MARC SECANELL GALLART

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Education

- **University of Victoria**, Victoria, British Columbia, Canada
  2004/09 – 2007/11   Ph.D. in Mechanical Engineering.
  2002/09 – 2004/08   M.A.Sc. in Mechanical Engineering.
  2000/09 – 2001/06   International Exchange Program Europe-Canada.

- **Universitat Politècnica de Catalunya** (UPC) – **School of Engineering of Barcelona**, Barcelona, Spain
  1996/09 – 2002/06   Bachelor of Engineering with an emphasis in electrical machines design and control.

Awards and Honours

- **Hydrogen and Fuel Cells Canada Scholarship**, 2007/01

- **National Science and Engineering Research Council of Canada Graduate Scholarship (CGS)**, 2005/09 – 2008/09

- **Petch Research Scholarship** (University of Victoria), 2004/09

- **University of Victoria Fellowship**, 2004/09 – 2005/09

- **ASI Exchange 2004 Communication Award**, 2004/03

- **ASI Scholarship Award**, 2002/10

- **University of Victoria Fellowship**, 2002/09 – 2003/09

- **Excellence Recruitment Award**, 2002/09

- **International Exchange Program Europe-Canada Scholarship**, 2000/09 – 2001/06

Research Experience

- **Assistant Professor:** Department of Mechanical Engineering, University of Alberta, 2009/01-Present
  - Principal Investigator: Energy system design laboratory
  - Projects:
    - 2009/01-Present: Computational design and optimization of polymer electrolyte fuel cell membrane electrode assemblies (Role: Principal investigator. Team size: 3 M.Sc students and myself)

- 2009/05-2009/10: Computational design of hybrid composite flywheels (Collaborative project with Dr. Pierre Mertiny (University of Alberta). Role: Co-investigator. Team size: 1 summer student, Dr. Pierre Mertiny and myself)

- **Research Associate**: Institute for Fuel Cell Innovation, National Research Council Canada, 2008/03-2009/01 (Research supervisor: Dr. Datong Song and Dr. Simon Liu)
  - Theoretical studies of the mass transport on a cathode catalyst layer

- **Post-doctoral Research**: Department of Mechanical Engineering, University of Victoria, 2007/11 – 2008/01 (Research advisors: Dr. N. Djilali and Dr. A. Suleman)

- **Doctoral Research:** Department of Mechanical Engineering, University of Victoria, 2004/09 – 2007/11 (Research advisors: Dr. N. Djilali and Dr. A. Suleman)
  - Theoretical study of mass, electronic and ionic transport and the reaction kinetics occurring inside a fuel cell.
  - Development of an adaptive finite element program in C++ for fuel cell modeling and design using the OpenSource deal.II finite element libraries.
  - Development of an optimization framework in C++ for gradient-based optimization using the OpenSource optimization tool DAKOTA.

- **Master's Research:** Department of Mechanical Engineering, University of Victoria, 2002/09 – 2004/08 (Research advisor: Dr. A. Suleman)
  - Development of a computational parallel framework in FORTRAN for aerodynamic shape optimization of airfoils using a finite volume program.

- **Undergraduate Research**: Department of Electrical Engineering, Universitat Politècnica de Catalunya, 2001/06 – 2002/06 (Research advisor: Dr. F. Córcoles)
  - Theoretical studies of a three-phase transformer and its performance during transient phenomena such as voltage sags.
  - Development of a computational model in MATLAB to study the transient behaviour of the transformer using differential-algebraic equation solvers.

Research Interests

- Computational modeling of fuel cells and fuel cell systems.
- Modeling and design of renewable energy systems.
- Multidisciplinary design optimization.
- Robust and reliability-based analysis and design.
- Finite element and adaptive finite element method.
- Object-oriented programming.

Professional Development

- **Danish Center for Applied Mathematics and Mechanics (DCAMM) Advanced School**, Course in *Topology Optimization: Theory, Methods and Applications*, Technical University of Denmark, Lyngby, Denmark, June 20th to 26th, 2007 (by invitation from Dr. M. Bendsøe)
    - o Theory and method of topology optimization.
    - o Application of topology optimization to the design of structures and MEMS.

- **Queen's - RMC Fuel Cell Research Center,** Kingston, Canada, January 27th to February 14th, 2007 (by invitation from Dr. Kunal Karan)
    - o Collaboration with Dr. Kunal Karan on electrode engineering.

- **University of Heidelberg**, *Deal.II User Workshop*, Heidelberg, Germany, January 3rd to January 5th, 2006
    - o Update on the new advances in the deal.II OpenSource finite element library.
    - o Collaboration with deal.II developers and other users.

Teaching Experience

- **Instructor,** Financial Management for Engineers, 43 students, Fall 2009
    - o Teach three lectures a week
    - o Prepare assignments, projects and midterm examinations
    - o Mark projects and midterms
    - o Responsible for one teaching assistant that marked the assignments

- **Instructor,** Engineering Fundamentals I, University of Victoria, Fall 2006 and 2007
    - o Teach tutorials (twice a week).
    - o Select the material for the tutorials, final exam, midterm and quizzes (in conjunction with the other two instructors).
    - o Mark midterm and final exam (in conjunction with the other two instructors).

- **Teaching Squares,** Learning and Teaching Center, University of Victoria, Fall term 2006
    - o Peer review of teaching practices through classroom observation and shared reflections.

- **Teaching Assistant Coordinator,** Fluid Mechanics II, University of Victoria, Fall term 2005 and 2004
    - o Coordinate four teaching assistants.
    - o Teach tutorials (once a week) and laboratories; mark assignments and quizzes.

- **Preparation for University Teaching Program,** Learning and Teaching Center, University of Victoria, September 2001 to present
    - o Program to prepare graduate students for teaching in higher education.

- **Presentation Skills Workshop**, Learning and Teaching Center, University of Victoria, October 2005
    - o Workshop to develop and improve the basic skills necessary to giving a good presentation.

- **Teaching Assistant**, Engineering Design, University of Victoria, Spring term 2005, 2004 and 2003

- o Teach laboratories at the machine shop and mark projects.

- **Teaching Assistant**, Computational Fluid Dynamics, University of Victoria, Fall 2005
    - o Prepare and teach new laboratories and mark assignments.

- **Invited lecturer at the Teaching Assistant Day**, Learning and Teaching Center, University of Victoria, September 2004
    - o Presentation on lesson planning.

- **Teaching Assistant**, Mechanics of Solids I, University of Victoria, Summer term 2003
    - o Teach laboratories and mark reports.

- **Institutional Skills Workshop**, Learning and Teaching Center, University of Victoria, September 2003
    - o Workshop to develop and improve teaching practices. Peer review and plenty of practice are the mainstays of the program.

- **Teaching Assistant**, Fluid Mechanics II, University of Victoria, Fall term 2002 and 2003
    - o Teach tutorials (once a week) and laboratories; mark assignments and quizzes.

Work Experience

- **University of Victoria**, Victoria, British Columbia, Canada
  2002/08 – 2002/09 - Research assistant.
    - o Literature survey of deployable satellite antennas.

- **AZM Engineering**, Barcelona, Spain
  2001/06 – 2001/11 – Design engineer.
    - o Implementation of subway and train station security systems.

University Services

- **University of Alberta**, Edmonton, Alberta, Canada
  2009/09 – To present   Member of the Mechanical Engineering Safety Committee

- **University of Victoria**, Victoria, British Columbia, Canada
  2004/09 – 2005/06   Chair of the 2nd Mechanical Engineering Graduate Research Colloquium.
  2003/09 – 2004/06   Vice-Chair of the 1st Mechanical Engineering Graduate Research Colloquium.
  2002/09 – 2004/09   Member of the Advanced Systems Institute of BC graduate committee.

Professional Services

- **Technical reviewer for:**
    - o 4th International ASME Conference on Fuel Cell Science, Engineering and Technology, June 19-21, 2006 (2)
    - o International Journal of Thermal Sciences (2)
    - o Journal of Power Sources (8)

- o International Journal of Hydrogen Energy (2)
- o Journal of Membrane Sciences (1 – 2 times)
- o Solar Energy Journal (1)

Publications and Presentations

Journal Publications

- M. Secanell, R. Songprakorp, A. Suleman and N. Djilali, "Optimization of a Proton Exchange Membrane Fuel Cell Membrane Electrode Assembly", *Structural and Multidisciplinary Optimization*, Published online May 2009, DOI:10.1007/s00158-009-0387-z.

- M. Secanell, R. Songprakorp, A. Suleman and N. Djilali, "Multi-Objective Optimization of a Polymer Electrolyte Fuel Cell Membrane Electrode Assembly", *Energy and Environmental Sciences*, 1(3) 378 - 388, 2008.

- M. Secanell, K. Karan, A. Suleman and N. Djilali, "Optimal Design of Ultra-Low Platinum PEMFC Anode Electrodes", *Journal of the Electrochemical Society,* 155(2) B125-B134, 2008.

- M. Secanell, K. Karan, A. Suleman and N. Djilali, "Multi-Variable Optimization of PEMFC Cathodes using an Agglomerate Model", *Electrochimica Acta*, 52(22):6318-6337, June 2007.

- M. Secanell, B. Carnes, A. Suleman and N. Djilali, "Numerical Optimization of Proton Exchange Membrane Fuel Cell Cathode Electrodes", *Electrochimica Acta*, 52(7):2668-2682, February 2007.

- J. Wishart, Z. Dong and M. Secanell, "Optimization of a PEM Fuel Cell System Based on Empirical Data and a Generalized Electrochemical Semi-Empirical Model", *Journal of Power Sources*, 161(2):1041-1055, October 2006.

- M. Secanell, P. Gamboa and A. Suleman, "Design of a Morphing Airfoil for a Light Unmanned Aerial Vehicle Using High-Fidelity Aerodynamic Shape Optimization", *AIAA Journal*, 44(7):1550-1562, July 2006.

- M. Secanell and A. Suleman. "Study of Sequential Optimization Algorithms for Application to Aerodynamic Shape Optimization", *AIAA Journal,* 43(10):2262-2267, October 2005.

Conference Publications (Refereed - Presenter indicated with an asterisk)

- M. Secanell[*], R. Songprakorp, N. Djilali and A. Suleman (2008) Design of a Polymer Electrolyte Fuel Cell Membrane Electrode Assembly under Different Operating Conditions, Proceedings of the 12th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, Victoria, BC, Canada, Sept. 10-12.

  - A preliminary version of this work was also presented as: M. Secanell, N. Djilali and A. Suleman[*] (2008) Optimization of Membrane Electrode Assemblies for PEMFC, Proceeding of the 4th AIAA Multidisciplinary Design Optimization Specialist Conference, Illinois, USA, April 7-10, 2008.

- J. Wishart[*], Z. Dong and M. Secanell, "Optimization of a PEM Fuel Cell System for Low Speed Hybrid Electric Vehicles", *Proceedings of the ASME International Design Engineering Technical Conference & Computers and Information in Engineering Conference*, Philadelphia, Pennsylvania, September 10-13, 2006.

- M. Secanell[*], N. Djilali and A. Suleman, "Optimization of a Planar Self-Breathing PEM Fuel Cell Cathode", *Proceedings of the 11th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, Portsmouth, Virginia, September 5-8, 2006.

- M. Secanell, N. Djilali[*] and A. Suleman, "Gradient-Based Optimization of PEM Fuel Cell Catalyst Layers", *Proceedings of the 5th International Conference on Engineering Computational Technology*, Las Palmas de Gran Canaria, Spain, September 12-15, 2006.

- M. Secanell[*], B. Carnes, N. Djilali and A. Suleman, "A PEM Fuel Cell Electrode Model for Gradient-Based Optimization", *Proceedings of the 3rd European Conference on Computational Mechanics*, Lisbon, Portugal, June 5-9, 2006.

- J. Wishart[*], M. Secanell, Z. Dong and G. Wang, "Optimization of a Fuel Cell System Based on Empirical Data of a PEM Fuel Cell Stack and Generalized Electrochemical Model", *Proceedings of the International Green Energy Conference*, Waterloo, Ontario, June 12-16, 2005, Paper No. 126.

- M. Secanell, P. Gamboa and A. Suleman[*], "Design of a Morphing Airfoil for a Light Unmanned Aerial Vehicle Using High-Fidelity Aerodynamic Shape Optimization", *Proceedings of the 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Austin, Texas , April 18-21, 2005.

- M. Secanell[*] and A. Suleman, "Sequential Optimization Algorithms for Aerodynamic Shape Optimization", *10th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, Albany, New York, August 30-September 1, 2004.

- M. Secanell[*], A. Suleman and A.P. Costa, "Control of an Adaptive Flight Vehicle", *Canadian Conference of Applied Mechanics*, Calgary, June 1-5, 2003.

- M. Secanell and F. Córcoles[*], "DAE Implementation of Dynamic Power Systems", *10th IEEE International Conference on Harmonics and Quality of Power*, Rio de Janeiro, Brazil, October 6-9, 2002.

Conference Presentations, Posters and/or Invited Talks (Presenter indicated with an asterisk)

- M. Secanell, "Membrane electrode assembly model for low relative humidity operation incorporating catalyst layer micro-structural details", Canada-US MEA Modeling and Characterization Workshop, Vancouver, BC, Canada, November 12-13, 2009.
- M. Secanell, "Energy systems design laboratory", MITACS Advanced Mathematical Modeling and Simulation of Transport Phenomena Workshop, Vancouver, BC, Canada, September 29, 2009.
- P. Dobson and M. Secanell[*], "Effect of size, thin film and electrolyte content in cathode catalyst layer agglomerate model predictions", Gordon Research Conference in Fuel Cells, Bryant University, July 26-31, 2009 (Poster presentation).
- M. Secanell[*], "Moving Beyond Trial-and-Error Design: Using Computational Methods to Develop the Energy Systems of the Future", University of Saskatchewan, Saskatoon, SK, Canada, April 2, 2009 (Invited lecture).
- M. Secanell[*], "Computational Modeling and Optimization of Energy Systems", National Research Council – Institute for Fuel Cell Innovation, Vancouver, BC, Canada, October 29, 2008 (Invited lecture).

- M. Secanell[*], A. Suleman, N. Djilali, D. Song and S. Liu, "Multi-Objective Optimization of Polymer Electrolyte Fuel Cells", *6th Congress of the International Society of Theoretical Chemical Physics*, *Symposium on Theory and Modeling of Materials and Processes in Fuel Cells*, Vancouver, BC, July 24, 2008 (Invited lecture).

- M. Secanell[*], A. Suleman, N. Djilai, D. Song and S. Liu, "Multi-Objective Optimization of Polymer Electrolyte Fuel Cells", *11th Ulm ElectroCemical Talks*, Ulm, Germany, June 10-12, 2008 (Poster presentation).

- M. Secanell[*], "Design and Optimization of a Proton Exchange Membrane Fuel Cells", 2nd *Graduate Innovation Forum*, University of Victoria, July 12, 2007 (Oral presentation).

- M. Secanell, K. Karan, N. Djilali[*] and A. Suleman, "Numerical Optimization of Polymer Electrolyte Membrane Fuel Cell Electrodes", *ASME Fuel Cell Science, Engineering and Technology Conference*, New York, USA, June 18-20, 2007 (Presented by N. Djilali).

- M. Secanell[*], N. Djilali and A. Suleman, "Numerical Analysis and Design of MEAs for PEM Fuel Cells", *Ballard Power Systems*, Burnaby, BC, Canada, June 11th, 2007 (Oral presentation).

- M. Secanell[*], N. Djilali and A. Suleman, "Design and Optimization of Proton Exchange Membrane Fuel Cells", *Young Scientists Workshop*, University of Victoria, Victoria, Canada, May 4-5, 2007 (Oral presentation).

- M. Secanell[*], N. Djilali and A. Suleman, "Modeling and Optimization of PEM Cathodes", *Queen's-RMC Fuel Cell Research Center (FCRC)*, Kingston, Ontario, Canada, February 9, 2007 (Oral presentation).

- M. Secanell[*], B. Carnes, A. Suleman and N. Djilali, "Two-Dimensional Gradient-Based Optimization of Proton Exchange Membrane Fuel Cell Electrodes", *Gordon Research Conference in Fuel Cells*, Bryant University, Smithfield, RI, July 23-28, 2006 (Poster).

- M. Secanell[*], "Numerical Optimization of a Proton Exchange Membrane Fuel Cell Electrode", *Graduate Innovation Forum*, University of Victoria, May 15, 2006 (Oral presentation).

- M. Secanell[*], "Computational Modeling and Optimization of Proton Exchange Membrane Fuel Cells using deal.II", *Deal.II User Workshop*, Heidelberg, January 3-5, 2006 (Oral presentation).

- M. Secanell[*], B. Carnes, N. Djilali and A. Suleman, "Gradient-Based Optimization of PEMFCs Catalyst Layers", *Fuel Cell Seminar*, Palm Springs, CA, November 14-18, 2005 (Poster).

- M. Secanell[*], "Sequential Optimization Algorithms for Aerodynamic Shape Optimization", *2nd Mechanical Engineering Graduate Research Colloquium*, University of Victoria, May 17, 2005 (Poster – honorary mention).

- M. Secanell[*], "Airfoil Shape Optimization for Aircraft Design", *1st Mechanical Engineering Graduate Research Colloquium*, University of Victoria, May 18, 2004 (Oral presentation).

Theses/Dissertations

- *Computational Modeling and Optimization of Proton Exchange Membrane Fuel Cells,* Ph.D. thesis, University of Victoria, 2008.

- *Development of a Design Tool for Aerodynamic Shape Optimization of Airfoils,* M.A.Sc. thesis, University of Victoria, 2004.

- *Differential-Algebraic Equations Implementation of a Three Phase Non-linear Transformer Model to Study Their Transient Response. Systematic Implementation of all Possible Transformer and Load Connections,* B. Eng. thesis, Universitat Politècnica de Catalunya, 2002 (In Spanish).