Hennessy, Victor Pisaniello

Supervisors:
Dr. Gerald Schneider, Dr. Nesimi Ertugrul

The purpose of this project is to investigate the feasibility of converting an existing aircraft into an all-electric aircraft (AEA). A current trend in the aerospace industry is the move towards more electrically powered aircraft. However, as yet, no attempt has been made to convert an existing aircraft into an AEA.

Our all-electric aircraft will have various advantages over conventional internal combustion (IC) aircraft. It will have greatly reduced noise and emission levels, and an increased level of motor redundancy.

The reductions in noise and emissions will be due to the use of fuel cells and electric motors, rather than IC engines and aviation fuel. These reductions are of great benefit to smaller airports operating near residential areas.

The increased level of redundancy will come about through the use of a fault-tolerant electric motor drive which is being developed by Adelaide University's Electrical and Electronic Engineering Department. The motor actually consists of two independently driven electric motors, both connected to the propeller shaft. If one fails, the other is able to safely transport the aircraft to the nearest landing site.

The aircraft to be converted was chosen according to various criteria, such as weight, dimensions, market popularity and price. The best candidate was the Cessna 172R.

VALIDATION OF PHYSICAL AND MATHEMATICAL MODELLING CRITERIA FOR ADVANCED GYRO-THERM BURNERS

Authors:
Yew Chen, Shandy Kiu, Robin Leong

Supervisors:
Associate Professor Graham Nathan, Mr Steven Hill

This project started with the objective to validate the physical and mathematical modelling criteria for advanced Gyro-Therm burners. An experimental investigation has been undertaken within a rotary kiln using an acid-alkali modelling methods developed by the Fuel and Combustion Technology Pty Ltd (FCT) in Australia.

Three different burners such as a multi-channel burner (MCB) and two Gyro-Therm burners with different nozzle diameters were used in the modelling. The Gyro-Therm burners nozzles were designed based on the prototype burner used in a trial at the International Flame Research Foundation (IFRF). The burners were designed to suit four different scaling criteria such as the Thring-Newby, Modified Thring-Newby, Craya-Curtet and Geometric. Two different secondary air temperatures were examined in the trials and were simulated in the model.

A clear acrylic rotary kiln was built to a simple geometric scale of the prototype rotary kiln used in the IFRF trial. In the experiment, the effects by varying some parameters such as the Reynolds number, insertion length, centre-body ratios and excess air are analysed.

The flow patterns and the flame length produced in the experiments by the different varying parameters were compared to the actual results obtained from the IFRF trials which were done by Jordan Parham in 2001.

GROUP THREE

Room EM324

ACTIVE MIRROR CONTROL

Authors:
Adrian Moo, Tong Huynh

Supervisors:
Dr Benjamin Cazzolato, Dr Anthony Zander

Schefenacker Vision Systems Australia is one of the world's largest producers of automotive rear view mirrors. One of their mirror models, the P131 used in Ford F250 trucks has been identified to vibrate excessively under certain conditions resulting in image distortion which is considered annoying by their customers and in extreme cases a safety.

This project builds upon last year's project which demonstrated a proof of concept for using Active Vibration Control to attenuate rear view mirror vibration and also quantified levels for human visual perception of vibration.

The primary focus of this project is to develop a working prototype capable of attenuating the vibrations levels in the mirror to improve image quality and mirror positioning using feedback control.

A simplified test rig incorporating the mirror assembly has been produced and has been used for testing the various control systems. A voice coil motor used predominantly in computer hard drives head positioning, has been adapted for use as the mirror actuating mechanism. This actuator will be used to perform both mirror positioning and vibration attenuation. The use of a single actuator performing both functions was chosen due to the space constraint within the mirror housing and also the need for a simpler mechanism compared to the current gear and motor assembly.

Positioning control has been achieved with a PID based controller while the implementation of the vibration attenuation controller is still in progress.

INTERNAL MEMORY MIRROR

Author:
Teng Li Gin

Supervisor :
Dr. Tien-Fu Lu

Client:
Schefenacker Vision System Australia

My client, Schefenacker Vision System Australia (SVSA) is one of the world's largest mirrors producer. One of their mirror models, internal memory rear vision mirror which is only used in luxury vehicles such as Mercedes Benz S-class to be fitted with extra features such as automatic dimming, memory position recall, digital readouts, map lights etc.

The project is to develop an interior mirror with automatic dimming and memory position recall in order to complement SVSA's product portfolio. This is achieved on current products by using electro-chromic glass for dimming, potentiometers for position sensing and electric motors for positioning.

The aim of this project is to determine the feasibility of using 'NanoMuscle' actuators to achieve the dimming and positioning functions. These actuators are available with in-built position sensing, silent, fast response, small size and simplified system integration.

Currently locking mechanism is being designed to hold the position of the NanoMuscle actuator as the actuator will be extended once the power is not supplied to it. Few possible solutions are obtained to get more displacement for the actuators.

The expected outcomes of this project include concept designs of internal rear vision mirror with technical drawings, the codes for the micro controller, and a working prototype.

POOL PLAYING ROBOT

Authors:
Justin Ghan, Tomas Radzevicius, Will Robertson, Alexandra Thornton

Supervisors:
Dr Benjamin Seth Cazzolato

Wanna play pool but got no friends? Well, with Eddie the robot you won't have to play with yourself anymore!

This project consists of the design and construction of a robot capable of competing against a human opponent in a game of pool.

The aim of this project is to achieve what similar past projects have not - that is, to design and build a robot which operates independently of human input; one that can play pool with speed and competency comparable to that of a human player.

This has been achieved by combining various systems and processes. Primary among these is the use of a vision system that determines the position of all of the balls on the pool table. This information is then interpreted by a software program that uses intelligent algorithms to determine the appropriate shot for the robot to play. This output is translated into physical actuation through a mechatronic system.

Start practicing Ladies and Gentlemen, Eddie is coming to town!

MOBILE ROBOT DEVELOPMENT

Authors:
Luke Andrews, Ben Koch, Buddhika Abeytunga

Supervisors:
Dr Tien-Fu Lu, Antoni Blazewicz

Mobile robots are becoming more common as their ability to operate in complex environments increases. This project aims to produce a prototype mobile robot that uses vision as its primary sensor to navigate in complex environments.

The overall goal is to produce a robot capable of recognising and finding a ball. To accomplish this goal, an existing robot has been modified to accommodate the vision sensor and support hardware.

This seminar will be a 20 minute presentation on how we intend to achieve the stated goal, an overview of the robot system covering hardware, image processing and motor control, the progress so far and the future of the project. The seminar will hopefully also include a live demonstration of the robots current capabilities.

UNDERWATER ROBOT PROJECT

Authors:
Clive Chai, Siau Tee Tan

Supervisors:
Dr Tien-Fu Lu, Mr Antoni Blazewicz

River Torrance is the main river in Adelaide city, supplying the needs from the community since the early days. Today, River Torrance has become a recreation park and therefore, it is important to keep the river clean and presentable to the tourist. It is necessary to analyse the degree of contamination of the river, water level reading or cleaning the rubbish in the river. It is also important to study the geological behaviour of the waterbed. Such activities are beyond manpower to accomplish, thus, the introduction of under water robots into this picture would bring satisfying results. In extend to that, under water robots could also contribute to the Australian coastline and deep-sea research.

This project aims to continue the development of the underwater robot from previous project team and improve the robot so to function without tethers or cables, to be fully remote control. In addition to that, visual supports, where a camera is mounted in front of the robot, so the robot has a multitude of applications in oceanography, environmental monitoring, and underwater resource studies.

The primary objective of the project is to develop technologies and methods for autonomous underwater exploration and observation where Australia has vast deep-sea area that yet to be discovered.

SKIDDING OF MOTOR VEHICLES ON BITUMEN AND DIRT

Authors:
Simon Martin, Suganthan Sumelingam

Supervisors:
Dr. Robert Anderson, Dr. Anthony Zander

Client:
Chris Hall (Hall Technical Services)

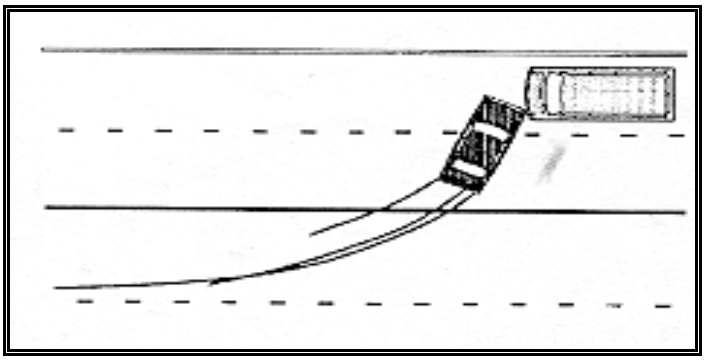


Figure 1 The critical speed accident situation

For many years the critical speed formula has been used in accident reconstructions to evaluate the velocity of a vehicle during yaw from the tyre marks at the scene. The type of accident depicted in Figure 1 often results in serious injury or fatality due to high speeds and collision forces involved. Many court decisions have been determined based on the accuracy of the Critical Speed Formula.

Until now the conditions of the surface have not been taken into account, except for the coefficient of friction. Previous work has been concerned solely with investigation and experiment on dry, bitumen roads. The primary aim of this project is to validate (or otherwise) the use of the Critical Speed Formula for estimating the speed from the curved marks left by the tyres of a car undergoing a yaw. A second aim is to generate a model to reconstruct a motor vehicle accident on unsealed roads based on measurements of tyre marks on the road surfaces. This seminar will describe the methods undertaken and a comparison between the measured results and those obtained using the Critical Speed Formula.

MULTI ROBOT COLLABORATION

Authors:
Michael Nielsen, Szee Thai Ng

Supervisor:
Dr Tien-Fu Lu

The aim of this year's project is to undertake an introductory study into the technology and methodologies available for use in the field of Multiple Robot Collaborations.

In Multi-Robot Collaborations, several similar robots are used to perform a task as a group. Within the group, each robot must be able to determine its position in relation to its surroundings, and the other robots in order to carry out the group task. Each individual robot may be required to undertake various tasks, such as moving to a particular location, or remain at a fixed location relative to another moving robot. The robots must also take provisions to avoid collisions between its team members, as well as avoiding static obstacles. Once the obstacle has been avoided, the main task should then be resumed.

The scope of this group's investigation will extend to cover the various requirements for a small group of robots to follow a defined path whilst simultaneously avoiding static obstacles and also while remaining in a defined formation. A simulation shall be produced to show the effect of the defined requirements on the performance of the collaboration, as well as providing a basis for further developments and the addition of more real-world constraints. An investigation into the real-world performance of technologies shall also be undertaken.

MICROMOUSE DEVELOPMENT

Authors:
Nathan Juers and Tim Griffin

Supervisor:
Dr Tien-Fu Lu

A micromouse is a fully autonomous mobile robot whose objective is to solve an unknown maze of a given size and execute an optimal path in as short a period of time as possible. The ultimate aim of the micromouse is to compete against other challengers to gain the best overall aggregate score, which is weighted heavily towards the time taken for it to carry out the optimal path run. The international competitions have been held regularly for over a decade being seen as a way to promote mobile robotics.

The Micromouse Development Project has evaluated alternative design configurations, both existing and theoretical, that may be applied to micromouse construction. Following this analysis a prototype design was created. The design task involved selection of a physical configuration in terms of the drive wheels and motors, sensor choice and configuration, design of a microcontroller based electronic circuit and developing a program to realise the functionality of the micromouse. After the selection of these components the project team built the prototype mouse, which is capable of exploring the maze. The project has also touched on maze solving algorithms, and ways in which the motion characteristics of a micromouse can be optimised.

AUTOMATIC LOUVRES SUB-ASSEMBLY

Author:
Cheong Leong

Supervisors:
Dr Tien-Fu Lu, Mr Hong Du

Client:
Polyaire

One of POLYAIRE's products, the MDO (Multi Direction Outlet) is a diffuser used to direct the airflow in both domestic and commercial markets. However, before the final product of MDO, it will require several louvres sub-assembly products (in regards to different series of MDO) to be mount within the MDO component. These louvres sub-assembly products are currently manufactured and manually assembled in POLYAIRE, South Australia. This process is too labour intensive and time consuming. Thus, POLYAIRE is looking into making the louvres sub-assembly process either automatic or fully machine assisted.

The aim of this industrial project is to observe, understand and analysis the existing production procedures. The student involved is to evaluate the louvres sub-assembly operation, identifying any non-value-added tasks and recommend elimination accordingly. It will also be a requirement to develop and recommend several different automatic concepts with alternatives that will benefits POLYAIRE. For example total cost saving after implementation, longevity, power consumption, maintenance, replacement, weight and size of any proposed automated systems or machines.

EXHAUST STACK DIRECTIVITY

Author:
Matthew Dewhirst

Supervisor:
Prof. Colin Hansen

When considering the plans of a new or recent development, a great deal of information is required in order to produce an accurate prediction of the noise that may propagate into the surrounding community. Unfortunately, some information currently utilised for these predictions is out-of-date, unreliable, or incomplete. This problem is significant when the development includes an exhaust stack- a noise source that is relatively common, yet often poorly modelled due to the amount of available acoustic information.

This project investigates an acoustic phenomenon known as exhaust stack directivity, which is a measure of the directional nature of sound radiation from industrial exhaust stacks and its relation to various physical factors of an exhaust stack such as its shape, size, and the presence or otherwise of acoustic linings. Previous work in this area is minimal, with only five known studies being conducted - the last in 1990. This project aims to identify relationships between exhaust stack directivity patterns and physical measures of exhaust stacks, and hence allow for easier more accurate community noise contributions from these types of source.

PLENUM CHAMBER ATTENUATION

Author:
Ben Spezzano

Supervisor:
Professor Colin Hansen

Plenum Chambers are commonly used in HVAC systems for the smoothing out of airflows but they also possess the ability attenuate noise. The extensive use of plenum chambers as a silencing element emphasises the need for an accurate prediction scheme in estimating the attenuation they will provide. The aim of this project is to investigate the validity of current prediction formulae for the transmission loss of plenum chambers.

The project involved the design and construction of a model plenum chamber along with accompanying inlet and outlet ducts. A speaker was employed to simulate an upstream noise source. Sensing microphones were arranged in each tube on a traverse and the readings were processed using a spectrum analyser. The plenum chamber was tested to determine its transmission loss for a range of tonal frequencies and 1/3 octave bands for a number of chamber configurations. Frequency analysis was employed using 1/3-octave band analysis. The experimental procedure will be presented and its results compared with the current theory.

FLOW OVER TOWED UNDERWATER SONAR ARRAYS

Author:
Boon Siong Tan

Supervisors:
Dr. M.K. Bull, Mr A. Blazewicz

The project is to perform a series of investigation of the fluid behavior where a long flexible cylinder is immersed in an axial flow. Part of the project is focused on the observation of flow patterns developing around the particular cylinder of various static positions (for example with a yaw angle of 2°, 3°, 4°, 5°…).

GROUP FOUR

Room EM316

SURVEILLANCE CAMERA PLATFORM FOR A PIPER SENECA II AIRCRAFT

Authors:
Liew Eng Kiat, Rajan Koo Peng Kiat, Benny Lim Liang Chern

Supervisors:
Dr Gerald Schneider, Dr Richard Kelso

As the title of the project suggests, the main scope for this project design is to build a platform to hold a camera inside the Piper Seneca II aircraft. The motive of the platform is to hold a camera that will capture clear & accurate geographic photographs of landscapes while flying in the air above them.

The platform will be designed with the assumption that a manufacturing firm has engaged the Adelaide University team to produce a prototype platform for evaluation as a production item. Thus, it follows that the platform will not only have strong & durable characteristics, but also have qualities which are generally desirable for production, such as low cost, easy to maintain & reliable! The main objectives of this project are to analyze the different components (sub-units) used in the project system and ultimately, construct a camera platform capable enough to fulfill the basic needs of aerial photography.

Therefore, the seminar presentation has been divided into the respective sub-units for clarity of tasks. In addition, there are also a multitude of other issues to present such as the manufacturing process, financial constraints & scheduling of project datelines.

ATTITUDE DETERMINATION USING GPS DIFFERENTIAL CARRIER PHASE MEASUREMENTS

Authors:
Sam Tuominen, Rob Minson

Supervisors:
Dr Gerald Schneider, Mr Steve Kollias

This seminar presentation will provide information relating to Global Positioning Satellite (GPS) principles and applications and their relevance to our project. Navigation principles are discussed and particular detail is given to position and attitude determination technology.

The development of our project definition from Zuni Rocket Payload Design to Attitude Determination using GPS Differential Carrier Phase Measurements will be discussed including an explanation of the ASRI Zuni Rocket Program. An overview of a proposed Zuni Rocket control system and an explanation of how our project fits into that control system will also be presented.

The majority of the seminar will detail the principles behind the aims of our project giving specific reference to the navigation message contained in GPS signals, interfacing a GPS receiver with a computer, parsing of data contained in the message using matlab, and using this data to obtain an attitude solution.

A discussion on the feasibility of our proposed design will be included in the seminar, providing insight into the difficulties associated with attitude determination and GPS aided control systems.

STRESS ANALYSIS OF AIRCRAFT WINGS REPAIRED USING FRICTION STIR WELDING

Authors:
Chang Wei, Leong, Hock Chan, Lim, Sung Kiang Alan, Yeo

Supervisors:
Professor Valerie Linton,Dr. Gerald Schneider

This paper outlines the works carried out to analyse the stress effects created upon the horizontal stabiliser when implementing an innovative method of repair, friction stir welding. Experimental research and findings have been carried out to have an in-depth understanding of friction stir welding.

Evaluation of the stress pattern created by friction stir welding has to be modelled using finite element analysis software, Strand7 and ANSYS. Modelling will be carried out in two areas, conventional structural repair and friction stir welding repair.

The results gathered from the two finite element analysis software will be compared against each other to determine the accuracy of results. Further verification of the overall results will be analysed with the experimental results from Thebarton Campus.

Upon completion of verification, the project will look upon the viability of substituting conventional structural repair to friction stir welding repair process onto horizontal stabilizer of P3- Orion.

INVESTIGATION OF HYDROGEN ASSISTED COLD CRACKING IN STEELS

Authors:
Ch'ng Kar Keat, Cheah Kin Mun

Supervisors:
Mr. Ian Brown and Professor Valerie Linton

Hydrogen Assisted Cold Cracking (HACC) is a serious and common problem that occurs in the welded joints of steel structures, which eventually leads to failure. Hence investigation into the cause of HACC is utmost important and beneficial as it can provide more information in methods of prevention of HACC. The aim of this project is to examine the effects of different welding conditions on mild steel that could lead to segregation of alloying elements within the weld during solidification. Segregation is believed to contribute to localized higher carbon equivalent and hence increasing the susceptibility of the welded joint to HACC.

This project progressed in three stages. In the initial stage, discussions were held to evaluate and decide on the appropriate type of welding process, material, weld joint configuration and welding parameters to be employed throughout the project. Welding was conducted in the workshop with the aid of a mechanical welding machine and numerous welds were produced on mild steel plates. The second stage involves preparation of metallographic specimens. This is where the welded samples were cut to reveal the cross sectional area of the weld before being mounted, polished and etched. In the final stage, microscopy analysis was performed where the specimens were analysed using both optical and electron microscope. The microstructures of the weld metal in each specimen were examined under different levels of magnification in search for the occurrences of segregation as well as the distinctive signs of HACC.

THE INFLUENCE OF THIRD PHASES ON THE PERFORMANCE OF SUPER DUPLEX

Authors:
Yee Ling, Siew, Mahendran Sinathuraja

Supervisor:
Professor Valerie Linton

The seminar presentation will begin with an introduction to the topic of the project and the problem to be investigated. This will be followed by the project plan, research approach, and discussion on the findings and results obtained from the research conducted.

At the beginning of the presentation, there will be an overview of the problem to be investigated. The presentation will continue with the project plan and the research approach that was used in the investigation. This will be followed by the literature review of the material involved in the problem. It will include a brief overview of its composition, microstructure, mechanical properties, corrosion resistant properties, and weldability.

The presentation will then continue with the findings and results obtained from the investigation and they will be discussed in detail. This will include references to journals and articles that were used to assist in the analysis of the findings obtained. At the end of the presentation, the project work thus far will be summarized, followed by a conclusion and a list of references of all the information used in the presentation. The audience will then be invited to ask questions.

INVESTIGATING THE EFFECT OF WATER AND CORROSIVE SUBSTANCES ON FATIGUE LIFE

Author:
Andrew Rowling

Supervisor:
Mr Ian Brown

The aim of the project is to show that water and corrosive substances, severely limit the fatigue life of rotating shafts under various applied loads.

This project involves the plotting of new data points for S-N curves, generated using the rotating, bending moment fatigue machine , built by a previous German exchange student named Uwre.

The rotating-bending fatigue machine, has been used to obtain data points for a biaxial state of stress. The biaxial state of stress was set up using a bending moment supplied by the added weights, and a torsion load supplied by the braking system. The previous braking system was unreliable due to the method of braking, clamping the outside of the rotating chuck-shaft assembly, with an A-frame style mountain-bike brake.

The braking system was modified by Daniel Hoffmeister, using a mountain-bike style disc brake caliper. Due to the machine not being used for a period of time, a new brake caliper had to be installed, and previous data for uniaxial-(bending moment only, torsion only) had to be confirmed. Also previous data for biaxial-(bending moment and torsion) had to be confirmed. Once this data was confirmed, the effect of water on the fatigue life of the specimen under a uni-axial and bi-axial state of stress was examined. Also sodium chloride solutions of various concentrations were used, to further prove the fatigue life of the loaded specimens was reduced.

Specimens of the same dimension had previously undergone tensile testing, to determine the maximum load which could be applied, to give the desired bending moment. The specimens had dimensions which were stated in the American Society for Metals Handbook.