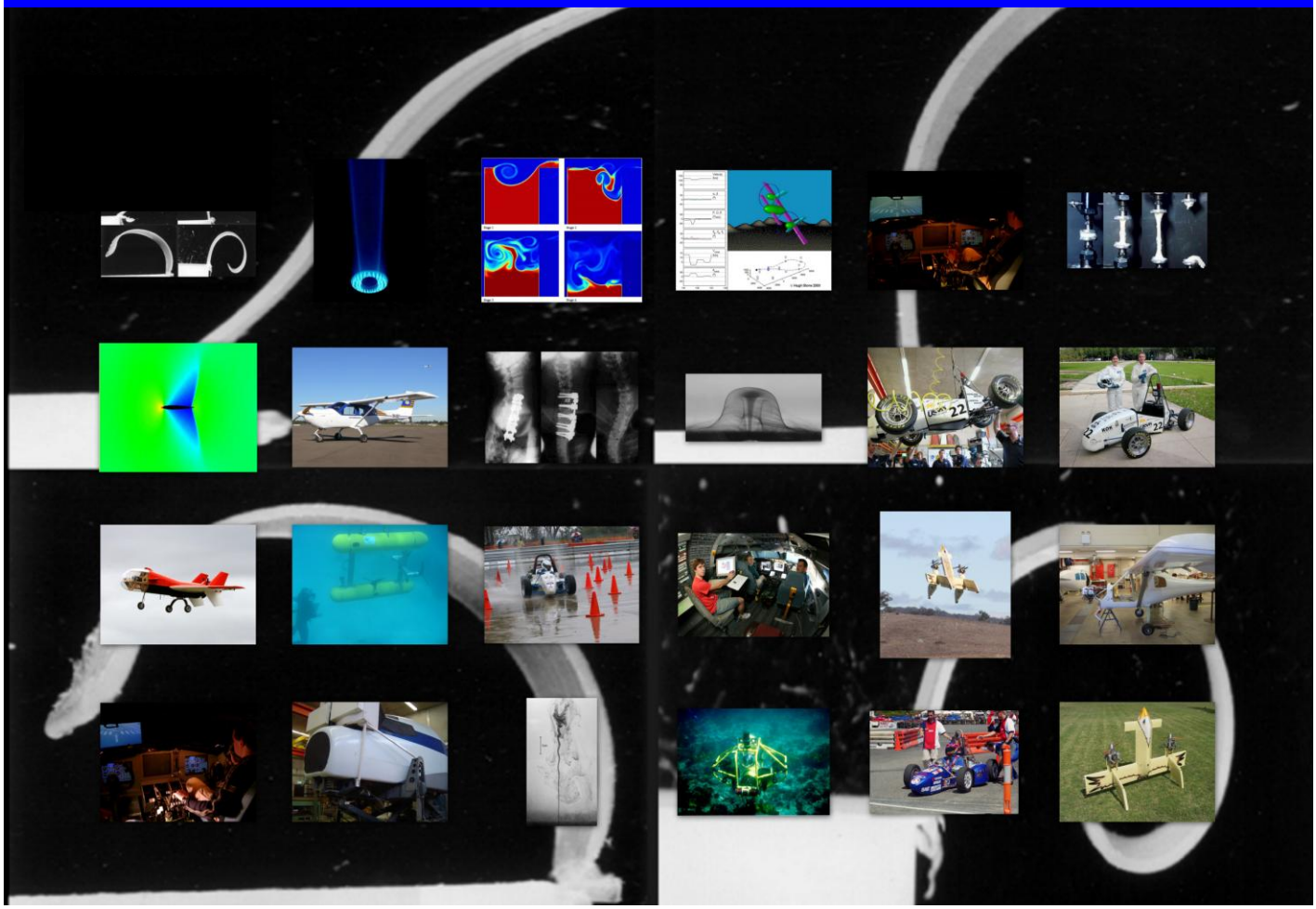
SCHOOL OF AEROSPACE, MECHANICAL & MECHATRONIC ENGINEERING

RESEARCH REPORT 2010



THE UNIVERSITY OF SYDNEY

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Designed and produced in-house by the School of Aerospace, Mechanical & Mechatronic Engineering, University of Sydney

Contents

Foreword

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Professor Steve Armfield
Head of School

We are pleased to publish this report which reflects the research strengths and achievements in the School of Aerospace, Mechanical and Mechatronic Engineering (AMME) for 2010. The school has a number of world class research groups and has continued to maintain its position as the dominant research school in the faculty, and one of the leading engineering research schools in the country. During the year $4.5 million of new research funding was obtained, 262 research articles and books were published, 121 research students were under supervision and 18 research students completed. With 29 permanent academic staff members the performance per capita places us on a par with the top engineering schools in the world. I would like to thank all the staff whose hard work and dedication has produced this outstanding research profile, and in particular to congratulate Prof. Yiu-Wing Mai on his appointment as a Member (AM) in the General Division of the Order of Australia and Prof. Hugh Durrant-Whyte on his election to the Royal Society; and on being named NSW Scientist of the Year.

Organisational Overview

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Academic Staff

Head of School

Prof Steve Armfield

Professors

Armfield, Steven
Behnia, Masud
Durrant-Whyte, Hugh
Mai, Yiu-Wing
Masri, Assaad
Nebot, Eduardo
Tanner, Roger
Tong, Liyong
Ye, Lin

Emeritus Professors

Bilger, Robert
Bird, Graeme
Steven, Grant

Honorary Professors

Brandwood, Arthur
Henderson, Le Roy
Kent, John
Zhang, Liangchi

Adjunct Professor

Chamitoff, Gregory

Associate Professors

Dunstan, Colin
Li, Qing
Ruys, Andrew
Sukkarieh, Salah
Zreiqat, Hala

Honorary Associate Professors

Diwan, Ashish
Wong, Shing-Chung
Youssef, Peter

Adjunct Associate Professors

Lowe, Allen
Roger, Greg
Zheng, Rong

Senior Lecturers

Auld, Douglass
Brooker, Graham
Gibbens, Peter
Karkenahalli, Srinivas
Jabbarzadeh, Ahmad
Kirkpatrick, Michael
Liao, Xiaozhou
McHugh, Paul
Rye, David
Scheding, Steven
Williams, Stefan
Wong, Kee Choon

Honorary Senior Lecturers

Bilston, Lynne
Tran, Giang

Lecturers

Wu, Xiaofeng
Verstraete, Dries
Vio, Gareth

Honorary Lecturers

Boughton, Phillip
Stone, Hugh

Adjunct Lecturer

Bates, Peter

Associate Lecturers

Briozzo, Paul
Fiford, Rod

Honorary Associates

Binder, Waltraud (Trudie)
Clarke, Elizabeth
Fan, Xijun
Houghton, Ron
Liu, Zizhen
Lu, Chunsheng
Mitra, Ashish
Nahar, Kazi Kamrun
Qin, Qing Hua
Shah, Shruti
Swain, Michael
Zhang, Xin-Ping

Research Staff

ARC Future Fellow

Liu, Hong Yuan

International Visiting Research Fellow

Thornber, Ben

Endeavour Research Fellow

Shen, Jen

ARC Australian Research Fellow

Li, Wei

ARC Postdoctoral Fellow- Industry

Nagarathinam, Srinarayana

ARC APD

Chang, Li

Australian Postdoctoral Fellow

Lu, Ye

ARC Research Associate

Tekyeh Marouf, Bahereh

University of Sydney Bridging Support Fellow

Du, Xusheng

Research Fellows

Bailey, Tim
Brooks, Alex
Bryson, Mitchell
Deng, Shiqiang
Elinas, Pantelis
Fitch, Robert
Johnson, David
Johnson-Roberson, Matthew
Kaupp, Tobias
Mahon, Ian
Makarenko, Alexei
Melkumyan, Arman
Melkumyan, Narek
Monteiro, Sildomar
Murphy, Richard
Mylvaganam, Kausala
Neito, Juan
Nettleton, Eric
Perera, Lochana
Peynot, Thierry
Pizarro, Oscar
Singh, Surya
Vasudevan, Shrihari
Velonaki, Mari

Post Doctoral Fellows

Baji, Avinash
Dai, Shao Cong
Jakuba, Mike
Kittipoomwong, Prakorn David
Luo, Quantian
Qi, Fuzhong
Ramos, Fabio
Starner, Sten
Wang, Yanbo
Williamson, Nicholas
Yaroshchyk, Pavel
Zhou, Shiwei

Postdoctoral Research Associates

Lu, ZuFu
Wang, Guocheng

Postdoctoral Researcher

Wang, Dong

Organisational Overview

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Research Staff

Research Associates

Allen, Thomas
Bertevas, Erwan
Douillard, Bertrand
Hill, Andrew
Juddoo, Mrinal
Lee Wo, Duane
Lin, Jiangzi (John)
Rungsiyakull, Chaiy
Uthayakumaran, Surjani
Worrall, Stewart

Senior Research Engineer (CRC-AS)

Beehag, Andrew

Administrative Staff

Research Assistant

James, Barbara

Finance Managers

Connell, Robin
Wang, Christy

Finance Officer

Du Toit, Lanita

Administrative Officers

Hunter-Smith, Lisa
Liang, Wendy
(Undergraduate Studies)
Martin, Vinita (Head of School's Office)
Olip, Ruth
Santos, Tessie
Sawtell, Olga
Sexton, Bronwyn
(Postgraduate Studies)
Tetradis, Natasha

Administrative Assistant

Gonzales, Susan

Workshop Staff

Senior Technical Officer

Stenger, Duncan (Manager, AMME Workshop)

Technical Officers

Attia, Muhammad Esa
Atzmon-Simon, Barak
Bandara, Dharmapriya
Beauport, Jean-Gerard
Blekhman, Alexander
Brown, Stuart
Calleija, Mark
Chan, Pak Hung (Victor)
Chen, Quanjun (Jerry)
Crundwell, Bruce
Elder, Greg
Geier, Matthew
Goyal, Abhinav
Hale, Timothy
Head, Adrian
Karkada, Stanley
Keep, Steve
Kim, Yeop
Klemme, Stanley
Lal, Ritesh
Lupton, Todd
Maclean, Andrew
McCouat, Nicholas
Merry, Laura
Nichani, Vijay
O'Shannessy, Robert
Randle, Jeremy
Ralph, Daniel
Riviere, Greg
Rodgers, Craig
Sadrossadat, Amir
Scaysbrook, Brian
Shearing, Trevor
Sinclair, Malcolm
Todhunter, John
Vitjuk, Ivan
Yang, Kwang Jin
Zigman, John

Technical Assistants

Mear, Paul
Potts, John

Organisational Overview

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Visiting Professors/ Scholars

Asmar, Daniel
Bussiba, Arry
Chesher, Chris
Chrigui, Mouldi
Cotterell, Brian
Freidrich, Klaus
Gao, Cun-Fa
Hou, Shujuan
Kim, Chul-Ho
Letty, Camille
Lim, Jae Dong
Ma, Haitao
Milella, Annalisa
Pyrz, Ryszard
Reina, Giulio
Sinclair, Murray
Su, Liying
Tang, Youhong
Tanimoto, Toshio
Vidal-Calleja, Teresa
Wang, Lifeng
Wei, Kexiang
Williams, Gordon
Wu, Cuilan
Xin, Jing (Linda)
Yang, Ying-Kui
Yu, Zhong-Zhen
Zhang, Donghai
Zhang, Jinping
Zhang, Ze
Zhang, Zhong
Zhou, Xing-Ping

Occupational Trainees

Basso, Brandon
Baudoin, Louis
Bourguignon, Antoine
Cui, Wei
De Boer, Edward
Dickens, John
Gobi, Adam
Hagel, Philipp
Huang, Yuan-Li
Jiang, An
Kazik, Tim
Koerner, Fabian
Kranzinger, Patrick
Krevolin, Katherine
Kuntz, Noah
Lees, Christian
Lu, Mingyu
Maria Cortijo, Anna
Miao, Xiaoting
Miao, Ying Gang
Mishra, Amit
Norberg, Johan
Ogliaro, Valeria
Pang, Rui
Qu, Dongdong
Roohaniesfahani, Seyediman
Schloegl, Tristan
Speck, Raphael
Sun, Guangyong
Ulrich, Franziska
Wang, Chao
Wurgler, Stefan

Research Highlights

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Research and Teaching Grants Awarded in 2010

Australian Research Council (ARC) Discovery Grant

DOUILLARD and Dieter $255,000
Multi-scale recognition: Generating meaning from mutli-resolution data

KIRKPATRICK, Armfield and Wenxian $350,000
The dynamics of turbulent entrainment in sheared convective boundary layers

LI and Zhou $210,000
An engineering approach to design of metamaterials

MASRI $1,250,000
Towards a unified view of clean turbulent combustion

TANNER and Fan $360,000
Rheology of suspensions with viscoelastic matrices

TONG $290,000
Design of compliant structure systems with integrated actuators

WANG $255,000
Effects of grain size on the deformation mechanisms and mechanical properties of gum metals (Ti alloys)

WILLIAMSON $301,400
Purging and destratifying of thermal and saline pools in Australia's inland rivers

YE and Fan $360,000
Fibrous fabric with directional transplanar transport properties for moisture and water

Australian Research Council (ARC) Linkage Grant

WILLIAMS, PIZARRO, BLAIR $245,541
Supervised autonomy for autonomous underwater vehicles (AUVs) using limited bandwidth communication channels

Australian Research Council (ARC) Linkage Infrastructure, Equipment and Facilities Grant (LIEF)

LIU (*Key Centre Research*), Mai (*et al)* $250,000
Accessing the third-dimension in scanning electron microscopy for rapid, high-resolution tomography of large samples materials

MASRI $600,000
Multi-dimensional, high-speed laser imaging facility for fluids and combustion

The Australian Orthopaedic Association Research Foundation

ZREIQAT $60,000
Novel coatings for orthopaedic application

University of Sydney Early Career Researcher Scheme (ECR)

VERSTRAETE $20,000
Fuel cell propulsion to extend the endurance of unmanned aerial vehicles

University of Sydney Major Equipment Scheme (ME)

WU $23,000
Small ground tracking station (UHF/VHF/S BAND)

University of Sydney Teaching Improvement (TIP) and Equipment Scheme (TIES)

AULD $33,045
Cross-faculty reporting and integration of program outcome information in Commerce and Engineering and IT degrees

KIRKPATRICK, Wong and Srinivas $10,000
Developing a new gas turbine laboratory

Research Highlights

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Appointments and Promotions

Dr Doug **Auld** appointed as Associate Dean, Education

Professor Assaad **Masri** appointed as Associate Dean, Research

Duncan **Stenger** appointed as Workshop Manager

Dr Mari **Velonaki** promoted to Senior Lecturer

Dr Dries **Verstraete** appointed as Lecturer in Aeronautical Engineering in Aeronautical Design

Awards and Honours

Dr Graham **Brooker** wins the AMME Teaching Award for 2010

Professor Hugh **Durrant-Whyte** elected as a Fellow of the Royal Society; named NSW Scientist of the Year

Dr Peter **Gibbens** wins 2010 Vice-Chancellor's Award for Outstanding Teaching;
awarded 2010 Citation for Outstanding Contributions to Student Learning by the Australian Learning and Teaching Council

Professor Yiu-Wing **Mai** appointed a Member (AM) in the General Division of the Order of Australia "for service to engineering, particularly in the fields of advanced composite materials and fracture research"

Professor Assaad **Masri** accepts position of Excellence in Research for Australia (ERA) Coordinator

Dr Thierry **Peynot** awarded US$261,993 by the US Air Force (AOARD) for his project on "Sensor Data Integrity and Mitigation of Perceptual Failures"

Associate Professor Salah **Sukkarieh** and Dr Xiaofeng **Wu** awarded Stream A funding ($300k) for the Space Research Program

Dr Stefan **Williams** awarded ARC Super Science Fellowship position;
wins the Dean's Award for Outstanding Teaching (AMME Award)

Professor Lin **Ye** succeeds Professor Yiu-Wing Mai as Director of the CAMT

Yang **Cao** (PhD student) wins Young Scientist award in the 6th International Symposium of Ultrafine Grained Materials

Dorji **Chavara** (PhD student) wins DMTC Industry Partnership Award

Jared **Holmes** (Undergraduate thesis student) wins the SOFE (Speak Out for Engineers) competition for NSW set up by the Institute of Engineers Australia. Jared then went on to win the Australian wide competition and came second in the Asia-Oceania competition. He developed the crash energy absorption module that is required for the front of Formula SAE cars. He ran the LSDYNA FEA software about 60 times and made and tested several prototypes.

Jiao Jiao **Li** (PhD student) wins Endeavour Research Fellowship to undertake work in the United States of America

Alex **Brooks**, Alex **Makarenko** and Tobias **Kaupp** (PhD students) who developed Terminator-style robots, will see their technology trialed by US Marines sharp-shooters in a $57 million contract

Jack **Ling** (thermo-fluids) and Mojtaba **Abtahi** (materials) (PhD students) receive high commendations for excellence in tutoring

Yuhang **Chen** (PhD student) receives $500 prize for the best presentation at the faculty held 2010 Student Conference "Connect with Fellow Researchers"

The following PhD students acknowledged for their outstanding research achievement during 2010: Yuhang **Chen,** Babak **Fakhim,** Ariell **Friedman,** William **O'Loughlin**, and Chaiy **Rungsiyakul**

Aerospace Research

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Research Group

Aerospace Design

Dr Dries Verstraete
P: + 61 2 9351 2393
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- Aircraft design
- Unmanned aerial vehicles
- Micro gas turbines
- Green and renewable propulsion
- Unconventional aircraft configurations
- Hydrogen in aviation
- Propulsion and structures of hypersonic aircraft

Aerospace Engineering

Dr Gareth Vio
P: + 61 2 9351 2394
gareth.vio@sydney.edu.au

- Non-linear aeroelasticity
- Non-linear vibration
- Non-linear system identification
- Gust response
- Aeroelastic tailoring
- Design of composite structures
- Morphing structures
- Natural selection optimisation

Design Optimisation Research

Dr K Srinivas
P: + 61 2 9351 4289
k.srinivas@usyd.edu.au

(Also a member of the Biomedical, Fluid Dynamics Research Groups & Finite Element Analysis Research Center)

- Hierarchical Asynchronous Parallel Evolutionary Algorithms (HAPEAs)
- Robust evolutionary methods for multi-objective and Multidisciplinary Design Optimisation (MDO) in aeronautics.
- Grid free flow-solvers and evolutionary algorithms.
- Adaptive aerofoils/wings design and optimisation using evolutionary algorithms.

Flight Simulation and Control

Dr Peter Gibbens
P: +61 2 9351 7350
peter.gibbens@sydney.edu.au

The Variable Stability Flight Simulator (VSFS) is an exclusive project to the University of Sydney, a national first. In addition to the application of the VSFS to AMME flight mechanics courses, the simulator offers significant potential in other areas. For instance, current post-graduate study is being performed with the aim of producing an avionics course based on the simulator systems. Other post-graduate projects involve guidance and control (landing and flight path) using visual systems - simulated with the VSFS.

Smart Structures Research

Professor Liyong Tong
P: +61 2 9351 6949
Liyong.tong@sydney.edu.au

(Also a member of Finite Element Analysis Research Center)

Research interests are mainly concerned with modeling behaviors of composite and smart structures. Current research areas and projects include:

- Failure analysis and damage tolerance of adhesive bonded composite joints
- Modeling behavior of 3D reinforced composite materials, including transverse stitching
- Behavior of composite plates and shells
- Smart structures using PZT sensors/actuators, including damage detection and performance control of thin-walled structures

Aerospace Research

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Space Engineering Research

Dr Doug Auld
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(Also a member of the Fluid Dynamics Research Group)

The DSMC (Direct Molecular Simulation - Monte Carlo Method) gas flow simulation technique was pioneered by Emeritus Professor Graeme Bird in this School. The method was originally used for simulation of rarefied gas flow around re-entry vehicles, but has now progressed to the stage of being a useful tool for solving a large range of aerodynamic and aerospace problems such as:

1. Simulation of flow separation in near continuum region
2. Rankine-Heugonot weak/strong shock reflection solutions
3. Nano-Fluid Simulations
4. Investigation of stability of low Reynolds number flows

Associate Professor Salah Sukkarieh
P: +61 2 9351 8154
salah@acfr.usyd.edu.au

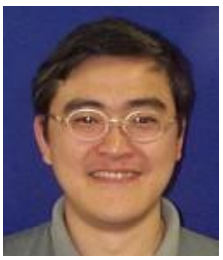
(Also a member of Australian Center for Field Robotics ACFR)

- Planetary Rover Systems
- Navigation in GPS denied environments
- Multi-robot systems for Space
- Multi-satellite navigation and control

Dr Xiaofeng Wu
P: +61 2 9036 7053
xiaofeng.wu@sydney.edu.au

- Small Satellite bus design
- Fault tolerance systems design
- Remote sensing

Unmanned Aerial Vehicle (UAV) Research



Dr KC Wong
P: +61 2 9351 2347
kc.wong@sydney.edu.au

Current UAV related research activities include the following:

- Autonomous remote sensing using UAVs;
- Decentralised navigation and control of autonomous flight vehicles;
- Simultaneous localisation and map building for autonomous flight vehicles;
- Design and development of rapid prototype UAVs;
- Wind-tunnel and flight based experimental research in aerodynamics and flight performance;
- Modelling of engine/propeller performance and aircraft stability characteristics;
- High fidelity aircraft model development for simulation based control system validation;
- Trajectory optimisation and autonomous guidance for unmanned aircraft;
- Sensor fusion strategies for state estimation using multiple redundant sensors, including Global Positioning Systems (GPS);
- Using GPS for aircraft attitude determination;
- System identification methods and neural networks for fault detection and reconfiguration;
- Robustness analysis of control laws in the presence of uncertain dynamics and wind gusts;
- Robust nonlinear high-performance manoeuvre tracking for autonomous aircraft;
- Autonomous safe recovery and landing of a UAV;
- Terrain Following for autonomous flight vehicles;
- Integration of available technologies into operational UAV systems;
- Real-time fight control software synthesis for UAVs;
- Design and fabrication of airframe components using advanced composite materials.

Aerospace Research

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Emeritus Professors
Prof Bird, Graeme
Prof Steven, Grant

Honorary/ Adjunct Staff
Dr Bates, Peter
Prof Chamitoff, Gregory
Dr Houghton, Ron
Dr Stone, Hugh

Research Fellow
Dr Bryson, Mitchell

Postdoctoral Fellow
Dr Luo, Quantian

Research Associate
Lin, Jiangzi (John)

Research Students
Brown, Sonya Ann
Chung, Jen Jen
De Sousa, Manuel
Dumble, Steven
Hemakumara, Madu Prasad
Ho, Ken Po Lam
Jimenez Jaramillo, Juan Pablo
Kassir, Abdullah
Kiang, Jademond
Lawrance, Nicholas Robert Jonathon
Lee, Chang-Joon
Lehmkuehler, Kai
Lin, Jiangzi
Lui, Sin Ting Angela
Medagoda, Eran Dimantha Bandara
Moscoso Lavagna, Luis
Reid, Alistair Smyth
Tsai, Allen Chung-Yao
Vasista, Srinivas

Research Grants*

Sponsor/ Grant Name	Chief Investigator [other AMME investigators]	Project Title	Duration	Awarded Amount ($)
Meat and Livestock Australia Ltd/Research Support	Sukkarieh, Salah	UAV surveillance systems for the management of woody weed infestations	May 2008 - Nov 2010	**285,000**
Department of Agriculture, Fisheries and Forestry (Federal)/Research Support	Sukkarieh, Salah	Using UAVs and innovative classification algorithms in the detection of cacti	Mar 2009 - Dec 2010	**108,577**
Australian Research Council/Discovery Projects (DP)	Tong, Liyong	Morphing flexible structures with PLZT based optical actuators	Jan 2007 - Mar 2010	**351,942**
Asian Office of Aerospace Research and Development (USA)/Research Support	Tong, Liyong	Active pin reinforced sandwich panels	Jan 2007 - Sep 2010	**79,738**
DVC Research/Bridging Support Grant	Tong, Liyong	Structural shape control using bio-inspired composite actuators	Jan 2010 - Mar 2011	**50,000**

* Figures obtained from the Research Office, University of Sydney

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2010 Publications*

Book Chapters

Lee, D S, Srinivas, K, Gonzalez, L, Periaux, J, Obayashi, S 2010, Robust Multidisciplinary Design Optimisation Using CFD and Advanced Evolutionary Algorithms, Computational Fluid Dynamics Review 2010, World Scientific Publishing, Singapore, 1, 469-491

Conference Papers

Abuhashim, T, Bryson, M T, Sukkarieh, S 2010, Vision-based terrain modelling with applicationto change detection, Australasian Remote Sensing & Photogrammetry Conference

Bryson, M T, Reid, A, Hung, C, Ramos, F T, Sukkarieh, S 2010, Cost-Effective Mapping using Unmanned Aerial Vehicles in Ecology Monitoring Applications, 12th International Symposium on Experimental Robotics 2010

Bryson, M T, Reid, A, Ramos, F T, Sukkarieh, S 2010, An unmanned airborne system for vision-based mapping and classification in ecological monitoring applications, Australasian Remote Sensing & Photogrammetry Conference

Chen, X, Wu, X 2010, Model Predictive Control of Cube Satellite with Magneto-torquers, 2010 IEEE International Conference on Information and Automation, IEEE, USA, 997-1002

Goktogan, A H, Sukkarieh, S 2010, Using UAVs for the search and track of terrestrial animals, Queensland Pest Animal Symposium

Hung, C, Bryson, M T, Sukkarieh, S 2010, A novel vision-based tree crown and shadow detection algorithm using imagery from an unmanned airborne vehicle, Australasian Remote Sensing & Photogrammetry Conference

Korner, F, Speck, R, Goktogan, A H, Sukkarieh, S 2010, Autonomous Airborne Wildlife Tracking Using Radio Signal Strength, 2010 IEEE/RSJ International Conference on Intelligent Robots and Systems, IEEE, Piscataway, NJ, 107-112

Lee, D S, Gonzales, L, Srinivas, K, Periaux, J 2010, Multi-fidelity Nash Game Strategies for Reconstruction Design in Aerospace Engineering Problems, AIAC-13 Thirteenth Australian International Aerospace Congress, Unknown, Unknown

Lee, D, Periaux, J, Gonzalez, L, Srinivas, K, Onate, E 2010, Active flow control bump deign using hybrid NASH-Game coupled to evolutionary algorithms, V European Conference on Computational Fluid Dynamics (ECCOMAS CFD 2010), ECCOMAS, Portugal

Medagoda, E, Gibbens, P W 2010, Efficient Predictive Flight Control, International Conference on Control, Automation and Systems 2010 (ICCAS 2010), International Conference on Control, Automation and Systems, Gyeonggi-do, Korea, 1297-1302

Journal Papers

Bryson, M T, Reid, A, Ramos, F T, Sukkarieh, S 2010, Airborne Vision-Based Mapping and Classification of Large Farmland Environments, Journal of Field Robotics, 27(5), 632-655

Cole, D T, Thompson, P R, Goktogan, A H, Sukkarieh, S 2010, System development and demonstration of a cooperative UAV team for mapping and tracking, International Journal of Robotics Research, 29(11), 1371-1399

Kiang, J, Tong, L 2010, Nonlinear magneto-mechanical finite element analysis of Ni-Mn-Ga single crystals, Smart Materials and Structures, 19(1), 1-17

Lin, J, Luo, Z, Tong, L 2010, A new multi-objective programming scheme for topology optimization of compliant mechanisms, Structural and Multidisciplinary Optimization, 40(1-6), 241-255

* Records obtained from the Integrated Research Management Application (IRMA), University of Sydney

Lin, J, Luo, Z, Tong, L 2010, Design of Adaptive Cores of Sandwich Structures Using a Compliant Unit Cell Approach and Topology Optimization, Journal of Mechanical Design, 132(8), 081012-1-081012-8

Luo, Q T, Tong, L 2010, Multi-physics field models of photostrictive unimorphs and heterogeneous bimorphs subjected to light illumination and mechanical loading, International Journal of Solids and Structures, 47(16), 2006-2016

Manan, A, Vio, G, Harmin, M, Cooper, J 2010, Optimization of aeroelastic composite structures using evolutionary algorithms, Engineering Optimization, 42(2), 171-184

Medagoda, E, Gibbens, P W 2010, Synthetic-Waypoint Guidance Algorithm for Following a Desired Flight Trajectory, Journal of Guidance, Control, and Dynamics: devoted to the technology of dynamics and control, 33(2), 601-606

Plain, K P, Tong, L 2010, The effect of stitch incline angle on mode I fracture toughness - Experimental and modelling, Composite Structures, 92(7), 1620-1630

Srinivas, K, Townsend, S, Lee, C-J, Nakayama, T, Ohta, M, Obayashi, S, Yamaguchi, T 2010, Two-Dimensional Optimization of a Stent for an Aneurysm, Journal of Medical Devices, 4(2), 021003-1-021003-7

Verstraete, D, Hendrick, P, Pilidis, P, Ramsden, K 2010, Hydrogen fuel tanks for subsonic transport aircraft, International Journal of Hydrogen Energy, 35(20), 11085-11098

Wu, X, Yang, F, Lishman, R 2010, Land cover change detection using texture analysis, Journal of Computer Science, 6(1), 92-100

Yang, K J, Gan, J S K, Sukkarieh, S 2010, An efficient path planning and control algorithm for RUAVs in unknown and cluttered environments, Journal of Intelligent and Robotic Systems: theory and applications, 57, 101-122

Yang, K J, Sukkarieh, S 2010, An analytical continuous-curvature path-smoothing algorithm, IEEE Transactions on Robotics, 26(3), 561-568

Biomedical Engineering Research

Back to Index

Research Group

A/Professor Andrew Ruys
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(Also a member of Materials and Structures Research Group CAMT)

Biomaterial synthesis & testing

A/Professor Colin Dunstan
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Bone cell regulation; Biomaterials; Cancer metastasis to bone; Osteoporosis

Dr Hala Zreiqat
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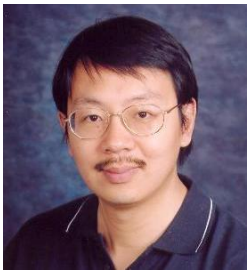
Skeletal tissue engineering; Biomaterials and scaffolds development; Arthritis and other musculoskeletal conditions; Bone; Cartilage; Orthopaedics and Dental biomaterials



Dr Qing Li
P: + 61 2 9351 8607
qing.li@sydney.edu.au

(Also a member of Materials and Structures Research Group CAMT & Finite Element Analysis Research Center)

Computational scaffold tissue engineering; Remodelling for orthopaedics; Dental biomechanics and biomaterials; Computational design for periodic microstructural materials- Optimisation of structural topology

Academics

Dr K Srinivas

Adjunct/ Honorary Academics

Prof Brandwood, Arthur
A/Prof Bilston, Lynne
Dr Boughton, Philip
Dr Clarke, Elizabeth
A/Prof Diwan, Ashish
A/Prof Roger, Greg
Dr Shah, Shruti
Dr Tran, Giang
A/Prof Youssef, Peter

Research Fellow

Dr Li, Wei

Postdoctoral Fellows

Dr Lu, ZuFu
Dr Wang, Guocheng
Dr Zhou, Shiwei

Honorary Associates

Dr Binder, Waltraud (Trudie)
Dr Liu, Jane (Zizhen)
Dr Mitra, Ashish
Dr Nahar, Kazi Kamrun
Dr Swain, Michael

Research Associate

Rungsiyakull, Chaiy

Research Assistant

James, Barbara

Research Students

Baume, Alex
Boughton, Elizabeth Anne
Cadman, Joseph Edward
Chen, Junning
Chen, Yuhang
Field, Clarice Jasper
Hogg, Michael Christopher
Lau, Howard
Li, Jiao Jiao
Lok, Peter Yin Cheung
Lu, William
Ma, Yujia
Miles, Brad Peter
Nandakumar, Deepika
Roohaniesfahani, Seyediman
Rungsiyakull, Chaiy
Soh, Khian Leong Edwin
Tammareddi, Sririam
Yu, Nicole Y C
Zhang, Zhongpu

Biomedical Engineering Research

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Research Grants*

Sponsor/ Grant Name	Chief Investigator [other AMME investigators]	Project Title	Duration	Awarded Amount ($)
Australian Research Council/Discovery Projects (DP)	Li, Qing [Li, Wei]	Computational scaffold optimisation for tissue engineering	Jan 2007 - Jun 2010	**215,000**
DVC Research/Bridging Support Grant	Li, Qing	CFD driven topological design for coronary stents	Jan 2009 - May 2010	**50,000**
Australian Research Council/Discovery Projects (DP)	Li, Qing	Topology optimisation of periodic structures for stent design	Jan 2010 - Dec 2012	**300,000**
Australian Research Council/Discovery Projects (DP)	Li, Wei [Swain, Michael]	Topography optimization of implants for enhancing osseointegration	Jan 2010 - Dec 2014	**600,000**
Australian Research Council/Linkage Projects (LP)	Ruys, Andrew	Oxide bioceramics for drug delivery	Jan 2006 – Nov 2010	**86,275**
Australian Research Council/Linkage Projects (LP)	Ruys, Andrew [Li, Qing; Li, Wei]	Cochlear implants: Identifying current paths through computational modelling of MRI data	Jan 2007 - Dec 2010	**102,346**
Australian Institute of Nuclear Science and Engineering/Awards	Ruys, Andrew	Porous refractory carbides	Jan - Dec 2010	**2,550**
Australia Malaysia Institute/Research Support	Swain, Michael [Li, Qing]	Enhancing dental education through computational modelling	Mar 2009 - Mar 2011	**10,000**
National Health and Medical Research Council/Project Grants	Zreiqat, Hala [Dunstan, Colin]	Novel coatings for orthopaedic implants	Jan 2009 - Dec 2011	**430,125**
National Health and Medical Research Council/Career Development Awards	Zreiqat, Hala	Molecular mechanisms controlling the maintenance and differentiation of skeletal tissue/device interface for biomedical engineering applications	Jan 2006 - Dec 2010	**436,250**
National Health and Medical Research Council/Project Grants	Zreiqat, Hala [Dunstan, Colin]	Harnessing the physiological effects of strontium and zinc to produce novel biomaterials for orthopaedic applications	Jan 2010 - Dec 2012	**539,500**
Australian Research Council/Linkage Projects (LP)	Zreiqat, Hala [Wu, Chengtie]	Scaffolds for bone tissue regeneration and use in orthopaedic applications	Jan 2009 - Dec 2012	**504,000**
DVC Research/Bridging Support Grant	Zreiqat, Hala	Biomaterials for orthopaedic applications	Jan - Dec 2010	**50,000**
Rebecca L Cooper Medical Research Foundation/Equipment Grant	Zreiqat, Hala	Novel scaffolds for augmenting large bone defects	Mar 2010 - Feb 2011	**20,000**
Australian Orthopaedic Association Research Foundation Ltd/Research Support	Zreiqat, Hala [Dunstan, Colin]	Novel coatings for orthopaedic application	Sep 2010 - Oct 2011	**53,454**

* Figures obtained from the Research Office, University of Sydney

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2010 Publications[†]

Book Chapters

Chen, Y, Cadman, J E, Li, Q 2010, Effect of Scaffold Architecture on Tissue Regeneration, 6th World Congress of Biomechanics (WCB 2010) August 1 - 6, 2010 Singapore: In Conjunction with 14th International Conference on Biomedical Engineering (ICBME) and 5th Asia Pacific Conference on Biomechanics(APBiomech), Springer, Berlin, 31, 815-818

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Li, J, Roohani-Esfahani, S, Lu, Z., Wang, G, Kaplan, D, Zreiqat, H 2010, Novel Silk-Modified Strontium-Hardystonite Composite Scaffolds for Skeletal Regeneration, TERMIS - North America 2010 Conference on Tissue Engineering & Regenerative Medicine International Society, Tissue Engineering & Regenerative Medicine International Society, USA, Abstract Number 1217

Li, W, Rungsiyakull, C, Field, C, Lin, D, Zhang, Z, Li, Q, Swain, M V 2010, Computational biomechanics of bone's responses to dental prostheses osseointegration, remodeling and resorption, 9th World Congress on Computational Mechanics and 4th Asian Pacific Congress on Computational Mechanics WCCM-APCOM 2010, IOP Publishing Ltd, Bristol, UK, 10, 1, 012122-1-012122-7

Rungsiyakull, C, Li, Q, Li, W, Swain, M V 2010, Multiscale Bone Remodeling Simulation of Single and Cantilever Implant-supported Fixed Dental Prosthesis, 1st International Conference on Applied Bionics and Biomechanics ICABB-2010, ICABB, Online

Tammareddi, S, Sun, G, Li, Q 2010, Computational design analysis for deployment of cardiovascular stents, 9th World Congress on Computational Mechanics and 4th Asian Pacific Congress on Computational Mechanics WCCM-APCOM 2010, IOP Publishing Ltd, Bristol, UK, 10, 1, 012123-1-012123-7

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Wang, G, Lu, Z., Liu, X, Zhou, X, Ding, C, Zreiqat, H 2010, Nanostructured glass-ceramic coatings for orthopaedic applications, 15th Annual Scientific Meeting of the Australian and New Zealand Orthopaedic Research Society ANZORS 2010, Australian and New Zealand Orthopaedic Research Society, Australia

Zhong, X, Ji, C, Kazarian, S, Ruys, A J, Dehghani, F 2010, Chitosan/Poly (e-Caprolactone) Composite Hydrogel for Tissue Engineering Applications, The 26th Southern Biomedical Engineering Conference, Springer, United States, 32, 188-191

Zhou, S, Li, W, Li, Q 2010, Sensitivity analysis for electromagnetic topology optimization problems, 9th World Congress on Computational Mechanics and 4th Asian Pacific Congress on Computational Mechanics WCCM-APCOM 2010, IOP Publishing Ltd, Bristol, UK, 10, 1, 012199-1-012199-5

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Awaja, F, Moon, J, Zhang, S, Gilbert, M, Kim, C, Pigram, P 2010, Surface molecular degradation of 3D glass polymer composite under low earth orbit simulated space environment, Polymer Degradation and Stability, 95(6), 987-996

[†] Records obtained from the Integrated Research Management Application (IRMA), University of Sydney

Awaja, F, Zhang, S, James, N, McKenzie, D R 2010, Enhanced Autohesive Bonding of Polyetheretherketone (PEEK) for Biomedical Applications Using a Methane/Oxygen Plasma Treatment, Plasma Processes and Polymers, 7(12), 1010-1021

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Chan, M C, Ruys, A J 2010, Sintering Studies of Carbon Fibre-Reinforced Fused Silica for High-Temperature Applications, Interceram, 59(1), 18-20

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Chen, Y, Zhou, S, Li, Q 2010, Multiobjective topology optimization for finite periodic structures, Computers & Structures, 88(11-12), 806-811

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Lin, D, Li, Q, Li, W, Swain, M V 2010, Bone remodeling induced by dental implants of functionally graded materials, Journal of Biomedical Materials Research. Part B: Applied Biomaterials, 92B(2), 430-438

Liu, P Y, Kalak, R, Lue, Y, Jia, Y, Erkkila, K, Zhou, H, Seibel, M J, Wang, C, Swerdloff, R, Dunstan, C R 2010, Genetic and Hormonal Control of Bone Volume, Architecture, and Remodeling in XXY Mice, Journal of Bone and Mineral Research, 25(10), 2148-2154

Lu, Z., Zreiqat, H 2010, Beta-tricalcium phosphate exerts osteoconductivity through 21 integrin and down-stream MAPK/ERK signaling pathway, Biochemical and Biophysical Research Communications, 394(2), 323-329

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Ma, Y, Bryce, N S, Whan, R M, Xiao, L (Y), Li, K, Ruys, A J, Hambley, T W, Boughton, P C 2010, Growth of DLD-1 Colon Cancer Cells on Variotis Scaffolds of Controlled Porosity: A Preliminary Study, Journal of Biomimetics, Biomaterials, and Tissue Engineering, 8, 79-89

Ooi, L, Zheng, Y, Zhou, H, Trivedi, T, Conigrave, A D, Seibel, M J, Dunstan, C R 2010, Vitamin D deficiency promotes growth of MCF-7 human breast cancer in a rodent model of osteosclerotic bone metastasis, Bone, 47(4), 795-803

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Schindeler, A J, Morse, A, Peacock, L, Mikulec, K, Yu, N, Liu, R L, Kijumnuayporn, S, McDonald, M, Baldock, P, Ruys, A J, Little, D G 2010, Rapid cell culture and pre-clinical screening of a transforming growth factor-beta (TGF-beta) inhibitor for orthopaedics, BMC Musculoskeletal Disorders, 11(105), 105-1-105-9

Sturm, S, Zhou, S, Mai, Y, Li, Q 2010, On stiffness of scaffolds for bone tissue engineering - a numerical study, Journal of Biomechanics, 43(9), 1738-1744

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Wang, G, Zreiqat, H 2010, Functional Coatings or Films for Hard-Tissue Applications, Materials, 3(7), 3994-4050

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Wu, C, Chang, J, Zreiqat, H 2010, Engineered Ca-Si Based Ceramics for Skeletal Tissue Reconstruction, Materials Science Foundations (monograph series), 62, 122-149

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Yu, N, Schindeler, A J, Peacock, L, Mikulec, K, Baldock, P, Ruys, A J, Little, D G 2010, In vivo local co-delivery of recombinant human bone morphogenetic protein-7 and pamidronate via poly-D, L-lactic acid, European Cells and Materials, 20, 431-442

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Zhou, S, Li, W, Li, Q 2010, Design of 3-D Periodic Metamaterials for Electromagnetic Properties, IEEE Transactions on Microwave Theory and Techniques, 58(4), 910-916

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Zreiqat, H, Ramaswamy, Y, Wu, C, Paschalidis, A P, Lu, Z., James, B, Birke, O, McDonald, M, Little, D G, Dunstan, C R 2010, The incorporation of strontium and zinc into a calcium-silicon ceramic for bone tissue engineering, Biomaterials, 31(12), 3175-3184

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Materials & Structures Research

Centre for Advanced Materials Technology (CAMT)

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The Centre for Advanced Materials Technology (CAMT) was established in 1989 at the University of Sydney, Australia. The aims of CAMT are to conduct high quality fundamental research in materials science and technology and to promote collaboration with industry in the design, engineering, development and manufacturing technology of advanced materials, which can give a competitive edge to new products and processes. It has a widely recognised international and national reputation for high quality research, equipped with state-of-the-art facilities of processing, characterisation and mechanical testing.

CAMT carries out investigations and R&D projects for industry. Technology transfer to industry occurs through workshops, short courses and seminars. The Centre has an international exchange program and supports postgraduate students in advanced materials technology. CAMT is one of partners of CRC-ACS (Cooperative Research Centre for Advanced Composite Structures).

Research Group

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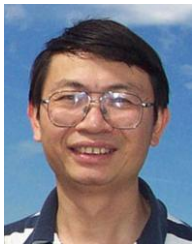
Materials science and engineering; advanced fibre composites; polymer blends; forming, joining and welding; biomimetics, biomaterials and biomechanics; failure analysis and diagnosis; mechanical behaviour of materials (metals, polymers, ceramics, composites, etc); fracture and fatigue mechanics; friction and wear; advanced thin films; eco-materials; smart materials and structures



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Materials characterization using advanced electronic microscopy techniques

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Materials science; property profile of composite materials (fatigue and fracture, residual strength, long-term properties, structure-property relationship and microscopic characterisation); interlaminar stresses and delamination in composite laminates; manufacturing techniques and processing models for high performance polymer composites; composites design; rehabilitation of infrastructure using fibre composites, polymer composite tribology and epoxy adhesive joints for engineering structures

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Centre for Advanced Materials Technology (CAMT)

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Academics
Dr Li, Qing
A/Prof Ruys, Andrew

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Dr Du, Xusheng
Dr Liu, Hong-Yuan
Dr Mylvaganam, Kausala
Dr Tekyeh Marouf, Bahereh

Postdoctoral Fellows
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Dr Chang, Li
Dr Lu, Ye
Dr Wang, Dong
Dr Wang, Yanbo

Honorary Associates
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Dr Lu, Chunsheng
Dr Qin, Qing Hua
Dr Wong, Shing-Chung
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Dr Zhang, Xin-Ping

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Dr Beehag, Andrew

Administrative Assistant
Santos, Tessie

Technical Staff
Karkada, Stanley
Shearing, Trevor

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Bashyal, Bal Krishna
Fang, Yujiang
Huang, Nao
Lian, Qi
Mustapha, Samir Ahmad
Ni, Song
Tugcu, Kaan
Wang, Gongtao
Wang, Xiaohang
Zeng, Ying
Zhang, Jianing
Zhu, Yiwei

Research Grants*

Sponsor/ Grant Name	Chief Investigator [other AMME investigators]	Project Title	Duration	Awarded Amount ($)
Australian Research Council/Discovery Projects (DP)	Chang, Li	Towards new generations of lubricants using nanoparticles	Jan 2008 - Dec 2010	**290,000**
Australian Research Council/Discovery Projects (DP)	Du, Xusheng	Novel nanostructured high energy cathode material	Jan 2007 - Jun 2010	**260,000**
DVC Research/Bridging Support Fellowship	Du, Xusheng	High performance protective coatings with novel functional nano-additives	Jan - Dec 2010	**29,145**
Australian Research Council/Discovery Projects (DP)	Liao, Xiaozhou [Lu, Chunsheng; Wang, Yanbo]	Atomistic mechanisms of the mechanical behaviour of nanostructured silicon carbide films	Jan 2009 - Dec 2011	**300,000**
Australian Research Council/Discovery Projects (DP)	Liao, Xiaozhou	Transmission electron microscopy investigation of the deformation mechanisms of nanostructured materials	Jan 2007 - Dec 2011	**980,000**
Department of Innovation, Industry, Science and Research (Federal)/International Science Linkages (ISL): Australia-China Fund for Scientific and Technological Cooperation (Australia-China Special Fund)	Liao, Xiaozhou	Mechanism of isothermal nanocrystallisation in amorphous metallic alloys and the deformation behaviour of amorphous/nanocrystalline composites	Jan 2010 - Jun 2011	**50,000**
Australian Research Council/Linkage Projects (LP)	Liao, Xiaozhou	In-situ transmission electron microscopy nanoindentation investigation of advanced structural metallic materials	Jan 2010 - Dec 2012	**301,338**
Australian Research Council/Future Fellowships (FT)	Liu, Hong Yuan	Fatigue life prediction of nano-filler modified composites	Nov 2009 - Dec 2013	**624,300**

* Figures obtained from the Research Office, University of Sydney

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Centre for Advanced Materials Technology (CAMT)

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Sponsor/ Grant Name	Chief Investigator [other AMME investigators]	Project Title	Duration	Awarded Amount ($)
Australian Research Council/Discovery Projects (DP)	Lu, Ye	Fundamentals of damage identification in tubular structures using guided waves	Jan 2009 - Dec 2011	**300,000**
Australian Research Council/Discovery Projects (DP)	Mai, Yiu-Wing	Some outstanding mechanics problems in layered ferroelectromagnetic composites with enhanced magnetoelectric effect	Jan 2006 - Mar 2010	**490,000**
Australian Research Council/Discovery Projects (DP)	Mai, Yiu-Wing	Nanostructure design and toughening mechanisms of novel thermosets	Jan 2008 - Dec 2011	**630,000**
DVC Research/Bridging Support Grant	Wang, Yanbo	In-situ deformation investigation of a Ti alloy	Jan - Dec 2010	**20,000**
Cooperative Research Centre for Advanced Composite Structures/Research Support	Ye, Lin	CRC advance composite structures II - Program 1 aerospace composites	Jan 2005 - Dec 2009	**360,734**
Australian Research Council/Discovery Projects (DP)	Ye, Lin [Yu, Zhongzhen]	Fundamental roles of nano-particles in CF/EP composites	Jan 2008 - Dec 2010	**303,000**
Australian Research Council/Discovery Projects (DP)	Ye, Lin	Fundamentals of active sensor network for damage identification in engineering structures	Jan 2008 - Dec 2010	**375,000**

2010 Publications*

Books

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Conference Papers

Chang, L, Friedrich, K, Ye, L 2010, A Study on the Transfer Film in Sliding Contact between Polymeric Composites and Steel Disks Using Nanoindentation, The Seventh Asian-Australasian Conference on Composite Materials (ACCM7), Industrial Technology Research Institute, Taiwan

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* Records obtained from the Integrated Research Management Application (IRMA), University of Sydney

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Cao, M, Ye, L, Zhou,, L, Su, Z, Bai, R 2010, Sensitivity of fundamental mode shape and static deflection for damage identification in cantilever beams, Mechanical Systems and Signal Processing, 25(2), 630-643

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Chen, C R, Mai, Y 2010, Comparison of cohesive zone model and linear elastic fracture mechanics for a mode I crack near a compliant/stiff interface, Engineering Fracture Mechanics, 77(17), 3408-3417

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Lim, S H, Yu, Z, Mai, Y 2010, Effects of loading rate and temperature on tensile yielding and deformation mechanisms of nylon 6-based nanocomposites, Composites Science and Technology, 70(13), 1994-2002

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Tang, Y, Gao, P, Ye, L, Zhao, C, Lin, W 2010, Organoclay/thermotropic liquid crystalline polymer nanocomposites. Part V: morphological and rheological studies, Journal of Materials Science, 45(11), 2874-2883

Tang, Y, Gao, P, Ye, L, Zhao, C, Lin, W 2010, Organoclay/Thermotropic Liquid Crystalline Polymer Nanocomposites. Part VI: Effects of Intercalated Organoclay on Nanocomposite Morphology, Thermal and Rheological Properties, International Journal of Smart and Nano Materials, 1(3), 173-186

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Yang, Y, Li, W, Luo, Y, Xiao, H, Fu, S, Mai, Y 2010, Novel ultraviolet-opaque, visible-transparent and light-emitting ZnO-QD/silicone composites with tunable luminescence colors, Polymer, 51(12), 2755-2762

Zheng, J, Zhou, X, Xie, X, Mai, Y 2010, Silica hybrid particles with nanometre polymer shells and their influence on the toughening of polypropylene, Nanoscale, 2(10), 2269-2274

Zhou, C, Du, X S, Liu, Z, Mai, Y, Ringer, S P 2010, Multi-holed clay nanotubes and their modification with a polyaniline nanolayer, Journal of Materials Science, 46(2), 446-450

Zhou, C, Liu, Z, Du, X S, Ringer, S P 2010, Electrodeposited PEDOT films on ITO with a flower-like hierarchical structure, Synthetic Metals, 160(15-16), 1636-1641

Materials & Structures Research

Finite Element Analysis Research Center

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The Finite Element Analysis Research Center was (FEARC) has been a part of the School of Aerospace, Mechanical and Mechatronic Engineering at The University of Sydney since July 1992. The center's primary aim is to serve as a national focus for research in Finite Element Analysis.

Research Group

The academic members of the center include:

Director

Prof Tong, Liyong (Aerospace Research Group)

Emeritus Professors

Prof Steven, Grant

Research Fellows

Dr Qing Li (Biomedical Research Group)
Dr Wei Li (Biomedical Research Group)
Dr K Srinivas (Aerospace Research Group)

The staff and associates of FEARC are very active in a large range of topics, samples of which are given below:

- FE analysis for the draping of cloth structures for aircraft or garment.
- Error estimation in dynamic and buckling FEA analysis.
- FE Modelling of Piezo-elastodynamics for the control of very flexible structures.
- Evolutionary structural optimisation.
- FE Modelling and design optimisation of dental structures.
- FE modelling of biomechanical processes such as spinal manipulation or hip implants or prosthesis.
- Crack tracking algorithms for fracture mechanics.
- FEA modelling of acoustics and fluid/structure interaction.

Rheology Research

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Research Group

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- Rheology
- Polymer processing
- Computational mechanics

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- Nano-rheology and nano-tribology
- Boundary condition and wall slip at the fluid-solid interface
- Characterizing material properties by molecular level simulations
- Novel 3D nano-structures, the origin of high rigidity for ultra-thin liquid films
- Low friction states of films only a few nanometer thick
- Linking material properties and molecular architecture en route to design of customized purpose materials
- Using molecular simulations to study crystallization of polymers

Honorary/ Adjunct Staff

Prof Fan, Xijun
A/Prof Zheng, Rong

Postdoctoral Fellows

Dr Dai, Shao Cong
Dr Kittipoomwong, Prakorn David
Dr Qi, Fuzhong

Research Associates

Bertevas, Erwan
Dr Lee Wo, Duane
Dr Uthayakumaran, Surjani

Research Students

Bertevas, Erwan
Lee-Wo, Duane
Ramin, Leyla

Research Grants*

Sponsor/ Grant Name	Chief Investigator [other AMME investigators]	Project Title	Duration	**Awarded Amount ($)**
Cooperative Research Centre for Polymers/Research Support	Tanner, Roger	Project 4.1 Effect of additives on polymer properties	Jan 2006 - Dec 2012	**234,009**
Australian Research Council/Discovery Projects (DP)	Tanner, Roger	Modelling soft viscoelastic solids	Jan 2010 - Dec 2012	**400,000**

* Figures obtained from the Research Office, University of Sydney

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2010 Publications[†]

Book Chapter

Uthayakumaran, S, Wrigley, C 2010, Wheat: characteristics and quality requirements, Cereal grains: Assessing and managing quality, Woodhead Publishing Ltd, Cambridge, Food Science, Technology and Nutrition series n190, 59-110

Conference Papers

Jabbarzadeh-Khoei, A, Ramin, L 2010, Molecular Dynamics Simulations of Alkanethiol Self Assembled Monolayers on Au(111): Effects of Loading and Chain Size on Tribology and Film Structure, International Tribology Congress - ASIATRIB 2010, International Tribology Congress, Australia, ID: 1126

Jabbarzadeh-Khoei, A, Tanner, R I 2010, Separating the effects of shear rate and strain on flow induced crystallization of polymers by large scale molecular simulations, International Soft Matter Conference 2010, RSC Publishing, Spain

Kittipoomwong, P, Jabbarzadeh-Khoei, A, See, H T 2010, Dynamic simulation of fiber suspensions, The Society of Rheology 82nd Annual Meeting, The Society of Rheology, USA

Ramin, L, Jabbarzadeh-Khoei, A 2010, Effect of Loading and Shear Rate on Tribological Behaviour of Dodecanethiol Self Assembled Monolayer on AU(111): A Molecular Dynamic Simulation Study, STLE/ASME 2010 International Joint Tribology Conference (IJTC 2010), ASME, USA

Journal Papers

Bertevas, E L, Fan, X, Tanner, R I 2010, Simulation of the rheological properties of suspensions of oblate spheroidal particles in a Newtonian fluid, Rheologica Acta, 49(1), 53-73

Chang, L, Friedrich, K, Schlarb, A, Tanner, R I, Ye, L 2010, Shear-thickening behaviour of concentrated polymer dispersions under steady and oscillatory shear, Journal of Materials Science, 46(2), 339-346

Fan, X, Tanner, R I, Zheng, R 2010, Smoothed particle hydrodynamics simulation of non-Newtonian moulding flow, Journal of Non-Newtonian Fluid Mechanics, 165, 219-226

Fan, X, Zheng, R, Liu, G, Tanner, R I, Edward, G 2010, Modelling Post-molding Warping, International Polymer Processing, 25(1), 47-54

Htoon, A, Uthayakumaran, S, Piyasiri, U, Appelqvist, I, LÃ³pez-Rubio, A, Gilbert, E, Mulder, R 2010, The effect of acid dextrinisation on enzyme-resistant starch content in extruded maize starch, Food Chemistry, 120(1), 140-149

Jabbarzadeh-Khoei, A, Tanner, R I 2010, Flow-Induced Crystallization: Unravelling the Effects of Shear Rate and Strain, Macromolecules, 43(19), 8136-8142

Tanner, R I, Qi, F, Dai, S C 2010, Bread dough rheology: an improved damage function model, Rheologica Acta, 50(1), 75-86

Tanner, R I, Qi, F, Housiadas, K 2010, A differential approach to suspensions with power-law matrices, Journal of Non-Newtonian Fluid Mechanics, 165(23-24), 1677-1681

Zheng, R, Tanner, R I, Lee Wo, D, Fan, X, Hadinata, C, Costa, F, Kennedy, P, Zhu, P, Edward, G 2010, Modeling of flow-induced crystallization of colored polypropylene in injection molding, Korea - Australia Rheology Journal, 22(3), 151-162

[†] Records obtained from the Integrated Research Management Application (IRMA), University of Sydney

Robotics Research

Australian Centre for Field Robotics (ACFR)

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The Australian Centre for Field Robotics (ACFR) is based in the School of Aerospace, Mechanical and Mechatronic Engineering at The University of Sydney, and is dedicated to the research, development, application and dissemination of field robotics principles.

The group has substantial experimental facilities including three laboratories and a field test site, a range of experimental and production vehicles, industry-quality mechanical and electrical design and fabrication facilities, and employs the latest in embedded computing, sensing and control technologies.

The ACFR is now the largest robotics and automation research group in Australia and is also one of the largest of its kind in the world.

Research and Industry Partnerships

- ARC Centre of Excellence for Autonomous Systems (CAS)
- CRC Mining Australia
- Rio Tinto Centre for Mine Automation
- Centre of Expertise in Defence Autonomous & Uninhabited Vehicle Systems, DSTO, Australian Government
- Centre for Autonomous Aerospace Systems
- Centre for Social Robotics
- IMOS AUV Facility
- Academic Capability Partner - BAE Systems

Key Research Areas

The Fundamental Research Program focuses on enabling technologies in four key areas. These areas draw together common themes and research priorities from the applied research program with the goal of supporting long-term developments across the whole field robotics area.

- Perception, sensing, representations of information, the modelling and management of uncertainty, data fusion and perceptual interpretation.
- Control, of individual micro and macro machines, of heterogeneous groups of platforms and sensors, and of contact and interaction with the environment and each other.
- Learning, supervised and unsupervised learning in unstructured and dynamic environments, multi-agent learning, pattern recognition and concept formation.
- Systems, design and optimisation of “systems of systems”, modelling and management of complexity, large scale systems theory, and modelling of information flow.

These themes define the science of field robotics and represent the main focus of ACFR. The projects ensure that the many threads of the fundamental research programs are brought together and that a bridge exists to further commercial development of research results.

Robotics Research

Australian Centre for Field Robotics (ACFR)

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Research Group

Professor Hugh Durrant-Whyte
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- Demonstration of non-Gaussian Decentralised Data Fusion (DDF) concepts on multiple heterogeneous autonomous systems
- To develop weed detection methodologies and weed destruction methods that can be implemented in an autonomous non-herbicidal weeding system
- High-speed on-road autonomous ground vehicle manoeuvres
- Unmanned agricultural operations

Professor Eduardo Nebot
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Perception research

Associate Professor Salah Sukkarieh
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- UAV systems for agriculture and ecosystem management
- Decentralised navigation and control of UAVs
- Simultaneous localisation and map building for UAVs

Dr Graham Brooker
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Sensor research

Dr David Rye

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Systems Research (Perception and Control)

- Fish-Bird (an interactive kinetic artwork in which two robots in the form of wheelchairs communicate with their audience, and with each other, through movement and written text)
- CAS Outdoor Research Demonstrator (generic UGV platform for testing control, perception and learning algorithms)

Dr Steve Scheding
P: + 61 2 9351 8929
s.scheding@cas.edu.au

Perception Research

- Fish-Bird
- CAS Outdoor Research Demonstrator
- Investigation and development of appropriate multi-sensor systems to monitor/estimate foodstuff temperature, mass and moisture content, and foodstuff chemical/protein changes)

Dr Stefan Williams
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- Long-term operation of a robotic ground vehicle in an outdoor environment
- Undersea vehicles
- Fish-Bird

Robotics Research

Australian Centre for Field Robotics (ACFR)

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Research Fellows

Dr Johnson, David
Dr Johnson-Roberson, Matthew
Dr Makarenko, Alexei
Dr Nieto, Juan
Dr Singh, Surya
Dr Velonaki, Mari

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Dr Bailey, Tim
Dr Melkumyan, Arman
Dr Pizarro, Oscar

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Dr Brooks, Alex
Dr Bryson, Mitchell
Dr Douillard, Bertrand
Dr Elinas, Pantelis
Dr Fitch, Robert
Dr Hill, Andrew
Dr Jakuba, Michael
Dr Kaupp, Tobias
Dr Mahon, Ian
Dr Monteiro, Sildomar
Dr Murphy, Richard
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Dr Perera, Lochana
Dr Peynot, Thierry
Dr Ramos, Fabio
Dr Vasudevan, Shrihari
Dr Worrall, Stewart

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Olip, Ruth
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Wang, Christy (Finance)

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Bandara, Dharmapriya
Beauport, Jean-Gerard
Blekhman, Alexander
Calleija, Mark
Chan, Pak Hung (Victor)
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Goyal, Abhinav
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Ralph, Daniel
Randle, Jeremy
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Chung, Jen Jen
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Mariam, Nazifa
Mcallister, Rowan Thomas
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Morton, Peter Michael
O'Callaghan, Simon
Ott, Lionel
Reid, Alistair Smyth
Seiler, Konstantin Martin
Seotsanyana, Motlatsi
Silvera Tawil, David
Silversides, Katherine
Steinberg, Daniel
Toohey, Lachlan James
Van De Ven, Joop Johannes Wilhelmus
Vial, John Francis Stephen
Wood, David Kenneth
Zhan, Kai

Robotics Research

Australian Centre for Field Robotics (ACFR)

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Research Grants*

Sponsor/ Grant Name	Chief Investigator [other AMME investigators]	Project Title	Duration	Awarded Amount ($)
Australian Research Council/Centres of Excellence (CE)	Durrant-Whyte, Hugh [Nebot, Eduardo]	Centre for autonomous systems	Jan 2003 - Dec 2010	**15,200,000**
Australian Research Council/Federation Fellowships (FF)	Durrant-Whyte, Hugh	Data fusion and perception in autonomous networks	Jan 2007 - Dec 2011	**1,606,210**
Technological Resources Pty Ltd/Research Support	Durrant-Whyte, Hugh	Rio tinto centre for mine automation	Jan 2007 - Dec 2011	**18,500,000**
University of Pennsylvania (USA)/Shared Research Support	Durrant-Whyte, Hugh	MAST: Micro Autonomous Systems and Technology	May 2008 - Nov 2013	**304,836**
DVC Research/Postdoctoral Research Fellowship Scheme	Jakuba, Michael	Efficient multiple plume source search	Sep 2008 - Sep 2011	**245,293**
Australian Research Council/Discovery Projects (DP)	Pizarro, Oscar [Williams, Stefan; Pizarro, Oscar]	Cost-effective autonomous technologies for long term monitoring of marine protected areas	Jan 2010 - Dec 2014	**798,000**
Australian Research Council/Discovery Projects (DP)	Ramos, Fabio	Learning from uncertain and missing labelling in relational data	Jan 2008 - Dec 2010	**235,944**
Meat and Livestock Australia Ltd/Research Support	Sukkarieh, Salah	UAV surveillance systems for the management of woody weed infestations	May 2008 - Nov 2010	**285,000**
Department of Agriculture, Fisheries and Forestry (Federal)/Research Support	Sukkarieh, Salah	Using UAVs and innovative classification algorithms in the detection of cacti	Mar 2009 - Dec 2010	**108,577**
Australian Research Council/Discovery Projects (DP)	Velonaki, Mari	Physicality, Tactility, Intimacy: Interaction between Humans and Robots	Jan 2009 - Dec 2013	**753,757**
Australian Research Council/Linkage Projects (LP)	Williams, Stefan [Jakuba, Michael; Pizarro, Oscar]	Autonomous repeatable surveys for long term monitoring of marine habitats	Jan 2009 - Dec 2011	**320,000**
Australian Research Council/Discovery Projects (DP)	Williams, Stefan	Autonomous exploration and characterization of benthic habitats linked to oceanographic processes	Jan 2008 - Dec 2010	**134,000**
Department of Innovation, Industry, Science and Research (Federal)/National Collaborative Research Infrastructure Strategy (NCRIS)	Williams, Stefan [Jakuba, Michael; Pizarro, Oscar]	Use of Autonomous Underwater Vehicle at the IMOS AUV facility	Jul 2008 - Jun 2013	**1,582,499**

* Figures obtained from the Research Office, University of Sydney

Robotics Research

Australian Centre for Field Robotics (ACFR)

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2010 Publications[†]

Books

Finn, A. & Scheding, S.J. Developments and Challenges for Autonomous Unmanned Vehicles: A Compendium, Springer, Berlin, ISBN 978-3-642-10703-0

Book Chapters

Melkumyan, A. & Murphy, R. 'Spectral domain noise suppression in dual-sensor hyperspectral imagery using Gaussian processes'. In K. Wong, B. Mendis, & A. Bouzerdoum (Eds), Neural Information Processing: Models and Applications, pp. 684–691, Springer, Berlin

Seiler, K., Singh, S.P.N. & Durrant-Whyte, H.F. 'Using Lie group symmetries for fast corrective motion planning'. In D. Hsu, V. Isler, J-C. Latombe & M.C. Lin (Eds), Algorithmic Foundations of Robotics IX, pp. 37–52, Springer, Berlin

Curated and Catalogued Works of Art

Velonaki, M. 'Current State of Affairs', interactive installation with mirror, water and electricity. In A. Lærkesen (curator), Unknown Territories — Between a Rock and a Hard Place, Cockatoo Island, Sydney, Australia, 10 September–4 October

Velonaki, M., Rye, D. & Scheding, S. 'Circle D: Fragile Balances', interactive installation with two autonomous objects. In V. Lynn & H.J. Kim (curators), The Trickster, Gyeonggi Museum of Modern Art, Ansan City, South Korea, 7 September–5 December

Velonaki, M., Rye, D. & Scheding, S. 'Circle E: Fragile Balances', installation with kinetic object. In V. Lynn & H.J. Kim (curators), The Trickster, Gyeonggi Museum of Modern Art, Ansan City, South Korea, 7 September–5 December

Velonaki, M., Rye, D. & Scheding, S. 'Circle D: Fragile Balances', interactive installation with two autonomous objects. In A. Choi, M. Lee & WF Wong (curators), Fugue in the Key of Understanding, Osage Kwun Tong, Kowloon, Hong Kong, 27 March–18 April

Velonaki, M., Rye, D. & Scheding, S. 'Circle E: Fragile Balances', installation with kinetic object. In A. Choi, M. Lee & WF Wong (curators), Fugue in the Key of Understanding, Osage Kwun Tong, Kowloon, Hong Kong, 27 March–18 April

Conference Papers

Abuhashim, T., Bryson, M.T. & Sukkarieh, S. 'Vision-based terrain modelling with application to change detection'. Proc. Australasian Remote Sensing and Photogrammetry Conf., 16 pp., Alice Springs, Australia, 13–17 September

Agamennoni, G., Nieto, J.I. & Nebot, E.M. 'Robust and accurate road map inference'. Proc. 2010 IEEE Int. Conf. Robotics and Automation, pp. 3946–3953, Anchorage, USA, 3–8 May

Agamennoni, G., Nieto, J.I. & Nebot, E.M. 'Vehicle activity segmentation from position data'. Proc. 13th Int. IEEE Conf. Intelligent Transportation Systems, pp. 330–336, Madeira Island, Portugal, 19–22 September

Ahsan, N., Williams, S.B., Jakuba, M., Pizarro, O.R. & Radford, B. 'Predictive habitat models from AUV-based multibeam and optical imagery'. Proc. OCEANS 2010 MTS/IEEE Seattle Conf. & Exhibition, 10 pp., Seattle, USA, 20–23 September

Allen, T.L. 'Bounded anytime deflation'. Proc. 2010 Australasian Conf. Robotics and Automation, 8 pp., Brisbane, Australia, 1–3 December

[†] Records obtained from the Integrated Research Management Application (IRMA), University of Sydney

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Thermodynamics and Fluids Research

Combustion

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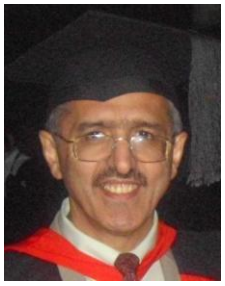
Research Group



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Lifted flames;
Incineration of halons and CFC's;
Chemical inhibition of halons in flames;
Experimental investigations of methanol and ethanol flames;
PDF-Monte Carlo calculations of turbulent non-premixed flames

Honorary Associates

Prof Bilger, Robert
Prof Kent, John
A/Prof Lowe, Allen

Postdoctoral Fellows

Dr Starner, Sten
Dr Yaroshchyk, Pavel

Research Associate

Juddoo, Mrinal

Research Students

Al-Harbi, Ahmed
Badra, Jihad
O'Loughlin, William
Meares, Shaun
Sivapalan, Kumaresan

Research Grants*

Sponsor/ Grant Name	Chief Investigator [other AMME investigators]	Project Title	Duration	Awarded Amount ($)
Australian Research Council/Discovery Projects (DP)	Masri, Assaad [Bilger, Robert]	Finite rate chemistry effects in turbulent combustion	Jan 2007 - Dec 2010	**500,000**
Australian Research Council/Discovery Projects (DP)	Masri, Assaad	Investigations of surface-gas reactions and mixing in micro-combustion	Jan 2008 - Dec 2010	**390,000**
Australian Research Council/Discovery Projects (DP)	Masri, Assaad [Bilger, Robert]	Strongly transient processes in turbulent combustion	Jan 2010 - Dec 2012	**653,555**
DVC Research/International Visiting Research Fellowship (IVRF)	Masri, Assaad [Thornber, Ben]	Development of very high-order accurate ILES methods for turbulent lean premixed combustion	Feb - Apr 2010	**17,500**

* Figures obtained from the Research Office, University of Sydney

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Conference Papers

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[†] Records obtained from the Integrated Research Management Application (IRMA), University of Sydney

Thermodynamics and Fluids Research

Fluid Dynamics

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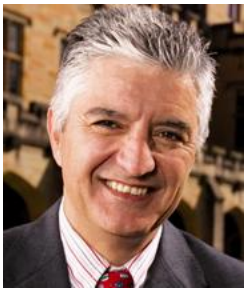

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Heat and mass transfer;
Electronic cooling;
Ventilation

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Dr Nagarathinam, Srinarayana
Dr Williamson, Nicholas

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Bartos, Nick
Dittko, Karl Albert
Djanali, Vivien
Fakhim, Babak
Gillam, Natalie
Hattori, Tae
Javadzadegan, Ashkan
Luthfi
Miles, Robert John
Tang, Chi Yan
Wong, Kaichung
Zecevic, Vanja

Research Grants*

Sponsor/ Grant Name	Chief Investigator [other AMME investigators]	Project Title	Duration	**Awarded Amount ($)**
Australian Research Council/Discovery Projects (DP)	Armfield, Steven [Kirkpatrick, Michael]	Investigation and optimisation of displacement ventilation and cooling systems	Jan 2009 - Dec 2012	**300,000**
Australian Research Council/Linkage Projects (LP)	Armfield, Steven [Kirkpatrick, Michael]	Freshing, mixing and purging of riverine saline ponds by freshwater overflow	Jan 2005 - Dec 2010	**132,400**
Australian Research Council/Linkage Projects (LP)	Nagarathinam, Srinarayana [Armfield, Steven; Behnia, Masud]	Design tools for optimising data centre layout to minimise energy usage	Jan 2010 - Dec 2012	**288,000**
DVC Research/Bridging Support Grant	Williamson, Nicholas	Mixing in stratified channel flow	Jan - Dec 2010	**50,000**

* Figures obtained from the Research Office, University of Sydney

2010 Publications[†]

Conference Papers

Aberra, T, Armfield, S W, Behnia, M, Maruyama, S, Komiya, A 2010, Numerical Study of 3D Nonlinear Disturbance Growth in Transitional Natural Convection, 14th International Heat Transfer Conference (IHTC14), ASME, USA, IHTC14-23300-1-IHTC14-23300-9

Bartos, N.P, Kirkpatrick, M P, Armfield, S W 2010, Fluid Mechanics of Displacement Air-Conditioning, 17th Australasian Fluid Mechanics Conference, University of Auckland, Auckland, New Zealand

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Fakhimghanbarzadeh, B, Behnia, M, Armfield, S W, Srinarayana, N 2010, Heat Transfer and Air-Flow Analysis of a Non-Uniformly Cooled Data Centre, 7th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics (HEFAT 2010), HEFAT, Turkey, 1, 883-888

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Fakhimghanbarzadeh, B, Srinarayana, N, Wong, S, Behnia, M, Armfield, S W 2010, Addressing Thermal Challenges in Design of Data Centres, ASME 2010 10th Biennial Conference on Engineering Systems Design and Analysis (ESDA2010), ASME, Istanbul, Turkey, ESDA2010-24690-1-ESDA2010-24690-10

Hattori, T, Armfield, S W, Kirkpatrick, M P 2010, Numerical Simulation of a Natural Ventilation Flow with a Line Heat Source Using Various Advection Schemes, 17th Australasian Fluid Mechanics Conference, University of Auckland, Auckland, New Zealand

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Jiracheewanun, S, Armfield, S W, Behnia, M 2010, Two- and Three- Dimensional Simulation of Combined Natural Convection Cooling of a Drink Can, 17th Australasian Fluid Mechanics Conference, University of Auckland, Auckland, New Zealand

Komiya, A, Torres, J, Okajima, J, Moriya, S, Maruyama, S, Behnia, M 2010, An Investigation of Concentration Dependency of Mass Diffusion Coefficients in Multi-Component Diffusion, 14th International Heat Transfer Conference (IHTC14), ASME, USA, IHTC14-22501-1-IHTC14-22501-6

Lehmann, R, Reddy, R, Armfield, S W 2010, Numerical and Experimental Investigation of Helicopter Fuselage Aerodynamics, 17th Australasian Fluid Mechanics Conference, University of Auckland, Auckland, New Zealand

Nateghi, M, Armfield, S W 2010, Natural Convection Ventilation In Fully Open Enclosures, 14th International Heat Transfer Conference (IHTC14), ASME, USA, IHTC14-22404-1-IHTC14-22404-9

Srinarayana, N, Armfield, S W, Behnia, M, Lin, W 2010, Critical Froude number for transition from a steady to an unsteady plane fountain injected into a homogeneous fluid, 17th Australasian Fluid Mechanics Conference, University of Auckland, Auckland, New Zealand

Williamson, N J, Armfield, S W 2010, The stability of conjugate natural convection boundary layers, 17th Australasian Fluid Mechanics Conference, University of Auckland, Auckland, New Zealand

Williamson, N J, Armfield, S W, Lin, W 2010, Entrainment in turbulent fountain flow, 17th Australasian Fluid Mechanics Conference, University of Auckland, Auckland, New Zealand

[†]Records obtained from the Integrated Research Management Application (IRMA), University of Sydney

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Armfield, S W, Williamson, N J, Kirkpatrick, M P, Street, R 2010, A divergence free fractional-step method for the Navier-Stokes equations on non-staggered grids, ANZIAM Journal, 51, C654-C667

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Ranga Dinesh, K, Jenkins, K, Savill, A, Kirkpatrick, M P 2010, Influence of Bluff-Body and Swirl on Mixing and Intermittency or Jets, Engineering Applications of Computational Fluid Mechanics, 4(3), 374-386

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Ranga Dinesh, K, Savill, A, Jenkins, K, Kirkpatrick, M P 2010, A study of mixing and intermittency in a coaxial turbulent jet, Fluid Dynamics Research, 42(2, Article number 025507), 025507 - 1-025507 - 20

Ranga Dinesh, K, Savill, A, Jenkins, K, Kirkpatrick, M P 2010, Large Eddy Simulation of a turbulent swirling coaxial jet, Progress in Computational Fluid Dynamics, 10(2), 88-99

Ranga Dinesh, K, Savill, A, Jenkins, K, Kirkpatrick, M P 2010, LES of intermittency in a turbulent round jet with different inlet conditions, Computers & Fluids, 39(9), 1685-1695

Sakurai, A, Maruyama, S, Matsubara, K, Miura, T, Behnia, M 2010, An Efficient Method for Radiative Heat Transfer Applied to a Turbulent Channel Flow, Journal of Heat Transfer, 132(2), 023507-1-023507-7

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Williamson, N J, Armfield, S W, Lin, W 2010, Transition behaviour of weak turbulent fountains, Journal of Fluid Mechanics, 655, 306-326

Graduates 2010

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Doctor of Philosophy

Chavara, Dorji
Synthesis and Testing of Metal-Ceramic Functionally Graded Materials

Field, Clarice
Bone Remodelling Simulation by Fixed Partial Dentures

Gounder, James
An Experimental Investigation of Non-Reacting and Reacting Spray Jets

Gupta, Raghavendra
CFD Simulations of Gas-Liquid Flow in Microchannels

Johnson, David
Complex Target Reconstruction Using Near-Field Synthetic Aperture Radar

Johnson-Roberson, Matthew
Large-Scale Multi-sensor 3D Reconstructions and Visualizations of Unstructured Underwater Environments

Katz, Roman
Track Based Classification of Dynamic Obstacles

Ling, Jack Chan Lung
Compressors for Miniature Unmanned Aerospace Propulsion Systems

Plain, Kristopher
Modelling and Testing of One-Sided Stitched Laminated Composites

Robertson, Scott
Vehicle Operations in Uncontrolled Environments

Rollo, Jennifer
An Experimental and Numerical Investigation of the AXTRA Design in Turbomachinery

Toh, Jake Geok Phuay
Variable Weights for Value Function Approximation

Wang, Dong
Damage Diagnostic Imaging Technique for Structural Health Monitoring

Master of Philosophy (Research)

Meikle, Scott
Avionics System Teaching Enhancement Using Flight Simulation

Merry, Laura
Generic Architecture Design for Navigation Filtering

Moser, Michael
Automated Laser Range Scanner Registration in Structured Environments

Orchansky, David
Designing an Effective User Interface for Improving the Awareness of Mining Vehicle Operators

Rollo, Peter
Airflow, Efficiency and Acoustic Studies of Two Novel Fans

Zhang, Zhongpu
Transient Thermal Modelling for Ceramic Prosthesis

Master of Engineering (Course work)

Du, Zhen
Huhe, Narisi
Kapoor, Rajiv
Kerim, Abdul Al Sultani
Kevin, Bryan Schwitter
Li, Kai
Liang, Xue Bai
Liu, Juhua
Liu, Qing
Ma, Yujia
Penm, Steven
Thottungal, Shanu Eldho
Vrba, Hadrien
Wu, Heng
Zhang, Chao
Zhang, Yi

Master of Professional Engineering

Li, Yi

Undergraduate Research- FSEA Racing Car

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Academic Staff
Dr Lozzi, Andrei

Senior Technical Officer
Elder, Greg

The thesis students in the Formula SAE (Society of Automotive Engineers of America) team have to invent, design, analyse and make most of the parts of the car. When they have done that, they will be faced with their triumphs and errors, nothing can make one an engineer quicker than that. The saying: 'those that have made no mistakes have never made anything' appears all too true. Students join this team because it lets them do the sort of thing that ambitious engineers want to do, and they can do it years before industry will entrust with similar opportunities.

FSAE teams are also in part set up to be like commercial companies, at the end they have to front up to investors to convince them, that because they have made a great prototype race car, and developed a good commercial plan, they represent a good investment to set up production. The cost of the car has to be justified part by part, process by process. The competition is not just about good design, manufacture and performance, but also about cost and effectiveness.

Figure 1 shows one of our many fund raising functions. Here on a cool spring morning we have set up a hot bacon-and-egg roll stand for incoming students. Even the otherwise secretive STIG got into the action.

Figure 1: Fund raising event

FSAE requires that each team make a completely new car each year. We have tried hard but must conclude that we cannot meet that requirement, and get the car to test tracks early enough to find and sort out bugs, tune the car and train drivers. Therefore the plan is to more or less make about half a car each year, and to progressively replace all its parts with tested and upgraded items. By doing this we may be penalized about 5% of the total points. On the other hand if we have a failure and do not finish the final and most demanding event, we stand to lose up to 40% of the points.

Shown here are a few examples of the research and development projects that the teams have undertaken to arrive at more effective, lighter and hopefully cheaper parts for forthcoming cars. Figure 2 shows our new drive train. The differential is at the center and carbon fiber drive tubes extend either side from it. Julien Seno won the Conversazione prize for it in 2010. Julien made test rigs to establish the functionality and reliability of all its parts.

Figure 2: Drive train

Figure 3 has Nicolas Tindal next to the dynamic dynamometer that he proposed, designed and made almost completely by himself. Our School does not possess a suitable dynamometer, which typically are very expensive. Nick's dyno connects a large flywheel to the output sprocket of the gearbox. The rate at which the flywheel accelerates indicates the torque the engine is developing, when that is multiplied by its angular velocity, we arrive at the engine power. The power characteristic of the engine can be determined in about 30 to 60 seconds.

Figure 3: Nicholas Tindal with dynamic dynamometer

Figure 4 shows our brake test rig developed to allow us to investigate the friction coefficient, clamping pressure and temperature at which our brake pads can be operated at. This sort of data is not provided by brake pad manufacturers. On the track separately, we can determine the rate at which heat is dissipated from the brake disks to the atmosphere. This data will then allow us to tailor-make brakes to closely meet the rigours of our competition. Brakes that reach appropriate working temperatures develop the required torques, while being light and compact as practical.

Figure 4: Brake test rig

Undergraduate Research- FSEA Racing Car

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The engine in adjacent figure (figure 5), is one of the more demanding but interesting parts of the car. We have replaced 600 cc four cylinder engines for 550 cc two cylinder Aprilie. These engines are half the weight, more compact and have high torque from idle. Daniel Bartos and others have applied industrial software to try to develop an intake that feed both cylinders equally.

The Engine Control Unit has also been a real test. Alex Chen with some considerable help from a NZ computer whiz, has been able for the first time to adjust injection and ignition in a manner that will allow us to tune the engine to suit our own intake and exhaust manifolds. Every year we rely on Mechatronics students to do this critical work.

Figure 5: Engine

Finally, the figure below (figure 6) shows two venues that we have taken to in our attempt to arrive at lighter, stiffer and cheaper wheels. Wheels and other suspension components are referred to as unsprung mass. That is, they have to follow the irregularities of the road, which they do less precisely the heavier they are. The wheel on the left hand side of the figure 6 is our latest effort to make the wheel centers from two opposing cones of sheet aluminium alloy, welded to a hub in the center. This design which mimics the construction of some aircraft wheels has good promise but also problems that have to be resolved. On the right is a prototype carbon fiber rim that is bolted to a center that has been machined from a thick slab of aluminium alloy. This design is more conventional, but expensive and potentially heavier.

Figure 6: Wheels

Student Research Showcase

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Engineering Sydney hosted its annual Research Conversazione on Friday 29 October 2010. The Research Conversazione has a long history having been run for nearly 2 decades. It was developed to allow our students, both undergraduate and postgraduate, to discuss the results of their research with industry. It is a showcase, but in reality it is more than that, it is an interaction allowing for free flowing dialogue which is reflected in the title Conversazione. This year the students work from the 5 Schools was displayed in 4 venues.

There were 47 posters presented from the School of Aeronautical, Mechanical & Mechatronic Engineering which were judged by the relevant industry representatives and academics from the Faculty for the following prizes generously sponsored by Shelston IP and Watermark Patent Attorneys.



Shelston IP Best Poster Awards - Undergraduates

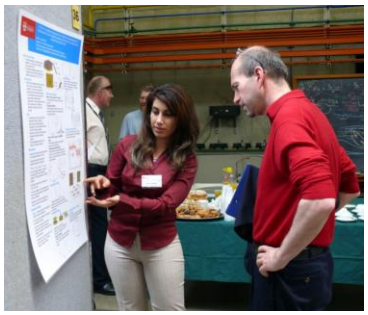
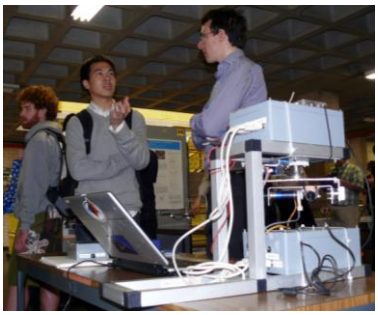
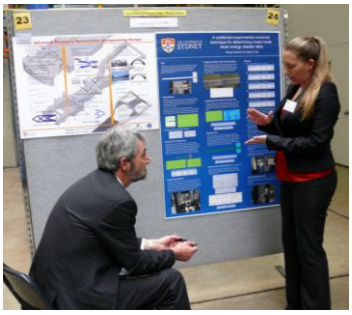
Thomas Siebert (Aeronautical)
Dasun Abeygoonawardan (Biomedical)
Julien Seno (Mechanical)
Eloise Matteson (Mechatronics)
Joel Cappelli (Space)

Shelston IP Best Poster Awards - Postgraduates

Kai Lehmkuehler (Aeronautical)
Iman Roohaniesfahani & Peter Lok (Biomedical)
Mojtaba Abtahi (Mechanical)
Nasir Ahsan (Mechatronics)

Watermark Best Poster Awards in Biomedical Engineering

Undergraduate: Dasun Abeygoonawardan
Postgraduate: Jiao Jiao Li

Performance Overview

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Research Income Awarded in 2010 for Projects Commencing in 2011*

ARC Grants	$4,476,941
Industry/ Private Funds	$60,000
Total	**$4,536,941**

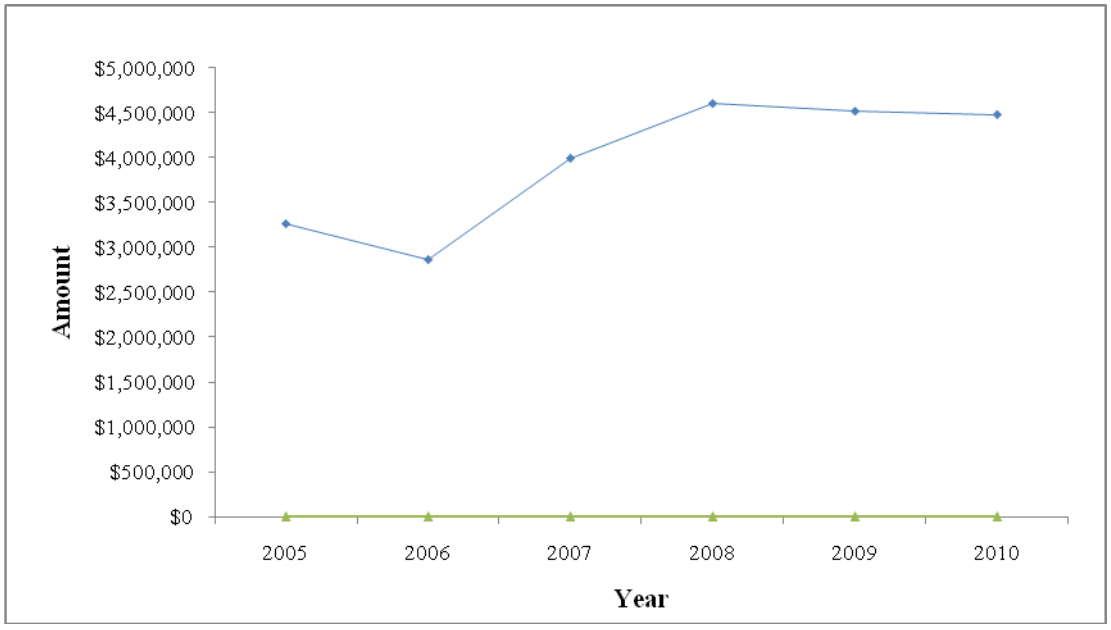

Figure 1: Total ARC and NHMRC Funding/ Year (2005 – 2010)

* Figures obtained from the Research Office, University of Sydney

Performance Overview

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Research Output

The publications reported and approved for the University's **Higher Education Research Data Collection** (HERDC) are reported below.

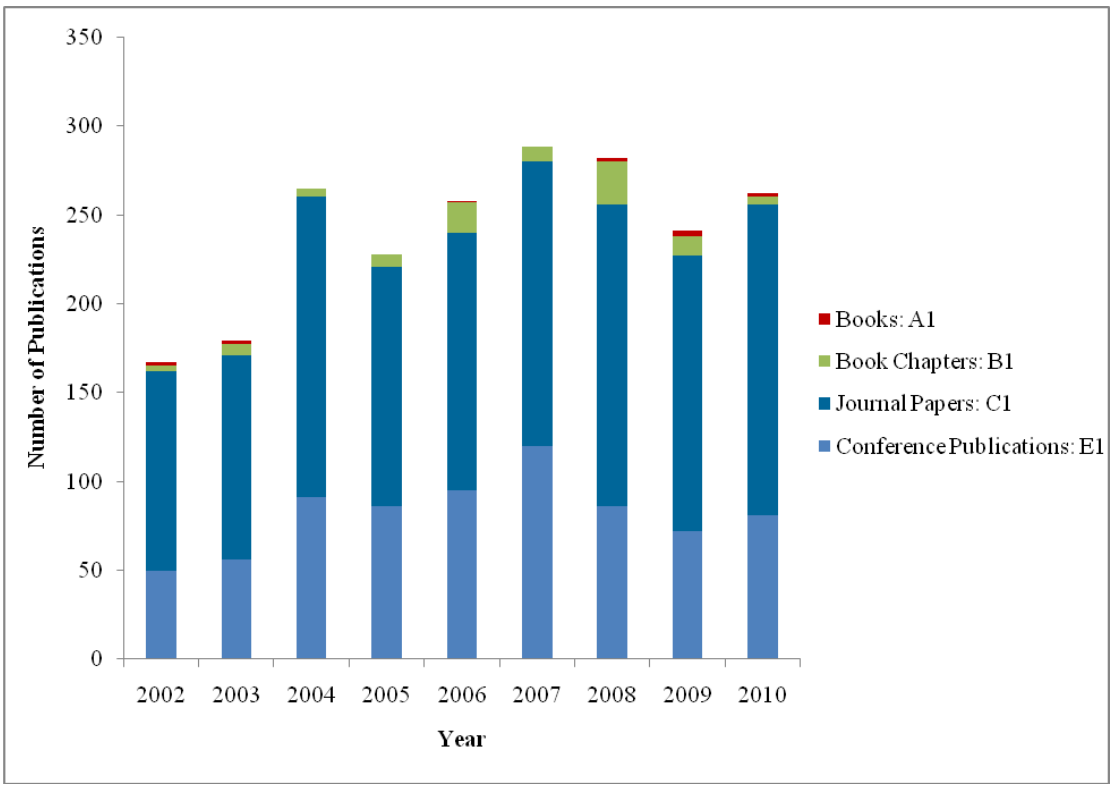

Figure 2: Research Publications 2002- 2010
A1: Authored research books published by commercial publisher (2)
B1: Authored research chapters in commercially published books (4)
C1: Refereed articles in scholarly journals (175)
E1: Full written papers that are published and peer reviewed (81)

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Postgraduate Supervision and Completions

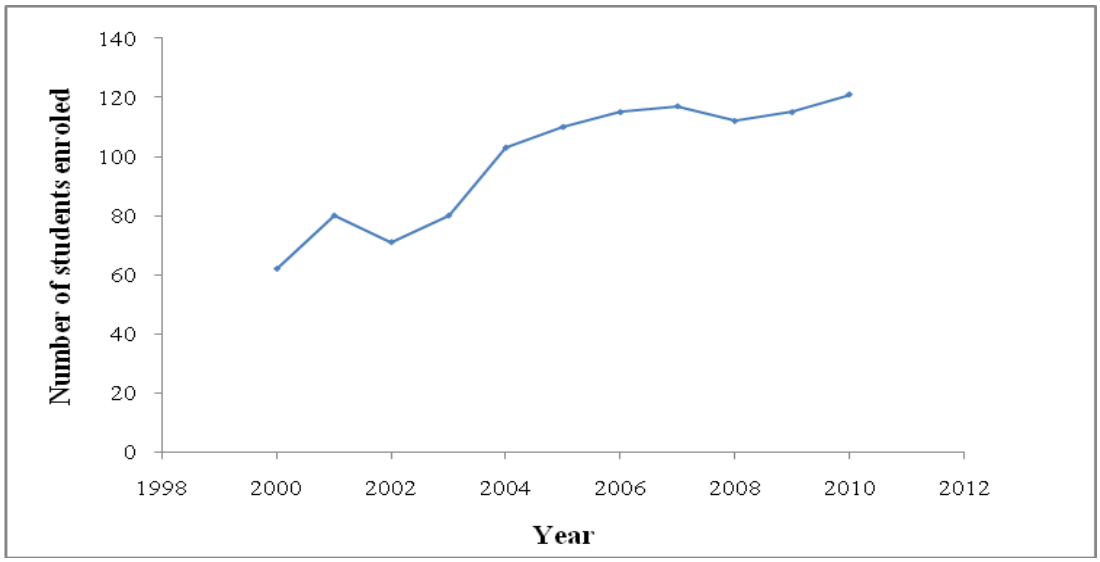

Figure 3: Total number of enroled Master of Philosophy and PhD students (2000- 2010)

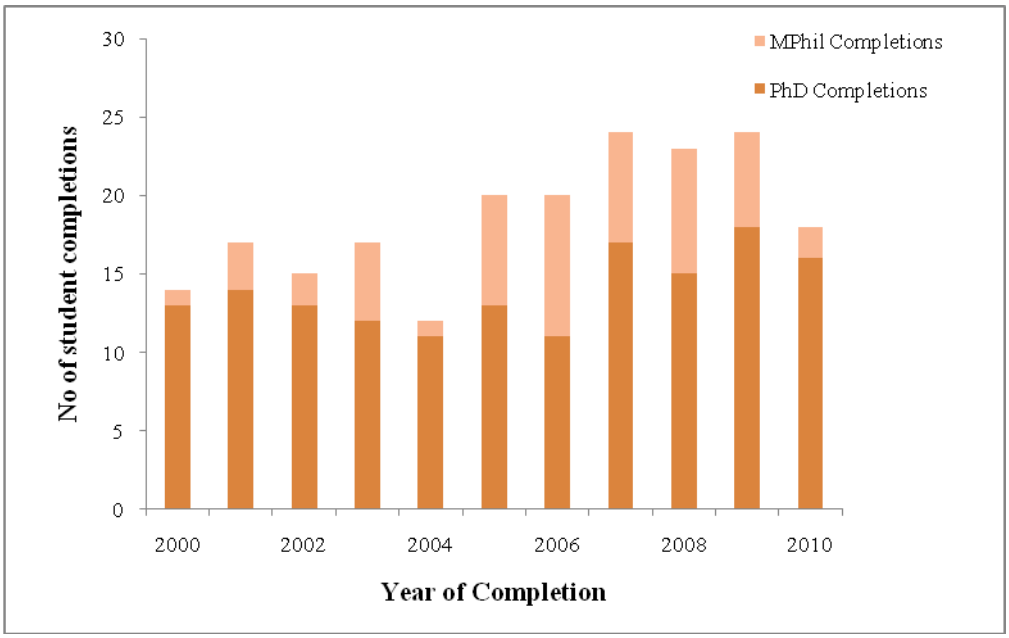

Figure 4: PhD and MPhil completions. (2000 – 2010)