

# SHAYNE GOOCH

## EDUCATION

### Professional

- PhD in Mechanical Engineering      University of Canterbury      2001
- BE (Mechanical)      University of Canterbury      1995

### Technical

- New Zealand Certificate in Engineering (Mechanical)      1992
- Advanced Trade Certificate in Fitting, Turning and Machining      1991
- Certificate of Completion for 9000hr apprenticeship in Fitting, Turning and Machining, New Zealand Qualifications Authority.      1989
- Trade Certificate in Fitting, Turning and Machining      1987

## PROFESSIONAL SOCIETIES

American Society of Mechanical Engineers (ASME), Member since 2002, ASME appointments include:

- **Chair of Information Management Committee**, 2002 – present;
- Member of the International Activities Committee of the Design Engineering Division of the ASME, 2003 – present;
- Member of the Design Education Committee of the Design Engineering Division of the ASME, 2005 – present.

Design Society (International), Member since 2005

## BOOKS

1. **Hales C., and Gooch S.D.** (2004) “Managing Engineering Design (Second Edition)”, Springer-Verlag (London), UK, ISBN: 1-85233-803-2.
2. **Gooch, S. D.** (2001) “Design and Mathematical Modelling of the Kinetic Sculpture Blade”, Ph.D. Dissertation, Department of Mechanical Engineering, University of Canterbury.
3. **Medland, A.J., Hicks, B.J. and Gooch S.D.,** (2008), “Using Constraints in the Understanding of the Interactions between Products and Humans” Chapter 2 in Designing Inclusive Futures, ed Langdon, P.M., Clarkson, P.J. and Robinson, P., pp 15-22, Springer Verlag, ISBN 987-1-84800-240-4

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## EMPLOYMENT

1. Employer: **University of Canterbury**, Christchurch, NZ.  
Business: Research and Education.  
Position: Senior Lecturer.  
Duration: January 2000 – present.  
Experience:
  - Research, teaching and professional consulting involving the engineering design process, engineering design evaluation, biomedical engineering and advanced engineering mechanics;
  - Director of Studies for: final year undergraduates (January 2003 – December 2006); and intermediate year undergraduates (January 2008 –present);
  - Sole responsibility for teaching final year mechanical engineering design (Jan 2000 – present).
  - Practical work coordinator (January 2008 –present);
  
2. Employer: **Hales & Gooch Ltd.**, IL, USA and Christchurch, NZ.  
Business: Large Loss and Design Process Investigations.  
Position: Director.  
Duration: November 2004 – present.  
Experience:
  - Consulting in design process issues, forensic investigations, and failure analysis involving engineering systems;
  - Investigation of mechanical equipment failures, including expert reports and testimony;
  - Analysis of engineering design problems and underlying design process issues;
  - Analysis of workplace accidents involving man machine interactions;
  - Engineering design research and education.
  
3. Employer: **University of Canterbury**, Christchurch, NZ.  
Business: Research and Education.  
Position: Teaching assistant.  
Duration: February 1999 – December 1999.  
Experience:
  - Developed new lectures in Risk and Reliability Engineering for a final year undergraduate design class;
  - Assisted with marking design assignments.
  
4. Employer: **Technix Group Limited**, New Plymouth, NZ.  
Business: Engineering Research.  
Position: Research Engineer.  
Duration: January 1998 - February 1999.  
Experience: Responsible for a research project involving engineering mechanics/design.

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5. Employer: **Christchurch Polytechnic Institute of Technology**, Christchurch, NZ.  
Business: Education.  
Position: Lecturer (Part Time).  
Duration: January 1997 – December 1997.  
Experience:
  - Taught Mechanical Engineering Drawing for NZCE;
  - Taught Mechanics of Machines for Advanced Trade Certificate.
  
6. Employer: **Lemar Environmental Ltd**, Christchurch, NZ.  
Business: Water Treatment.  
Position: Design Engineer.  
Duration: 1995 - 1996.  
Experience: Design and installation of a water treatment plant including water pumps, centrifuges, heat exchangers, combustor and evaporators.
  
7. Employer: **Self Employed**, Christchurch, NZ.  
Business: Engineering  
Position: Design Engineer.  
Duration: University holidays 1994 and 1995.  
Experience: Installation of a water treatment plant for Lemar Environmental.
  
8. Employer: **Business owner**, Christchurch, NZ.  
Business: Waste removal.  
Position: Owner/operator.  
Duration: 1990 - 1993.  
Experience: I created this business to fund my University studies, activities involved:
  - Business start up including business plan
  - Development of accounting system and marketing strategy
  - Sale of business to a competitor company (still operating).
  
9. Employer: **New Zealand Electricity Department**, Christchurch, NZ.  
Business: Power generation and distribution  
Position: Fitter and Turner  
Duration: 1985 - 1992  
Experience:
  - Completed apprenticeship as a Fitter, Turner and Machinist
  - Construction and maintenance of: hydro generators; high voltage switchyards and transmission lines
  - Safety and operational training including Switchyard Operators Certificate (1988)

## JOURNAL PAPERS

1. **Gooch, S.D. and Raine, J.K.** (2003) “The Engineering Design of a Vibrating Kinetic Sculpture”, Spectrum, Issue 41, The Journal of the Vibrations Association of New Zealand, Spring 2003.
2. **Keir, M.S., Gooch, S.D., Fischer, L.N., Mulholland, A.P. and O'Leary, A.J.** (2003) “Vibrating Conveyor Design”, Spectrum, Issue 41, The Journal of the Vibrations Association of New Zealand, Spring 2003.
3. **Gooch, S.D. and Raine, J.K.** (2000) “The Dynamics and Limits on Scaling of a Flexible Kinetic Sculpture”, Proceedings of the Institute of Mechanical Engineers, Vol. 214, Part C, 537-548.
4. **Raine, J.K. and Gooch, S.D.** (1998) “Dynamic Analysis and Engineering Design of Kinetic Sculptures”, IPENZ Transactions, Vol. 25, No. 1/Gen.
5. **Raine, J.K., Gooch, S.D. and Webb, E.A.** (1997) “Artistic Dreams, Engineering Limitations”, New Zealand Science Monthly, Vol. 8 Issue 9, South Pacific Information Services, Christchurch, NZ.

## TECHNICAL PAPERS

1. **Gooch, S.D., Hollingsworth, L. and Medland, A.J.** (2009) “The Study of the Interaction of Humans with Wheelchairs to Improve the Design”, Proceedings of the ASME 2009 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference: 6th Symposium on International Design and Design Education, DETC2009-87475, August 30 – September 2, 2009, San Diego, California, USA
2. **Hollingsworth, L., Gooch, S. D., Woodfield, T., Rothwell, A. G. and Yao F.** (2009), The Effect of Triceps Function on Wheelchair Propulsion for People with Tetraplegia, Fourth Asian Pacific Conference on Biomechanics, April 14-17 2009, University of Canterbury.
3. **Gooch, S. D., Woodfield, T., Hollingsworth, L., Rothwell, A. G., Medland, A. J. and Yao F.** (2008), On the Design of Manual Wheelchairs for People with Spinal Cord Injuries, Proceedings of the 10th International Design Conference, Design 2008, pp 387-394, May 19 – 22 2008, Dubrovnik, Croatia.

4. **Medland, A.J. and Gooch S.D.**, (2008), The Evaluation Of The Ability Of A Constraint-Based Manikin To Represent Normal Human Tasks, Proceedings of the 10th International Design Conference, Design 2008, pp 649-656, May 19 – 22 2008, Dubrovnik, Croatia.
5. **Medland, A.J., Hicks, B.J. and Gooch S.D.**, (2008) “Using Constraints in the Understanding of the Interactions between Products and Humans”, CWUAT, 4th Cambridge Workshop on Assistive Technology, 14-16 April, University of Cambridge, UK
6. **Gooch, S.D., Rothwell, A. G., Yao F., Dunn J. and Woodfield T.**, (2007) “Quantifying Manual Wheelchair Propulsion Ability vs Injury Level for People with Spinal Cord Injuries”, International Meeting on Upper Limb in Tetraplegia Conference, September 17-20, Shriners Hospitals for Children, Philadelphia, Pennsylvania.
7. **Gooch, S.D., Rothwell, A. G., Yao F., Dunn J. and Woodfield T.**, (2007) “A Procedure for Measuring Manual Wheelchair Propulsion Ability for People with Spinal Cord Injuries”, International Meeting on Upper Limb in Tetraplegia Conference, September 17-20, Shriners Hospitals for Children, Philadelphia, Pennsylvania.
8. **Hollingsworth, L., Medland, A.J., Gooch, S.D., Rothwell, A. G., Lintott A. and Woodfield T.**, (2007) “Using Constraint Modelling to Predict the Upper Body Strength Capabilities of People with Tetraplegia”, International Meeting on Upper Limb in Tetraplegia Conference, September 17-20, Shriners Hospitals for Children, Philadelphia, Pennsylvania.
9. **Gooch S. D.** (2005) “Long Term Issues In Design Research” ICED05, Proceedings of the 15th International Conference on Engineering Design, August 15 – 18, 2005, Melbourne, Australia.
10. **Gooch S. D., Raine J. K. and McCallion H.**, (2004) “Design Optimization for a Vibrating Vertical Cantilever”, Proceedings of the 8th International Design Conference - Design 2004, pp 1263-1269, May 18 - 21, Dubrovnik, Croatia.
11. **Gooch, S.D. and Medland, A.J.** (2003) “Steps Towards Geographically Dispersed Collaborative Student Design Projects”, Proceedings of 2003 ASME International Design Engineering Technical Conferences: 15th International Conference on Design Theory & Methodology, DETC2003/DTM-48680, September 2 - 6, 2003 in Chicago, Illinois, U.S.A.
12. **Gooch, S.D. and Raine, J.K.** (2003) “The Engineering Design of a Vibrating Kinetic Sculpture”, Vibrations Association of New Zealand Inc., 14th Annual Conference, 5th to 8th May 2003, Christchurch, NZ (Prize for Best New Presenter).

13. **Keir, M.S., Gooch, S.D., Fischer, L.N., Mulholland, A.P. and O'Leary, A.J.** (2003) "Vibrating Conveyor Design", Vibrations Association of New Zealand Inc., 14th Annual Conference, 5th to 8th May 2003, Christchurch, NZ.
14. **Gooch, S.D., Hales, C. and Raine, J.K.** (2001) "Engineering Design in New Zealand: Introducing Internet Based Design at Canterbury", Proceedings of the DETC'01 ASME 2001 Design Engineering Technical Conference and Computers and Information in Engineering Conference, IED-21206, September 9-12, Pittsburgh, PA.
15. **Gooch, S.D. and Raine, J.K.** (1997) "A Twice Full Scale *Blade*: The Engineering Design of a Kinetic Sculpture", Proceedings of the IPENZ Annual Conference, Wellington, NZ, 2, 247-252.
16. **Gooch, S.D.** (1996) "Scaling Blade – A Technical Note for the Engineering Design of a Kinetic Sculpture", IPENZ Proceedings of the Third New Zealand Conference of Postgraduate Students in Engineering & Technology, Canterbury University Press.

#### **PRIZES, AWARDS AND OTHER HONOURS**

1. **NZ Pulp & Paper Design Prize**, (1995) awarded for excellence in third professional year engineering design, University of Canterbury.
2. **NZ Aluminium Smelters Design Prize**, (1994) awarded for excellence in second professional year engineering design, University of Canterbury.

#### **SEMINARS**

1. **Gooch, S.D.** (Feb 2008) "Upper Body Strength Capabilities of People with Tetraplegia", Department of Orthopaedic Surgery, Department of Orthopaedic Surgery & Musculoskeletal Medicine, University of Otago.
2. **Gooch, S.D.** (29 Sept. 2002) "Len Lye", An interview the radio station 98.3 RDU, Christchurch, NZ.
3. **Gooch, S.D.** (14 March 2002) "Multidisciplinary Projects in the Arts and Engineering Sciences", Science and Art Symposium, The Ministry of Research, Science and Technology (MoRST) and Creative New Zealand, Wellington, NZ.
4. **Webb, E.A. and Gooch, S.D.** (June 30th 2001) "A Brown Paper Bag Idea - An Adventure in Art and Engineering Science", Len Lye Symposium, University of Auckland.
5. **Gooch, S.D.** (Oct 1996) "Scaling Blade - The Engineering Design of a Kinetic Sculpture", Departmental seminar, University of Canterbury

**APPOINTMENTS ON EDITORIAL BOARDS AND REVIEW PANELS**

1. **Journal of Engineering Design**, Member of Journal Editorial Board, Jan 2007 - present. (Reviewer)
2. **ASME International Design Engineering Technical Conferences & Computers and Information In Engineering Conference 2009**, 6th Symposium on International Design and Design Education (DEC), Scientific Advisory Panel, 30 August - 2 September 2009, San Diego, CA, U.S.A. (Reviewer)
3. **17th International Conference on Engineering Design, ICED 09**, Scientific Advisory Panel, 24-27 August 2009, San Francisco, CA, USA. (Reviewer)
4. **International Conference on Research into Design (ICoRD'09)**, National Science Seminar Complex, Indian Institute of Science, Bangalore, India. 7-9 January, 2009, (Reviewer)
5. **ASME International Design Engineering Technical Conferences & Computers and Information In Engineering Conference 2008**, Scientific Advisory Panel, August 3-6 2008, New York City, U.S.A.
6. **10<sup>th</sup> International Design Conference, Design 2008**, Conference Scientific Advisory Board, Reviewer, Session Chair at Conference, Dubrovnik, Croatia, 2008..
7. **16th International Conference on Engineering Design, ICED 07**, Scientific Advisory Panel, 28-31 August 2007, Paris, France.
8. **ASME International Design Engineering Technical Conferences & Computers and Information In Engineering Conference 2006**, Co-Coordinator for the 3rd Symposium On International Design And Design Education (DEC), September 10-13, 2006, Philadelphia, PA.
9. **9<sup>th</sup> International Design Conference, Design 2006**, Conference Scientific Advisory Board, Dubrovnik, Croatia, 2006.
10. **15th International Conference on Engineering Design, ICED 05**, Rapporteur for theme of "Engineering Design Knowledge Management"; Scientific Advisory Panel; Chair of '*Design for better products*' sessions, 15-18 August 2005, Melbourne, Australia:.
11. **16th International Conference on Design Theory and Methodology (DTM)**, Scientific Advisory Panel, 28 September - 2 October 2004, Salt Lake City, Utah, U.S.A.

12. **8th International Design Conference, Design 2004**, Conference Scientific Advisory Board, Dubrovnik, Croatia, 2004.
13. **University of Bath**, Innovative Manufacturing Research Centre, External review of research proposal, Dec 2003.
14. **Journal of Structural Engineering**, American Society of Civil Engineers ASCE, Review journal paper, May 2003,.
15. **15th International Conference on Design Theory and Methodology (DTM)**, Scientific Advisory Panel, 2-6 September 2003, Chicago, Illinois, U.S.A.,
16. **International Conference on Manufacturing Research (ICMR 2003)**, Member of the International Scientific Committee and review of papers, 9-11 September 2003, Strathclyde, Scotland.
17. **Journal of Sound and Vibration**, Review journal paper, October 2002.
18. **International Conference on Engineering Design, ICED 03**, Scientific Advisory Panel, 19-21 August 2003, Stockholm, Sweden.

#### SELECTED TECHNICAL REPORTS

1. **Gooch, S.D.** (2008) Capability assessment for fish handling plant on-board a factory fishing ship, Christchurch, NZ.
2. **Gooch, S.D.** (2008) Design Assessment for a Novel Extrusion Machine, Christchurch, NZ.
3. **Gooch, S.D.** (2006), Design Assessment Report – Rabbit Block, Lab-Tek International, Christchurch, NZ.
4. **Gooch, S.D. and Hales, C.,** (2006) Using “Managing Engineering Design” in the new Product Design Engineering Programme at WelTec, Wellington Institute of Technology.
5. **Gooch, S.D., Gilmour, I.A. and Hales, C.,** (2005) Robert Kenny DAVIDSON Dive Fatality (OP-Tank), Technical investigation of a compressor used for filling dive tanks, presented at the Coroners Court, Blenheim, NZ.
6. **Gooch, S.D.,** (2005) Structural Assessment of a Semi-Trailer, Christchurch, NZ.
7. **Jermey, M.C. and Gooch, S.D.,** (2005) Aircraft Engine Test Cell Ramp, Cenco International, Minneapolis, USA.

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8. **Gooch, S.D.**, (2005) Design Assessment Report, P&W Engineering, Mosgiel, NZ.
9. **Gooch, S.D. and Hales, C.**, (2004) Machine Safeguarding, Davin Industries, Christchurch, NZ.
10. **Gooch, S.D.**, (2004) Flour Compaction in Transport Bins, River Mill Bakeries, Huntly, NZ.
11. **Gooch, S.D.**, (2004) Feasibility of a Braking System Upgrade for Isuzu NKR97 Road/Rail Truck, Tranz Rail Limited, Greymouth, NZ.
12. **Gooch, S.D.**, (2003) Transmission System Design for Multitube Vortexer (Test tube mixer), Lab-Tek International, Christchurch, NZ.
13. **Gooch, S.D.**, (2003) Test Rig for Measuring Clamping Force for Securing Pressure Sensor onto Printed Circuit Board, August 2003, Dynamic Controls Ltd, Christchurch, NZ.
14. **Gooch, S.D.**, (2002) Stainless Steel Cladding System for Cast Iron Press Rolls (700mm diameter x 3000mm long) for Pulp and Paper Mill, September 2002, Allied Industrial Engineering, Kawerau, NZ.
15. **Gooch, S.D.**, (2002) Proposal for Truck-Based Plastics and Glass Recovery System for Recycling Household Waste, April 2002, Street Smart Ltd, Auckland, NZ.
16. **Gooch, S.D.**, (2000) A New Drive System for a Kinetic Sculpture, January 2000, Technix Group Ltd, New Plymouth, NZ.
17. **Gooch, S.D.**, (1998) Service Station Canopy Design, 1998.

## UNIVERSITY TEACHING & ACADEMIC APPOINTMENTS

1. **University of Canterbury**, Christchurch, NZ:
  - **ENME440/640 Systematic Design of Engineering Systems:** 24 lectures on Mechanical Engineering Design Process. Involves senior year undergraduate and postgraduate students, January 2000 – present;
  - **ENME441/641 Special Applications:** 24 lectures on special topics in engineering design (e.g. design optimization, mathematical modelling, scaling and similitude, vibration isolation). Involves senior year undergraduate and postgraduate students, January 2000 – present;

- **ENME211 Elements of Machine Design:** Six lectures on conceptual design, managed the Canterbury contingent (approx 140 students) for the Weir-Warman international student design and build competition (**Canterbury students were the overall competition winners**), 2005;
- **ENME340 Mechanical Engineering Design A:** Six lectures on the engineering design of mechanical components and sub systems, third year undergraduate students, 2004;
- **ENGR101 Foundations of Engineering:** Responsible for mechanical components of this course, 1st year undergraduate (class size approximately 600 students), 2008 – present;
- **ENGR102 Engineering Mechanics:** 36 lectures on engineering mechanics, 1st year undergraduate (class size 450 students), 2003.

2. **University of Melbourne, AUSTRALIA:**

- Appointed as **Visiting Fellow**, March – December 2007.
- **External examiner** for Master of Engineering Science dissertation, Mechanical and Manufacturing Engineering, Tayebeh Alirezaee, “Optimising the Injection Mould Die Design Process”, 2007.
- **External examiner** for Master of Engineering Science dissertation, Mechanical and Manufacturing Engineering, 2003.

3. **Institutes of Technology and Polytechnics Quality, Wellington, NZ.**

- Appointed as **Member of Approval Panel for BEngTech Degrees** at the Metro Polytechnics (Includes Manukau, Waikato, Wellington and Christchurch institutes of technology, Otago Polytechnic and Unitec), 2009.
- Appointed as **Degree Monitor** for Bachelor of Creative Technologies Degree, Wellington Polytechnic, 2007 - 2009, appointed by ITPQ Wellington.
- Appointed as **Member of Accreditation Panel** for the Bachelor of Creative Technologies Degree, Wellington Polytechnic, 2007, appointed by ITPQ Wellington.

4. **Christchurch Polytechnic Institute of Technology, Christchurch, NZ:**

- *Mechanical Engineering Drawing (NZCE):* sole responsibility for full year course, five contact hours per week, 1997;
- *Mechanics of Machines (Advanced Trade Certificate):* sole responsibility for full year course, two contact hours per week, 1997.

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## UNIVERSITY RESEARCH

### 1. Research Areas

- **Evaluation of efficiency in engineering design:** this research involves investigating ways of improving the efficiency of the engineering design process and engineering project management.
- **Design for people with impaired arm strength:** The purpose of this research is to support the development of new devices and procedures which assist people with tetraplegia to live independently.
- **Design of flexible vibrating structures:** this research involves the development of mathematical procedures to study the influence of design parameters on the structural properties of flexible structures.

### 2. Supervision of Thesis & Research Projects

- Laura Hollingsworth, PhD Research Title: "Using SWORDS to model the upper body characteristics of people with C5 and C6 tetraplegia".
- Timothy Stevenson, PhD Research Title: "Simulation of Vehicle-Pedestrian Interaction".
- Dean Kirk, PhD Research Title: "Tolerance Based Reverse Engineering for Rapid, Quality Product Development".
- Fei Yao, ME Research Title: "Wheelchair propulsion assessments for people with tetraplegia".
- Mathew Singer, ME Research Title: "Assisted Forearm and Hand Orthosis".
- Guillaume Denisse, FMA, France. "Monitoring the condition of human joints".
- Aurelien Baudouin, FMA, France. "Data capture for a knee proprioception apparatus".
- Florent Monbrun, FMA, France. "Powered Elbow Orthosis".
- Armand Colongo, IFMA, France. "Development of a dynamometer for measuring wheelchair propulsion capability in people with tetraplegia".
- Benjamin Low, ME Research Title: "Endo-Prosthetic Knee Joint Development".
- Cedric Durand, IFMA, France. "Development of Web-based Tools for Engineering Design Project Management".

- Bertrand Huwig, IFMA, France. "Human Transfer Device: Car to Wheelchair".
- Nicolas Hourcade, IFMA, France. "Development of an Interactive Web-based Project Management System".
- Sebastien Teyssonier, IFMA, France. "Adding Running Resistance Capability to a Wheelchair Dynamometer".
- Matthew Wright, ME by Project and Examination: "Sealord Shipboard Conveyor Belt Washer. 2003".
- Andrew Gilkison, "Mathematical Model of Arm Motion during Wheelchair Propulsion".
- Raphael Nivoix, IFMA, France, "Design of an All-Terrain Wheelchair".
- Guillaume Gallant, IFMA, France, "Design of an Assistive Device for People with Tetraplegia".
- Tim Syme, University of Canterbury, "Design of a Wheelchair Dynamometer".
- Thomas Goecke, Technische Universitat Darmstadt, "Multitube Vortexer: Design for Manufacture".

### 3. Supervision of Senior Year Undergraduate Research Projects

- **KiwiRail:** "Brake Tester" (2009) (3 person student team)
- **Dynamic Composites:** "World Land Speed Record" (2009) (4 person student team)
- **Rio Tinto Aluminium Smelter:** Noise Reduction in Scrap Bins (2008) (3 person student team).
- **Canterbury District Health Board:** Assisted Elbow Orthosis (2008) (3 person student team).
- **Dynamic Controls Ltd:** "Low Cost Joystick", (2006) (3 person student team).
- **Commercial Diving Consultants Ltd:** "Hammer Screw Anchor" (2006) (4 person student team).
- **The Len Lye Foundation:** "Design of a Kinetic Sculpture: Sun God Meets Sea Serpent", (2005) (4 person student team).
- **Canterbury District Health Board:** "Design of a Powered Orthosis", (2005) (4 person student team).
- **Canterbury District Health Board:** "Kinematics of Wheelchair Propulsion", (2004), (4 person student team).

- **University of Canterbury:** “Development & Feasibility Study for Bio-Artificial Liver”, (2003), (4 person student team).
- **Methanex New Zealand Ltd:** “Pigtail Crimping Tool”, (2002) (4 person team).
- **Southern Cross Engineering Ltd:** “Vibrating Conveyor Design”, (2002) (4 student person team).
- **Methanex New Zealand Ltd:** “Design and Build a Crimping Tool using a Modified Firearm Device”, (2001) (3 person student team).
- **Southern Cross Engineering Ltd:** “Saw Guide Re-Design for an Edging Machine”, (2001) (4 person student team).
- **Mechanical Engineering Department, University of Canterbury:** “Linear Air Motor Analysis”, (2001)
- **University of Canterbury:** Mechanical Engineering Department, “Design of a Portable Ski Tow” (2001)
- **Howard Wright Ltd:** Design and Test of a Height Control System for a Prototype Ambulance Stretcher, (2000)
- **Electrical Engineering Department, University of Canterbury:** “Computer Based Prediction of Vehicle Performance”, (2000)
- **The Len Lye Foundation:** “Vibration Isolation of Len Lye's Kinetic Sculpture Blade”, (2000).

#### 4. Research Grants

- “Augmented Human Systems”, (2005 - 2009), Research Contract, Industrial Research Limited.
- “Design of a Powered Orthosis”, (2005), Canterbury District Health Board.
- “Kinematics of Wheelchair Propulsion”, (2004), Canterbury District Health Board.
- “Mathematical model of arm motion during wheelchair propulsion”, (2004), New Zealand Spinal Trust.
- “Kinematics of Wheelchair Propulsion”, (2003), New Zealand Spinal Trust.
- “Shipboard Conveyor Belt Washer”, (2002), Foundation for Research & Technology, NZ.

Nov 2009