Dr Sam Cubero Ph.D, B.E. (Hons) Mech *Australian Citizen* Born: 1972

ACADEMIC QUALIFICATIONS

1998 Ph.D, Doctor of Philosophy (Mechatronic Engineering), University of Southern Queensland, Australia
1993 B.E. (Hons) Mech, Bachelor of Engineering Degree (Honours) Mechanical, University of Queensland
Wynnum State High & Coorparoo State High School; Wynnum West Primary School, QLD, Australia

UNIVERSITY TEACHING EXPERIENCE (since 1998, approx. 12 years)

Curtin Uni	5 sem	308824	(E)	Mechatronic Project 234 (microcontrollers, mobile robotics) **
	9 sem	308828	(E)	Mechanical Design 321 (beam failure analysis, machine design) **
	9 sem	308809	(E)	Engineering Graphics 232 (AS1100 drawing, AutoCAD 2D/3D) **
	6 sem		(E)	Engineering Communications 321 (Excel, AutoCAD 2D/3D) **
	6 sem	308827	(E)	Mechatronic Automation 331 (Pneumatic circuits, PLCs, PID) **
	2 sem	12906	(E)	Mechatronic Systems Design 431 (robotics, PC control, sensors) *
USQ	1 sem	ENG4104		Engineering Problem Solving 4 (MATLAB simulation, control) *
	3 sem	MEC2304		Solid Modelling (ProEngineer WildFire, 3D parts & assemblies)
	3 sem	ENG4406		Robotics & Machine Vision (controller design, simulation, motor selection, forward & inverse kinematics, image filters & analysis) *
	2 sem	MEC2402	(E)	Stress Analysis (beam design, combined loading, failure analysis) *
	2 sem	ENG2102		Problem Solving 2 (PBL design/analysis of a real-world project) *
	4 sem	MEC2902		Mechanical Practice 2 (Warman contest, mobile robot design) *
	2 sem	ENG1101		Engineering Problem Solving 1 (teamwork, 1st year PBL project)

sem = 1 semester (15 weeks, or half a year)
** Dr Sam Cubero created the original lectures, lab exercises, assignments and tutorials for these new subjects
* New labs, tutorials, lectures, projects, or assignments & solutions were developed for these existing subjects
(E) means Examiner / sole lecturer / coordinator; No (E) means assistant examiner / facilitator or guest lecturer

MAIN FIELDS OF INTEREST & AREAS OF EXPERTISE (www.samcubero.com)

Mechatronics, robotics, mobile robots (remote controlled & autonomous wheeled and walking vehicles, UAVs)

Control with PCs, PLCs, microcontrollers (Atmel AVR, HC11), RS232, wireless communications (Zigbee etc.)

Electrical & Electronic circuit design (power supplies, sensor interfacing, actuator drive circuits, PCB design)

Control & Simulation Programming, Software development for PCs (Visual Basic, VB & C#.NET, C/C++)

Sensors (machine vision and object recognition, 3D scanning, industrial sensors, telemetry, GPS navigation)

Mechanical design, 2D & 3D CAD/CAM, manufacturing, materials, solid mechanics (failure analysis, FEA)

Actuator design and control (Electromagnetic, Hydraulic, Pneumatic, etc) for position, speed and force control

3D Game Programming, Real-time 3D Graphical Simulation of robotic systems (using DirectX & Direct3D)

Online learning using database-driven websites (ASP, IIS, VBS) & multimedia (audio / video editing, Camtasia)

PRINCIPAL APPOINTMENTS

July 1998-June 2007 (9 years, tenured from 2001)
Lecturer, Curtin University of Technology (Curtin Uni), Perth, WA, Australia

July 2007-Feb 2010 (2.5 years)
Lecturer, The University of Southern Queensland (USQ), Toowoomba, QLD, Australia

PROFESSIONAL EXPERIENCE & TRAINING

2007-2010: USQ University of Southern Queensland
Joined USQ as a lecturer in Mechatronic Engineering. Developed several new tutorials and online quizzes for teaching robotics, mechanical design, statics, stress analysis and microcontrollers for a range of different subjects. Performed consulting work and developed robotic hardware and control systems for automatically training horses. Supervised several successful student engineering projects in the areas of wireless data communications, new variable-compliance linear actuators, mobile robotics, 3D surface scanning using machine vision and microcontroller development. So far, supervised over 65 successful engineering "design and build" projects in the areas of machine design and mechatronic engineering. Developed the designs, equipment, tools and skills needed to build and test future research projects such as:

- Fully operational robotic farming automation systems (using machine vision and GPS technologies)
- Autonomous and remote-controlled mobile robots and UAVs (flying robots) for different types of farm work (eg. soil tilling, seed planting, dispensing compost / water / pesticides, harvesting / gathering etc.)
- Force, speed and position controlled robotic actuators and manipulators (eg. Even exotic rubbery robot arms that function like an elephant's trunk, or an octopus leg; parts manufactured using 3D printers)
- Powerful robotic exoskeleton suits for humans to wear (which will enhance human strength and endurance significantly in order to assist police, soldiers, healthcare workers, the elderly and infirm, and different kinds of manual workers or labourers who must perform physically strenuous jobs, often carrying heavy loads over long periods of time.) Such exoskeleton suits may also be used in future science-fiction action movies, similar to "Aliens", "Avatar", "District 9", and others, without using CG.

Dr Sam Cubero had also completed several 1 and 2 day "Professional Development" courses at USQ on topics such as: "Team Leadership", "Emotional Intelligence", "Conflict Resolution", "Supervising postgraduate student projects", "Preparing Teaching materials and assessments", "Moodle", "Online Quizzes", and other software used at USQ. In 2009, he completed a 30 hour "hands on" course on AutoDesk "Inventor 11" CAD (solid modelling) software at Toowoomba TAFE (ie. model & drawing creation for 3D parts and assemblies).

1998-2007: Curtin University of Technology (tenured position from 2001-2007)
Worked as a lecturer in Mechanical and Mechatronic Engineering at Curtin University of Technology, Perth. Developed the original teaching materials for 4 new core subjects for Mechanical and Mechatronic engineering degree courses (all EA accredited and approved on all inspection occasions). Supervised over 60 final year mechatronic engineering projects. About 98% of these projects resulted in the successful design and development of new control methods, devices, robots and inventions leading to the publication of over a dozen refereed conference papers, and several commercial products. Attended several practical manufacturing courses at Subiaco TAFE (AMTC: Advanced Manufacturing Technologies Centre), Perth. Gained over 200 hours of hands-on training in metalwork (lathe turning, milling, arc welding, sheet-metalwork, etc), foundry practice and mould design, plastic & elastomer materials and manufacturing, and about 180 hours of MasterCAM training (2D, 2.5D, 3D surfaces & solid modelling, Toolpaths and NC code generation) and CNC machining.

1995-1997 and 2002-2003: SPI "Straying Prevention Indicator" Commercialisation efforts
Founder and managing director of "Advanced Innovations", a private company involved in the design and development of low-cost, machine-vision-based driver fatigue warning devices which can alert sleepy drivers if their vehicle had strayed or drifted out of the current marked road lane. Several prototypes were successfully designed, built and demonstrated on the Channel 9 Today Show (story aired several times) and patents were filed. Unfortunately, out of dozens of companies that were approached, no local companies in Australia were interested in manufacturing and selling this fully operational, low-cost invention, even though it could save the lives of over 30% of all motorists who die each year due to driver fatigue, so the company was dissolved in 2003. Several car manufacturers managed to mimic and imitate this invention with their own different designs.

1993: Final-year engineering project work for University of Queensland
Designed all the mechanical hardware and developed software for a new 5-degree-of-freedom "slug inoculation gantry robot" for a semi-automated casting production line at Toowoomba Foundries Pty Ltd.

1992-1993: Industrial work experience for University of Queensland
Mechanical Engineer at Mindustrial Design & Management Services, Capalaba, Brisbane. Programmed several AutoLISP applications for automating AutoCAD drawing procedures based on geometric data from a database of catalogue dimensions for standard sections (BHP beams like ASB, PFC, EA, UA, and hollow tubes like RHS, SHS, CHS), and bolts, etc. Automatic drawing of steel sections, standard bolts, and MIM standard stairs with tread was made possible with this software, which increased CAD drawing productivity by more than 10 times.

SHORT BIOGRAPHY

Sam Cubero was born in the Philippines in 1972 and arrived in Australia with his parents when he was 2 years old, in 1974. Sam learned how to program a computer at the age of 10 (Tandy TRS-80), and developed educational and graphical adventure game software for the SEGA™ SC-3000 and Microbee personal home computers. During high school, Sam taught himself BASICA and GWBASIC programming for IBM PCs and developed several educational and adventure games during his lunch breaks. He had also won 25 gold medals, 13 silver and 8 bronze medals in classical piano playing competitions from the age of 7 to 13. At age 14, Sam won the "Junior Piano Championship" trophy at the Wynnum/Manly Junior Music Eisteddfod, Brisbane. At high school, Sam earned the highest marks and straight “A” grades in almost every subject that he studied in every year, including maths, science, computer subjects and technical drawing/graphics, resulting in a “Tertiary Entrance Score” of 975 / 990. His high school teachers recommended that he pursue a career in engineering.

In 1990, Sam Cubero enrolled to study Mechanical Engineering at the University of Queensland, Brisbane, and excelled in mechanical design, control theory and mathematics (earning mostly “Distinctions” or 6/7 grades).

During 1992-1993, Sam worked as a full-time engineer (as part of student work experience) for a local engineering company (Mindustrial Design & Management Services), preparing BOM (Bill Of Material) parts lists for metal smelting plants, and creating drawings. Sam automated many tedious and time-consuming AutoCAD drawing procedures by programming AutoLISP routines for automatic drawing of standard beam sections, bolts, staircases with standard tread, etc. which increased drawing productivity by more than ten times. What would normally take draftsmen several hours to draw manually on AutoCAD, would take only less than a minute, using his custom-written AutoLISP drawing automation software. This software automated many repetitive drawing tasks by using equations to process standard catalogue dimensions in a database, to draw complex shapes, standard sections and lines, just like a human CAD operator, but almost instantly.

Sam completed his BEng (Bachelors Degree), with Honours, in Mechanical Engineering at the end of 1993 at the University of Queensland, Brisbane, and decided to focus his interests on a career in robotics and automation technology. Sam enjoys computer programming, mechanical design and building new practical inventions.

From 1994 to 1997, Sam studied under a world famous Professor of Robotics & Machine Vision, John Billingsley, to complete a PhD in Mechatronics, where he designed and built a position, speed and force controlled pneumatic actuator using a "world first" proportional flow gas valve design (known as the FPGV, or "Floating Plate Gas Valve", which is a variable flow air valve whose airflow is regulated by a controllable electromagnetic field, and it only has one moving part, ie. a floating plate that hovers without any external supports!). Sam later went on to use this device to drive the 12 degrees of freedom for a 4-legged pneumatic walking robot, known as the "STIC insect", which is on display at the Sydney Powerhouse museum. Over a period of a few weeks, Sam Cubero also invented, designed and built the "SPI" (Straying Prevention Indicator) device which can wake up sleepy drivers when their vehicles drift out of a marked road lane, through an audible alarm. The SPI uses adaptive machine vision technology to watch for painted road lines that cross underneath the front wheels of a vehicle. This invention was patented and demonstrated several times on the Channel 9 "Today Show" in 1996, however, several car makers copied the SPI concept and built their own versions (but their imitations were much more expensive and more unreliable compared to the original dual camera SPI.) Still, today, there are no systems like the “SPI” which are as reliable as a human road line watcher, able to reliably avoid false alarms and sunlight saturation problems. Due to lack of interest in Australia, the SPI project was “shelved” and the critical features of the 40+ page software control code were never published nor patented.

From 1998 to 2007, Sam Cubero worked as a lecturer at Curtin University of Technology, Perth, Western Australia, and was able to regularly publish technical papers describing new innovations, each year. At Curtin, Sam developed new teaching materials and taught the subjects: "Mechatronic Automation" (PLC programming, pneumatics, hydraulics, control circuit design, factory design, etc.), "Mechatronic Project" (microcontroller programming & mobile robotics), "Mechatronic System Design" (robotics and motor control), "Engineering Graphics" (AutoCAD 2D & 3D, Inventor, design for manufacture, choosing tolerances and fits for manufacture, etc), & "Engineering Communications" (Excel spreadsheets, PowerPoint, report-writing, etc). Sam Cubero authored or co-authored over a dozen technical papers describing novel and operational robotic devices and inventions developed under his supervision and team leadership. Dr Cubero also hosted the 1996 "Robot Wars" competition at Curtin University, which involved several rounds of destructive combat between

16 different "fighting robots", and this entertaining contest was televised on Channel 10 news (Australia) and was featured in an article in the "Engineers Australia" news magazine.

In mid 2007, Sam moved back to Queensland (closer to his family and relatives in Brisbane) and accepted a 3-year contract to work at the University of Southern Queensland (USQ), assisting in the teaching and delivery of several engineering subjects, such as "Solid Modelling" (using ProEngineer WildFire), "Engineering Problem Solving" (1, 2 and 4, involving PBL projects), "Mechanical Practice 2" (mobile robotics), and Sam was the lecturer / examiner for "Stress Analysis" (safe beam design for combined loading, failure analysis, stress analysis, material selection, bolt & weld analysis, etc.) Sam has received many praises and thanks from very satisfied students who have described him as: "favourite lecturer", "an excellent lecturer", and someone who 'makes complex concepts and topics easy to understand.' (Please read the "Reference_letters.zip" file on the www.samcubero.com website.) Unfortunately, Dr Sam Cubero did not find much opportunity to perform research working during 2007 to 2010 due to the very high teaching and marking workload at USQ (where the student : staff ratio was typically around 100:1 or sometimes even 150:1, due to the high number of external students at USQ; this ratio is much higher than the 40:1 to 50:1 ratio that existed at Curtin University of Technology. About 60-80 hours of teaching or marking work was necessary (and expected) each week at USQ, leaving very little time and energy available for applying for grants and conducting serious research work.

Sam Cubero had supervised more than 65 successul "design & build" engineering projects relating to robotic arm development, mobile robots (including flying robots or UAVs), optical machine vision and recognition, 3D laser scanners, 3D simulation/animation software development, telemetry, wireless data communications, PC / Windows programming (eg. serial communications protocols), microcontrollers (eg. HC11 assembly programming and Atmel AVR microcontroller chip programming), and automation hardware development.

Dr Cubero had occasionally been involved in independent engineering consulting work for the manufacturing, agricultural, healthcare and entertainment industries. Several of the projects he had supervised had led to the successful commercialisation of useful products and the implementation of industrial automation equipment that is currently in use. eg. "Hard-hat impact testing machine", "Automated soil hardness testing machine", "5-axis MIG welding gantry robot", "RFID tag component assembly system", "Flying VTOL car", and several different automation systems for factories, based on custom software for PCs (8255 I/O, DAC, ADC cards) and PLCs. Dr Cubero also served as a paper reviewer for various conferences, books and journals relating to mechatronics.

Over the years, Dr Sam Cubero had aquired and developed many useful non-engineering skills in the areas of:

- Website design & creation: FrontPage & Dreamweaver, ASP / VBScript, IIS, Access, SQL databases
- Video/audio editing, conversion & production: Pinnacle Studio, U-Lead, Roxio, Audacity, Nerovision
- Moodle and WebCT LMS (Learning Management System) software: Setting up online exams and tests. eg. automated marking of different types of technical questions and calculated quizzes and automatic online recording of grades; Online collection and grading of assignments and reports, etc.
- 3D game programming and simulation: DarkBasic Pro, 3D Studio Max, 3D modelling, digital artwork
- Management & Psychology: Effective principles of time management, team leadership, conflict avoidance and resolution, "Emotional Intelligence", etc. (several Professional Development courses).

You can view some sample movies of Sam Cubero's past projects and a brief description of his interests and skills at www.samcubero.com .

HOBBIES & EXTRACURRICULAR INTERESTS

- Regular study of the Bible, attending weekly Christian meetings, striving to apply Galatians 5:22, 23.
- Reading new books, magazines & websites (eg. management, real estate, property development, investments, personal improvement, computer programming, 3D game development & modelling etc.)
- Regular physical exercise: eg. Zumba dancing, long walks with my wife, swimming, gym/weights
- Occasional Piano playing: Classical music (8 years formal training), Jazz / Blues music & improvising
- Music composition (using chords) & Singing: Created over a dozen original songs & new MIDI music
- Occasional playing of chess: ELO rating ~ approx. 1500
- Occasional outdoor fun: rough-terrain 4-wheel-driving; camping; skiing (water & snow); surfing; etc.
- Occasional watching of big-budget action and science-fiction movies (eg. Avatar, Aliens, 2012, etc.)
- Building and selling a new home, landscaping, property development (typically once every few years).
- Occasional analysis of world news, economic forecasts, future trends & big developments in politics.

CAREER HIGHLIGHTS

2008

Successful design, development and testing of original student projects that Dr Cubero supervised at USQ:

- A large-scale 4-wheeled mobile robot for training horses for rodeo competitions (project funded by local horse trainers Mike Lawlor & Mark Buttsworth). A bigger, faster "Cowbot 2" robot is now being designed.
- A fully operational 3D surface scanner relying on a hybrid machine vision / laser scanning system
- A wireless network system for mobile robot communications / remote control and telemetry applications.

2006

Sam Cubero appeared on Channel 10 News story promoting Mechatronics Engineering on a short 2 minute story about a "Robot Wars" competition which he organized and hosted at Curtin University of Technology, Perth. 16 fighting robot vehicles fought each other over several elimination rounds. (Subject: Mechatronic Project 234) This story also appeared in a 2006 "Engineers Australia" magazine article. Sam Cubero was also interviewed by several radio stations, internet news reporters and newspapers in Perth, describing robotics, mechatronics and machine vision. During 2006, Dr Cubero's students designed, built and demonstrated:

- A successful VTOL quad-rotor UAV (Vertical Take-Off & Landing, Unmanned Aerial Vehicle), the first of its kind in Australia which can automatically self-stabilize. (Other Universities failed to achieve this!)
- A hydraulic robot arm manipulator that can position its end effector accurately, following a 3D model
- A robot arm for an electric scooter that collects and retrieves heavy far-away items on high grocery shelves. This project was developed with the assistance of Linak Australia and Scooters Australia P/L.
- A robotic soil hardness testing machine that automates the standard "Drop Hammer" impact test. PC software produces "Soil penetration vs. Number of drops" graphs and stores database records of test results. This project was developed with the assistance of EVH Drilling P/L (Perth).

2005

Dr Cubero was invited to present a 3 hour video seminar at De La Salle University, Manila, Philippines, at the IEEE "Mechatronics & Machine Vision In Practice" International Conference, describing dozens of robotics projects that he had supervised at Curtin University of Technology. He was also invited to present the same seminar at the University of Batangas before an audience of over 1000 academic staff and students in attendance, and he was awarded a "Plaque of Appreciation" by the Chair of Regents of that University, Governor Vicente E. Mayo (and was given several free guided tours around that area!) Dr Cubero also supervised student projects which resulted in the successful design, development and testing of:

- A fully operational, high precision 3D surface scanner and PC software for plotting scanned solid surfaces using 3D graphics. This project was developed with the support of sensor manufacturer & supplier SICK.
- A secure "Online Assessment System" (OAS), similar to WebCT and Moodle, which allows teachers/instructors to edit and develop their own teaching materials and graphical quiz questions for deployment and automatic marking over the internet. Student marks are recorded in a class database and result reports are created. The OAS can be developed further to cater for almost any kind of teaching material or different types of user input, and it was demonstrated to run successfully on a public web server at Curtin University of Technology. The OAS was created using VB, ASP/IIS and SQL Server databases.
- A fully operational hydraulic power-pack circuit to drive the legs of a 6-legged walking vehicle (Hydrobug). This project was developed with the assistance of local engineering and hydraulics suppliers.
- A fully-autonomous, self-steering, self-driving vision-guided mobile robot (wheeled vehicle) with an ANN (Artificial Neural Network) learning program that can learn how to drive and remain only in the "left lane" (based on observing human driving habits). It can also perform automatic vehicle overtaking manoeuvres.

2003

- Hosted IEEE "Mechatronics & Machine Vision In Practice" International Engineering Conference, Perth
- Design, construction and demonstration of a flying "UFO-like" UAV with no moving parts
- Successful development of low-cost (under $100 each), self-driving, fully autonomous, machine vision guided mobile robot racing cars, suitable for use in robotics competitions between different Universities.

On several occasions, Dr Cubero had participated in promoting interest in engineering by presenting "hands on" demonstrations and seminars during various High School visits and Science Exhibitions. He participated in a number of different mentoring programs over the years, assisting, supervising and encouraging young students as they gained practical experience and skills in designing and building motor controllers and mobile robots.

PUBLICATIONS IN PREPARATION (PEER REVIEWED)

Cubero, S 2010 (16-page paper completed & accepted for publication). "*Chapter 7: A robotic arm for electric scooters*" for the book "Intelligent Technologies for bridging the grey digital divide", Editors: Soar, Swindell, Tsang. Book scheduled to be published early 2010 by IGI Publishing.

Cubero, S 2010 (full paper accepted for publication). "*ESRA – Electric Scooter Robot Arm*" , for M^2VIP 2010 IEEE conference proceedings on CD-ROM. Editors: Robin Bradbeer & John Billingsley.

Cubero, S 2010 (full paper accepted for publication). "*Designing competitions to enhance mechatronic engineering education*" , for M^2VIP 2010 IEEE conference proceedings on CD-ROM. Editors: Robin Bradbeer & John Billingsley.

Cubero, S 2010 (?) (full book chapter completed, peer review pending). "*Electric Scooter Robot Arm*" , for book "Mechatronics and Machine Vision in Practice". Editor: John Billingsley. Soon to be published by Springer-Verlag.

Cubero, S 2010 (?) (full book chapter completed, peer review pending). "*Using competitions to enhance mechatronic engineering education*" , for book "Mechatronics and Machine Vision in Practice". Editor: John Billingsley. Soon to be published by Springer-Verlag.

Goh, S, **Cubero, S**, Zhou, H, (almost complete, waiting on co-authors' results). 2010 (?). "*A comparative study of the On-campus vs Off-campus student cohorts in a first year introductory engineering and spatial science course*". Expected to be submitted soon to the *"Computer Applications for Engineering Education"* Journal.

PUBLICATIONS (PEER REVIEWED)

Worden, J, Goh, S, Brodie, L, Zhou, H and **Cubero, S** 2009. "*A case study on the revitalisation of a 2nd level year engineering and spatial science PBL course*", Proc. AaeE 2009 conference, Adelaide.

Cubero, S 2008. "*Blind Search Inverse Kinematics for controlling all types of Serial-link robot arms*". Mechatronics and Machine Vision in Practice – Editors: Billingsley, J and Bradbeer, R. ISBN: 978-3-540-74026-1. pp 229-246.

Portlock, J and **Cubero, S** 2008. "*Dynamics and Control of a VTOL Quad-Thrust Aerial Robot* ". Mechatronics and Machine Vision in Practice – Editors: Billingsley, J and Bradbeer, R. ISBN: 978-3-540-74026-1. pp 27-40.

Cubero, S 2007 (Editor). "*Industrial Robotics: Theory, Modelling & Control*". pIV leterature, Verlag Robert Mayer-Scholz. Advanced Robotics Systems (ARS) International ISBN: 3-86611-285-8 (952 pages)

Sanathkumara, K and **Cubero, S** 2007. "*Automated Soil Hardness Testing Machine*". Proceedings of M2VIP 2006 14th International IEEE Conference on Mechatronics & Machine Vision in Practice, Xiamen, China. ISSN: 1908-1162.

Portlock, J and **Cubero, S** 2006. "*QTAR: Quad Thrust Aerial Robot*". Proceedings of M2VIP 2006 13th International IEEE Conference on Mechatronics & Machine Vision in Practice, Toowoomba QLD, Australia. ISSN: 1908-1162.

Frost, B and **Cubero, S** 2005. *"Development of a 3D laser scanner for guiding a six-legged walking robot "*. Proceedings of M2VIP 2005 12th International IEEE Conference on Mechatronics & Machine Vision in Practice, De La Salle University, Manila, Philippines. ISSN: 1908-1162. pp 26-36

Tjoe, D and **Cubero, S** 2005. *"A low-cost vision guided car for autonomous racing car competitions "*. Proceedings of M2VIP 2005 12th International IEEE Conference on Mechatronics & Machine Vision in Practice, De La Salle University, Manila, Philippines. ISSN: 1908-1162. pp 1-14.

Cubero, S 2005. *"Teaching Mechatronic Engineers how to build intelligent machines*", 3 hour presentation, Proceedings of M2VIP 2005 12th International IEEE Conference on Mechatronics & Machine Vision in Practice, De La Salle University, Manila, Philippines (published on CD-ROM)

Cubero, S 2004. *"A general purpose inverse kinematics algorithm for all manipulators*". Proceedings of M2VIP 2004 11th Int'l IEEE Conference on Mechatronics & Machine Vision in Practice, Macau, China.

Cubero, S, Layanto, J and Goode, M. 2003. *"Autonomous Racing Car Competition for Mechatronic Engineering Education*". Mechatronics and Machine Vision 2003: Future Trends. Research Studies Press. ISBN: 0-86380-290-7. pp 9-16. Also published on the M2VIP 2003 10th IEEE International Conference on Mechatronics and Machine Vision In Practice Conference Proceedings CD-ROM ISBN 962-442-246-X.

Cubero, S, 2000. *"A 6-legged Hybrid Walking and Wheeled Vehicle"*. Proc 7th International Conference on Mechatronics and Machnie Vision in Practice (M2VIP), Hervey Bay, QLD, Australia, September 19 – 21, 2000, pp. 293-302 "Mechatronics and Machine Vision", Research Studies Press, ISBN: 0 86380 261 3.

Cubero, S, 1999. *"Design of a six-legged passenger carrying hybrid walking vehicle with four-wheel-drive capability"*. Proc 2nd International Conference on CLimbing And Walking Robots (CLAWAR), pp. 361-372, September 1999, Portsmouth, UK, "CLAWAR: CLimbing And WAlking Robots", ISBN 186058 207 9.

Cubero, S, 1998. *"Force, compliance and position control for a pneumatic quadruped robot"*. PhD dissertation, Submitted Nov. 1997 - University of Southern Queensland, Toowoomba. Australia. 2 Volumes (approximately 1,500 pages). Doctoral PhD was awarded in September 1998 by the Vice-Chancellor of USQ.

Cubero, S, Billingsley, J, 1997. *"Force, compliance and position control for a space frame manipulator"* . Proc 4th International Conference on Mechatronics and Machine Vision in Practice (M2VIP), 22-24th Sep., pp. 124-130

Cubero, S, Billingsley, J, 1996. *"Automatic control of a surface adapting, four legged wall climbing robot*", Mechatronics 96 With Mechatronics & Machine Vision in Practice 96, University of Minho, Geuimaraes Portugal, September 1996, pp 1.135-1.142.

Cubero, S, Billingsley J, 1995. *"A novel proportional gas valve for mechatronics applications"*. Proc 2nd International Conference on Mechatronics and Machine Vision in Practice (M2VIP), Kowloon, Hong Kong, ISBN 962-442-076-9 (Patent filed in 1995 by National Centre for Engineering in Agriculture or NCEA, QLD)

Billingsley, J, **Cubero**, S. 1995. *"High speed manipulators for agricultural applications*", Proc. 1995 National Conference of the Australian Robot Association, Melbourne, July 1995, pp 54-58.

Cubero, S, Billingsley, J. 1995. *"Automatic surface transition adaptation for a quadrupedal space frame robot*", Proc. Second International Conference on Mechatronics and Machine Vision in Practice, Hong Kong, September 12-14, 1995, pp 113-118.

STUDENT TESTIMONIALS & TEACHING EVALUATIONS

The following comments are just a few samples of "word-for-word" extracts from actual student surveys and feedback reports collected over the years. For the purpose of protecting student privacy, the names of actual students who made the following written statements have been omitted. The original source documents or student survey reports containing each of the following comments can be presented to you in person if required.

Curtin University of Technology "Mechatronic Project 234" (microcontrollers, mobile robotics)

"Sam is an excellent lecturer with a lot of experience. I found the labs to be well equipped and managed. The challenge at the end of the semester "robot wars" was a great motivator and inspired me to put a lot of effort into my final project. I also found the lecture notes to be complete and a great resource."

"The labs help you to perfectly understand the lectures!! Brilliantly structured!!"

"Very good hands on work on implementing circuits and programs so that students would understand most of what is being done."

"Many practical sessions allow students to apply knowledge learned in lectures to real life problems."

"This unit [Mechatronic Project 234] is already very well organized and well taught."

"It's perfect!!" …

(Face to face comments from students: "All the students look forward to doing your subject the most… It's just so much fun! … This is the only subject this year where we get to design and build something, while the others are mostly just theory." … "Your labs are excellent."… "This is the best subject ever, period!"…)

Curtin University of Technology "Engineering Graphics 232" (AS1100 drawing, AutoCAD 2D & 3D)

"The labs were great! The assignment was also well designed."

"Demonstrations in lectures provided ample information to complete the set tasks. Labs were very helpful."

"The labs and examples in the lectures were very helpful."

"This unit grooms us for real life drafting and it has done so very much with the unit project that tests every aspect of the unit."

Curtin University of Technology "Mechanical Design 321" (beam failure analysis, machine design)

"Lecturer was excellent and knew his material."

"Tutorials were very helpful." … "Sam is very motivated."

"The assignments helped me apply learning outcomes to real engineering design problems and solve them with confidence."

"Designing your own product made things interesting. Worked examples and information on WebCT were helpful."

USQ ENG2102 Engineering Problem Solving 2: "Wind Power Turbine Analysis / Wind Farm Design Project" (2008) and "Ski Lift Design & Analysis / Ski Field Design Project" (2009)

(NOTE: EXT or "external" students are "Distance Education" students who were provided technical assistance and guidance through online forums and discussion boards that are monitored and answered almost every day.)

"Sam is a top guy, and one of the good lecturers I've come across, especially being external… He is pro-active in supporting us externals and earns his money."

"I would also like to thank Sam Cubero… he helped a lot in the machine design area and was very pro-active to myself and all students."

"I would like to take the opportunity to thank you [Sam] very much for all your mentoring and guidance and support. You were always there for me when I had an issue and I thank you for that. You provided me with information that made me rethink my approach to various problems which has allowed me to develop my problem solving skills even further. I do not think I would have achieved what I have if not for your assistance, detailed explanations and prompt responses... Once again Sam, thank you very much and I do hope our paths cross again sometime during the course of my degree."

"Thanks also for the effort you have put into this course, without your tutorials I would be still scratching my head. The extra effort you put in doesn't go unnoticed."

"Thanks again for all your hard and great work in helping students understand the mech eng concepts better."

"Thanks very much Sam, out of all the staff I came across during the course you provided the most feedback and helpful information. Cheers."

"I agree, thanks Sam for the prompt responses and in-depth feedback. The tutorial videos were greatly appreciated also. You have definitely put in much effort for the benefit of us students. Thanks again."

"I still appreciate every comment Sam has posted. Not only answering every question but going into further detail for our own benefit… Having many hours of very helpful, easy to understand and down to earth concepts has been the only thing getting me through this course. I also am studying engineering statics and Sam has been able to help me understand things taught in there much more clearer. So I would just like to say a very big thanks to Sam for all the effort he has put in this semester to help all of us out. You deserve a fair bit of credit Sam. Thanks again!"

"Sam has put a great deal of effort in to try and teach us not only Mechanical specific topics, but also some 'lifelong learning skills', our attitude to learning…" … " I will remember some of the things you said…"

"Sam, you have put in a huge effort and personally taken the time to try and answer everyone who has asked a question of you. The amount of time you have dedicated has been massive … To keep on top of that as well as do up all those tutorial videos (by the way, I found that to be a big help… even though I struggled) … is truly appreciated… Thanks again Sam."

USQ MEC2402 Stress Analysis (Semester 1, 2009) SELTS and SETS student survey comments:

"He [Sam] is an asset to the Uni, and like myself, I am sure that future students will benefit from his tutoring."

Q: What improvement would you suggest to the course itself ?
A: "None. Just make sure you keep the lecturer, he is great."

"He [Sam] is a very good lecturer, and his way of teaching is very effective. He is very helpful and cooperative." …

"The best lecturer I have had in 6 years external study with USQ."

"I would like to personally thank Sam Cubero. He is a shining example of what a University lecturer should be, a teacher first and an academic second."

Q: What did you find were the most helpful / effective aspects of this course?
A: "Sam's professional approach to the course, he was there for anyone who needed help, provided ample and excellent information and had our assignments returned promptly to assist with next assignments or exam prep. Best course I have been involved in at USQ. Well done Sam."… "Everything is good."…

"Lecturer [Sam] was prompt with replies to all calls for assistance for myself and other students. Personally I wish I had this type of support throughout my study to date. Also it is the kind of prompt assistance that I expected some years ago."

"the lecturer was very helpful"

"So much of this course was so much better than previous courses."… "This is the first course that I think I have learnt the content but it has been the hardest. Well done to the lecturer."

"Sam Cubero went above and beyond the call of duty with respect to assistance. With all due respect to past and previous lecturers, I have never come across a lecturer so committed to the success and welfare of students. He would answer queries at any time of the day (and night!) and would include additional examples and web links to assist with the problem."…

Q: What did you find were the most helpful / effective aspects of this course?
A: "Study material, lecturers and tutorials were very good. Very good lecturer response for this course."
A: "Sam's explanations on StudyDesk – by far the best examiner that I have come across."

"Very good study material and text. Excellent support from Sam. Prompt, helpful and detailed responses to queries. Sam's philosiphysing and motivational quotes were also quite amusing and appreciated!"

"Great course with awesome support from Sam."

"I would like to comment on Samuel Cubero. This lecturer is one of the most dedicated, thorough, helpful and knowledgeable individuals I have ever come across. As an external student, these qualities have assisted me in being less stressed and having a better understanding of the material."

"On a scale of 1 to 10, I would give [MEC2402 Stress Analysis] an overall rating of 9/10."

"He's very knowledgeable and knows interesting applications of the subject to make the content interesting."

"Awesome worked examples!"

Some students noted lecturer strengths like: "Interest in the course", "Relevance to real world situations", and "Having in-depth knowledge in the course and makes the subject interesting while teaching."

"I thought the exam was good and I thank Sam for preparing us well for the exam."

"This lecturer [Sam] has responded better than any other USQ lecturers I have had. His dedication and mentoring to external students is fantastic. If only the other USQ lecturers have the same enthusiasm. I thought the exam was great!"

"I like how you give all the information to students. That's very good help for an external student…"

"… Thanks Sam for no nasty surprises and a good course."

"I can honestly say Sam, that you are the best lecturer I've come across so far at my studies with USQ. You provide outstanding and timely support/feedback with any question posted on these forums and you even reply after hours and on weekends! No other lecturer I've come across yet does that, in other subjects sometimes you are even lucky to get support or a reply!"

"Yes Sam, you've done a great job. Favourite lecturer!"

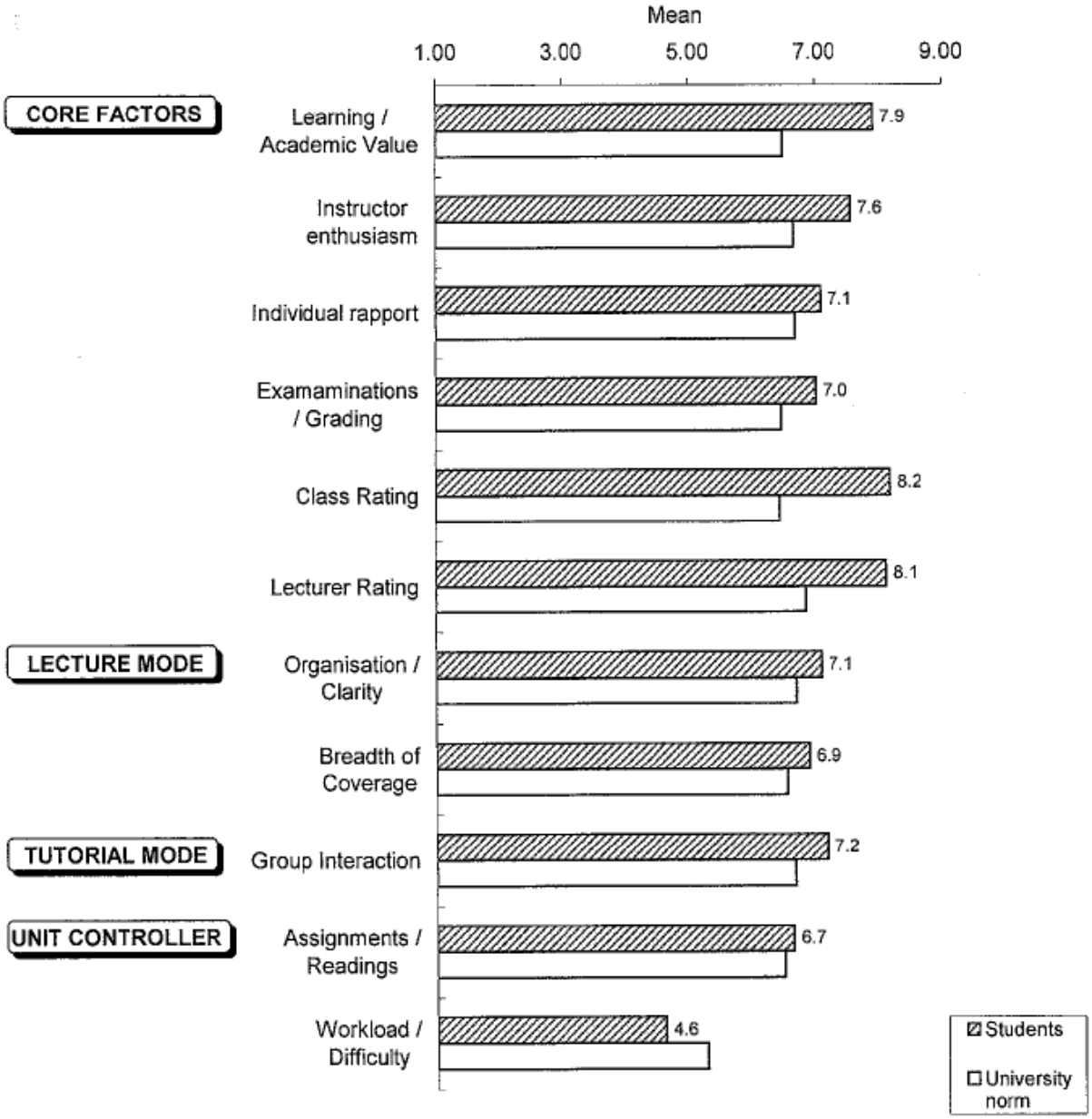
The following sample summary reports compare student survey evaluation results on teaching performance to University norms (averages).

Student Evaluation of Educational Quality (SEEQ)

SEEQ New Form

Teaching Evaluation - Summary Report, Curtin University

Subject: **Mechatronic Project 234** — Administered on: **30-May-06**
Teacher: **Sam Cubero** — No. students responding: **18**
School: **Mechanical Engineering** — Percentage response: **100%**



Printed: 08-Jun-06

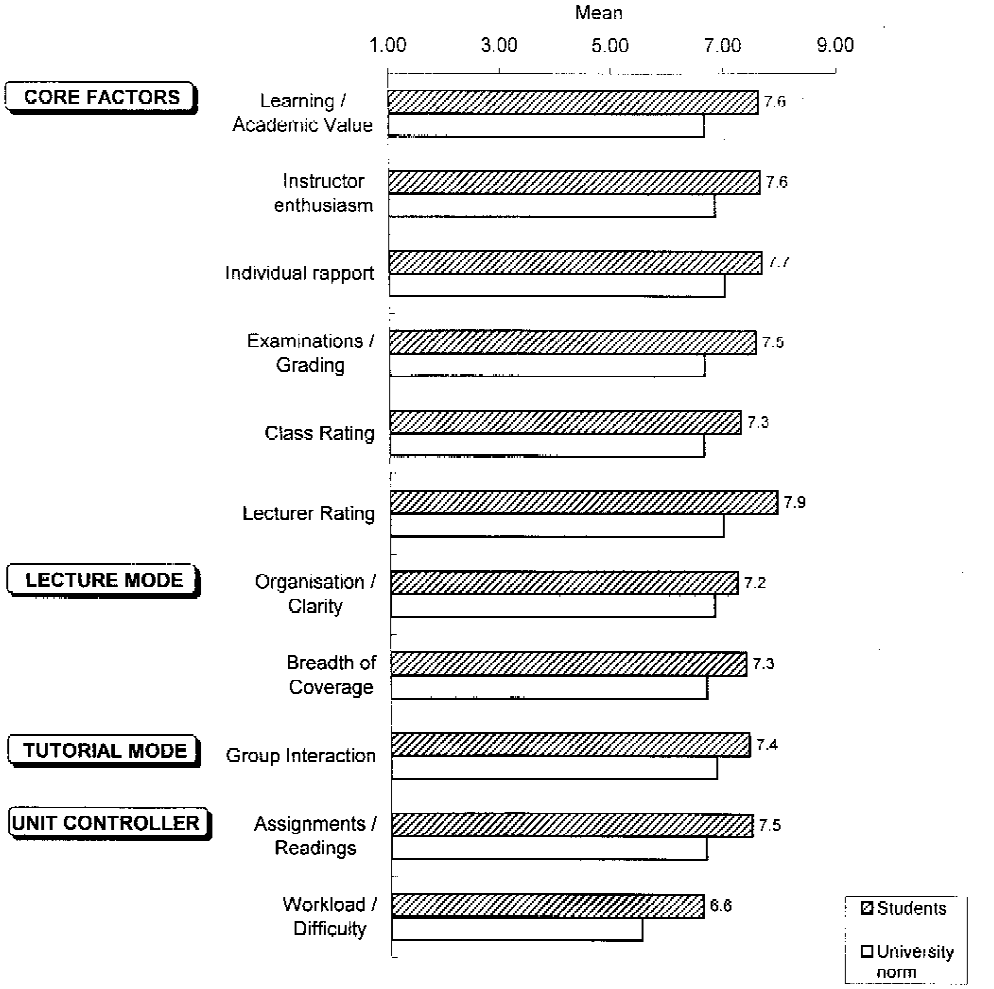
Reg# 96

NOTE: "Mechatronic Project 234" taught students how to build and control their own mobile robot and weapon system (using an AVR microcontroller) to compete in a final Robot Wars competition (televised on Channel 10 News, Australia, June, 2006.)

Student Evaluation of Educational Quality (SEEQ)
Curtin University of Technology

Summary Report

Subject: **Mechatronic System Design 332** Administered on: **6-Jun-03**
Teacher: **Sam Cubero** No. students responding: **11**
School: **Mechanical Engineering** Percentage response: **100%**



Printed: 19-Jun-03 Reg# 717

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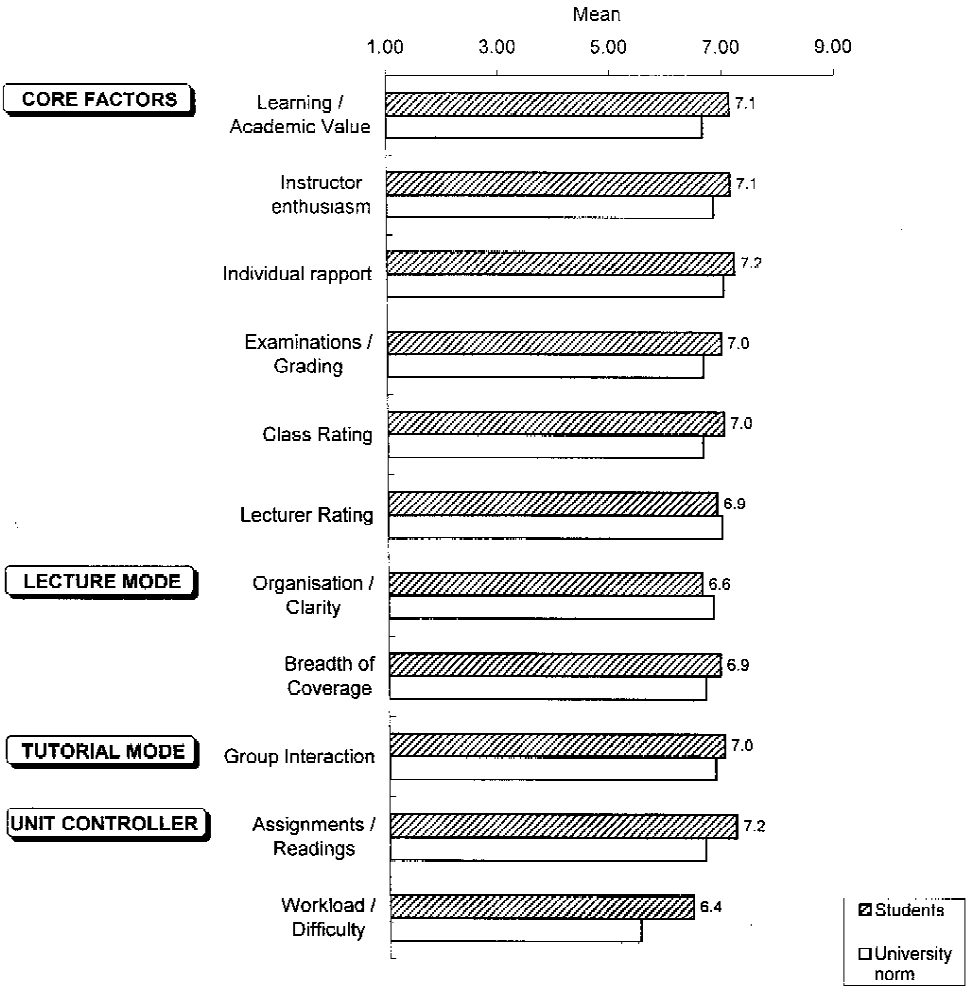
Student Evaluation of Educational Quality (SEEQ)
Curtin University of Technology

Summary Report

Subject: **Mechanical Design 335** | Administered on: **6-Jun-03**
Teacher: **Sam Cubero** | No. students responding: **15**
School: **Mechanical Engineering** | Percentage response: **100%**



Printed: 19-Jun-03

Reg# 716

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WEBSITE & ADDITIONAL INFORMATION

At www.samcubero.com you can find:

- "Teaching_Mechatronic_Engineers_2006.pdf": slideshow summarising successful teaching methods.
- "Reference_Letters.zip": testimonials and commendations from some students and colleagues (PDF files).
- "Subject_specifications.zip": subjects Dr Sam Cubero taught as examiner or assistant examiner/facilitator.
- Many fascinating YouTube demonstration movies of projects supervised or designed by Dr Sam Cubero.
- Personal views on mechatronic engineering education & research work and future opportunities.
- Brief summaries of past, present and future research projects and novel inventions (order the free DVD).

All of the topics and subjects mentioned on this website can be taught immediately as University-level undergraduate or post-graduate subjects. Lecture notes, lab materials, tutorials, assignment / exam questions and solutions have already been prepared or can be quickly created for immediate teaching, covering all of the topics mentioned. Such material can be used to teach an EA (Engineers Australia) accredited degree course in "Mechatronic Engineering", "Automation Engineering", "Manufacturing Engineering" and/or "Robotic Engineering" to world-class or world-leading standards, and has been proven in the past to make positive impacts on research activity. eg. providing advanced skills for students to conduct PhD or Masters research.

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WEBSITE

www.samcubero.com

MOST HIGHLY VALUED PERSONAL QUALITIES & ATTRIBUTES

To me, happiness and job satisfaction is about being free to exercise the following qualities in my work and daily living… ie. being: Creative, clever, ingenious, imaginative, original, fun, joyful, exciting, passionate, motivational, inspirational, realistic, pragmatic, practical, interesting, resourceful, organized, goal-oriented, meticulous, economical, open-minded, knowledgeable, aware of the "big picture", methodical, sedulous, studious, thoughtful, adept, peaceable, honest, truthful, transparent, communicative, clear, succinct, pertinent, helpful, friendly, affable, amiable, benevolent, kind, self-sacrificing, generous, respectful, reasonable, just, fair, flexible, accommodating, cooperative, caring, progressive, punctual, energetic, productive, industrious, reliable, persistent, indefatigable, respectable, presentable, positive, optimistic, humble, and always thankful… I want to be convinced that my work and contributions are making a positive difference, and that progress is being made.

PERSONAL THOUGHTS ABOUT THE FUTURE OF ROBOTICS & MECHATRONICS

Above all, I am thankful to my creator, the one true God, for all the talents and gifts he had allowed me to develop, which can benefit many people in my lifetime and more generations of people in the future… All credit, glory and honour for my work rightly goes to the Most High, the greatest inventor, designer and engineer who created all life, the human brain, this beautiful home we call Earth, and the wonderful Universe around us. The more that I learn about science and the laws and wonders of the Universe, the more I am humbled about how little I truly know. In Genesis 1:26, God said: "Let us make man in our own image, according to our likeness…" … Genesis 1:27 says: "And God proceeded to create man in his image, in God's image he created him…" Human beings were created in God's image, and one of God's foremost qualities is creativity or ingenuity. Being an engineer and researcher allows me to learn and create new ideas and inventions. I often come to realize that God had invented almost everything before, perhaps in a similar way or a slightly different but superior form. The level of precision, complexity and elegance of God's designs, found in Nature, is unmatchable and seemingly impossible to fathom or copy perfectly, using current man-made technology.

Mankind has benefitted from major scientific advances by harnessing the power of chemical reactions (as used by combustion engines, coal-fired power plants and solar panel generators), the heavy lifting and pushing ability of hydraulics and materials (eg. hydraulic pistons, motors and pumps, made of fabricated strong materials like steel), the speed and switching ability of silicon and semiconductor materials (as demonstrated by microprocessors used in computers), the programmability and control of software languages (like procedural or OOP code which relies on step-by-step logical flow-control instructions) and a variety of different sensors (eg. optosensor photodiodes used in CCD vision sensors, position sensors, force or pressure sensors, flow sensors, etc. which can be used for many different kinds of monitoring applications.) When such man-made devices are strapped together in the form of a humanoid biped walking robot, or a 6-legged walking robot, the movements of similar living creatures can be mimicked fairly crudely, but never perfectly nor better than the equivalent living creature being immitated. For example, there is no walking bipedal or humanoid-type robot that can move as proficiently or with the same level of skill and agility as a professional human dancer, pro-basketball player or Olympic ice-skater. There are no 6-legged walking robots that can move as effortlessly and as quickly over rough terrain as a common ant, and building 6-legged walking robots as small as a common ant, which can carry a payload several times its own weight, has not yet been achieved, however, this may require several major breakthroughs in the fields of nanotechnology and manufacturing. Also, there are no robotic birds (like a sparrow, pigeon or a hummingbird) which can fly, hover, reliably land on high tree branches, and walk around on the ground, foraging for food. There are currently no robotic manipulators as strong, as flexible, as lightweight and as compact as an octopus' leg, or an elephant's trunk (per unit mass). Why is it that biological muscles are far more energy efficient, lightweight, compact and self-contained than man-made actuators, such as geared electromagnetic motors, pneumatic muscles or hydraulic actuators? By attempting to replicate the very energy efficient, powerful and "optimized" designs found in nature, scientists and engineers can learn a great deal about how to design and build better actuators, practical walking mobile robots, very useful UAVs and a wide range of useful devices and robotic machines that will be considered useful outside of a University laboratory environment. Such devices and machines could perhaps perform certain kinds of tedious manual labour or domestic household chores, like removing weeds from the garden, trimming long grass, mowing the lawn, adding or removing laundry to and from a washing machine, hanging up the laundry on a clothesline, retrieving clothes from the clothesline and ironing them, stacking the dishwasher, vacuuming the floor and rugs, cleaning the kitty litter and replacing old litter with fresh new litter, tilling soil, planting seeds, harvesting crops, performing quality inspections, dispensing fertilizer and pesticides, delivering water (controlled irrigation) in a water-saving manner, mustering cows or sheep (using cooperative mobile robots), and dozens of other jobs.

Once the technology for developing lightweight, self-contained, compact, energy-efficient, position and force controlled actuators is available, and a method of manufacturing them and programming them at very low cost has been devised, it will be possible to launch a real worldwide "robotics revolution" whereby low-cost multi-purpose robots will be affordable and easy-to-use in almost every home, just like the common desktop PC or laptop computer. All the right ingredients for this "robotics revolution" to be realized are almost ready to be combined and exploited, because most of them are now available. With the advent of 3D printing and computer controlled sintering, manufacturing costs for producing components and actuators can be significantly reduced, due to the lower requirement of human labour in the production process. Hence, I believe we are truly on the verge of an industrial "renaissance". Soon, many companies will be manufacturing highly useful robotic devices and machines which may become indispensable tools in our workplaces, our homes and on most farms. It is better to use tireless robots to work for us, performing most kinds of tiring, repetitive or dangerous jobs. I believe that my knowledge and future work will contribute significantly towards the realization of these goals. I am passionate about developing good ideas and useful inventions that will help make the world a better place.