

Christopher M. Clark – C.V.

Professional Preparation

- 2004 **Ph.D. Aeronautics & Astronautics, Computer Sci. Minor, Stanford University**
“Dynamic Robot Networks: A Coordination Platform for Multi-Robot Systems”
Advisors - Stephen M. Rock and Jean-Claude Latombe
- 1998 **M.A.Sc. Mechanical & Industrial Engineering, University of Toronto**
“Neural Network Algorithms for PID Controlled Robots”
Advisor - James K. Mills
- 1995 **B.A.Sc. Engineering Physics, Mechanical Eng. Option, Queen's University**
“The Composite Robotic Arm”
Advisor – Jack Jeswiet

Appointments

- 2007 – Present Assistant Professor of Computer Science & Computer Engineering, California Polytechnic University, San Luis Obispo
- 2007 – Present Adjunct Professor, University of Waterloo, Canada
- 2004 – 2007 Assistant Professor, University of Waterloo, Canada
- 2003 - 2004 Software Architect, Kiva Systems, Woburn, MA
- 1995 - 1996 Control Systems Designer, Sterner Automation Ltd –Toronto, Canada
- 1992 -1994 Research Assistant, SLOWPOKE-II Nuclear Reactor Facility, Royal Military College, Canada

Awards

- 2008 – IEEE ICARCV Best Conference Paper Award Nominee (Top 5 of 320)
- 2008 - Northrop Grumman Excellence in Research and Development Award, Cal Poly
- 2008 - Computer Engineering Outstanding Professor Award, Cal Poly
- 2004 – Journal of Robotics and Autonomous Systems – Most downloaded paper 2004
- 1999 - Post-Grad. Scholarship B - Natural Sciences & Engineering Research Council of Canada
- 1996-97 - University of Toronto Open Fellowship - University of Toronto
- 1993-94 - COSEP research grant
- 1993 - Most Marketable Product Award - Queen's Engineering Competition
- 1991 - Katherine Doyle Scholarship - Queen's University
- 1991 - Monseigneur J. Hanley Scholarship - Regiopolis N.D.H.S.

Journal Publications

- **Reinforcement Learning of Adaptive Longitudinal Control for Dynamic Collaborative Driving**, Ng., L., Clark, C. M., and Huissoon, J. P., *To appear in the International Journal of Vehicle Information and Communication Systems*, 2008.
- **Reinforcement Learning of Dynamic Collaborative Driving II: lateral Adaptive Control**, Ng., L., Clark, C. M., and Huissoon, J. P., *To appear in the International Journal of Vehicle Information and Communication Systems*, 2008.
- **Decentralized Robust Control of Modular and Reconfigurable Robots with Harmonic Drive Transmission Systems**. Z. Li, W. Melek, C, Clark, *Robotica* 04 Jun 2008 .
- **A Complete and Scalable Strategy for Coordinating Multiple Robots within Roadmaps**. Peasgood, M., Clark, C., McPhee, J., *IEEE Transactions on Robotics*. Vol. 24, No. 2, Feb 2008.
- **Markov-Based Lane-Positioning Using Inter-Vehicle Communication..** Dao, T.S., Leung, K., Clark, C., Huissoon, J., *IEEE Transactions on Intelligent Transportation Systems*. Vol 8., No. 4, Dec 2007.
- **Probabilistic Road Map Sampling Strategies for Multi-Robot Motion Planning**. Clark, C., *Journal of Robotics and Autonomous Systems*, Vol 53, (3-4), 244-264, Dec, 2005.
- **Motion Planning for Formations of Mobile Robots**. Barfoot, T., Clark, C., *Journal of Robotics and Autonomous Systems*, Vol. 46, Issue 2, Feb, 2004.
- **Robotic System Sensitivity to Neural Network Learning Rate: Theory, Simulation and Experiments**. Clark, C., and Mills, J.K., *International Journal of Robotics Research*, Vol. 19, No. 10, pp. 955-968, October 2000.

Conference Publications

- **Altruistic Relationships for Optimizing Task Fulfillment in Robot Communities**, Clark, C.M, Morton, R., and Bekey, G.A., *Proc. of Distributed Autonomous Robot Systems (DARS 08)*, Nov, 2008.
- **Archaeology via Underwater Robots: Mapping and Localization within Maltese Cistern Systems**, Clark, C.M, Olstad, C.S., Buhagiar, K., and Gambin, T., *Proc. of the 10th International Conference on Control, Automata, Robotics and Vision (ICARCV 08)*, Dec, 2008.
- **Real time Experiments in Markov Based Lane Position Estimation Using Wireless Ad-Hoc Network**, Dao, T-S., Ng, L., Clark, C. M. and Huissoon, J. P., *Proc. of the 2008 IEEE Intelligent Vehicles Symposium (IV 08)*, June 4-6, 2008.
- **Reinforcement Learning of Adaptive Longitudinal Vehicle Control for Dynamic Collaborative Driving**, Ng, L., Clark, C. M. and Huissoon, J. P., *Proc. of the 2008 IEEE Intelligent Vehicles Symposium (IV 08)*, June 4-6, 2008.
- **Monocular Vision based Particle Filter Localization in Urban Environments**, Leung, K. Y. K., Clark, C. M., and Huissoon, J. P., *Proc. of the 2008 IEEE International Conference on Robotics and Automation*, May 19-23, 2008.

- **Toward Systematic Approaches to Design and Implement Vehicles Semi-Active Control Systems**, Bolandhemmat, H., Clark, C. M., Golnaraghi, F., *Proc. of ISIE08 - IEEE International Symposium on Industrial Electronics*, 2008.
- **Distributed Platoon Assignment and Lane Selection for Traffic Flow Optimization**, Dao, T-S., Clark, C. M. and Huissoon, J. P., *Proc. of the 2008 IEEE Intelligent Vehicles Symposium (IV 08)*, June 4-6, 2008.
- **Autonomous Control of a Differential Thrust ROV**. Wang, W. and Clark, C., *Proc. of the 2007 International Symposium on Unmanned Untethered Submersible Technology (UUST)*, 2007.
- **SIFT Approach Used in Fish Tracking for Autonomous Underwater Vehicle**, Zhou, J., Clark, C. and J. Huissoon, *Proc. of the 2007 International Symposium on Unmanned Untethered Submersible Technology (UUST)*, 2007.
- **Dynamics of Step-climbing with Deformable Wheels and Applications for Mobile Robotics**, A. Wilhelm, W. Melek, J.P. Huissoon, C. Clark, G. Hirzinger, N. Sporer, M. Fuchs, *IEEE/RSJ Conference on Intelligent Robotics and Systems*, 2007.
- **Design of a Wheeled Mobile Robotic Platform with Variable Footprint**, A. Wilhelm, J. Huissoon, W. Melek, C. Clark, M. Fuchs, G. Hirzinger, *IEEE/RSJ Conference on Intelligent Robotics and Systems*, 2007.
- **Optimized Lane Assignment Using Inter-Vehicle Communication**, T.S., Dao, C.M., Clark, and J.P., Huissoon.. *2007 IEEE Intelligent Vehicles Symposium, IV'07*.
- **Development and characterization of modular and reconfigurable robot joints with harmonic drive transmission systems**, Z. Li, W. Melek, C. Clark, *International Conference on Changeable, Agile, Reconfigurable and Virtual Production (CARV)*, Toronto, 2007.
- **Task Based Configuration Optimization of Modular and Reconfigurable Robots using a Multi-Solution Inverse Kinematics Solver**, S. Tabandeh, , W. Melek, C. Clark, *International Conference on Changeable, Agile, Reconfigurable and Virtual Production (CARV)*, Toronto, 2007.
- **A genetic algorithm approach to solve for multiple solutions of inverse kinematics using adaptive niching and clustering**. Tabandeh S, Clark C, Melek , W, *Proceedings of 2006 IEEE World Congress on Computational Intelligence*, Vancouver, BC, Canada.
- **A Distributed Sensing System for Vehicles State Estimation**. Bolandhemmat, H.R., Clark, C., Golnaraghi, M.F., *Proceedings of The 2006 ASME International Mechanical Engineering Congress and Exposition* , Chicago, Illinois, USA, November 2006.
- **Complete and Scalable Multi-Robot Planning in Tunnel Environments**. Mike Peasgood, John McPhee, and Christopher Clark, *Proc. of the 1st IFAC Workshop on Multivehicle Systems (MVS 06)*, October 2006.
- **A Decentralized Reinforcement Learning Controller for Collaborative Driving**. Ng L., Clark C., Huissoon J.P., In *Proceedings of 1st IFAC Workshop on Multi-Vehicle Systems 2006 MVS 06*. Oct 2-3, Salvador, Bahia, Brazil, 2006.
- **Cooperative Lane-Level Positioning Using Markov Localization**. Dao, T.S., Leung, K., Clark, C., Huissoon, J., *Proceedings of The International IEEE Conference on Intelligent Transportation Systems*, Toronto, Ontario, Canada, September 2006.

- **Development of a Microscopic Traffic Simulator for Inter-Vehicle Communication Application Research.** Leung, K., Dao, T.S., Clark, C., Huissoon, J., *Proceedings of The International IEEE Conference on Intelligent Transportation Systems* (In publication), Toronto, Ontario, Canada, September 2006.
- **Geographic Information System Estimation Using Inter-Vehicle Communication.** Leung, K., Dao, T.S., Clark, C., Huissoon, J., *Proceedings of The Mechatronics Forum Biennial International Conference*, Malvern, Pennsylvania, June 2006.
- **Software and Control Architecture Development of an Autonomous Vehicle.** Leung, K., Clark, C., Huissoon, J., *Proceedings of ASME International Student Conference 2006*, Istanbul, Turkey, May 2006.
- **Modeling and Simulation of the VideoRay Pro III Underwater Vehicle,** W. Wang, and C. M. Clark, OCEANS'06 Asia Pacific IEEE Singapore, May 2006.
- **Autonomous fish tracking by ROV using Monocular Camera,** J. Zhou, C. M. Clark, *Proceedings of the the 3rd Canadian Conference on Computer and Robot Vision (CRV'06) - Volume 00*, 2006.
- **Localization of Multiple Robots Equipped with Simple Sensors.** Peasgood, M., Clark, C., and McPhee, J., *Proc. of the IEEE Conference on Mechatronics and Automation*, 2005.
- **Towards Gaussian Multi-Robot SLAM as Applied to Underwater Robotics.** Kroetsch, D. and Clark, C., *Proc. of the 2005 International Symposium on Unmanned Untethered Submersible Technology (UUST)*, 2005.
- **Motion Planning for Multi-Robot Systems using Dynamic Robot Networks.** Clark, C., Rock, S. and Latombe, J.C., *Proceedings of the 2003 International Conference on Robotics and Automation*, Taipei, Taiwan, May, 2003.
- **Using Dynamic Robot Networks for Motion Planning in Multi-Robot Space Systems.** Clark, C., Rock, S. and Latombe, J.C., *Proceedings of the 7th International Symposium on Artificial Intelligence, Robotics and Automation in Space*, Kobe, Japan, May, 2003.
- **An Integrated System for Command and Control of Cooperative Robotic Systems.** Clark, C., Frew, E. W., Jones, H.L., and Rock, S. M., *Proceedings of the 11th International Conference on Advanced Robotics*, Portugal, June, 2003.
- **Applying Kinodynamic Randomized Motion Planning with a Dynamic Priority System to Multi-Robot Space Systems.** Clark, C., Bretl, T., and Rock, S., *Proceedings of the 2002 IEEE Aerospace Conference*, Big Sky, MT, March, 2002.
- **Kinematic Path-planning for Formations of Mobile Robots with a Nonholonomic Constraint.** Barfoot, T., Clark, C., Rock, S., and D'Eleuterio, G., *Proceedings of the 2002 IEEE/RSJ International Conference on Intelligent Robots and Systems*, Lausanne, Switzerland, September, 2002.
- **Randomized Motion Planning for Groups of Nonholonomic Robots.** Clark, C., and Rock, S., *Proceedings of the 6th International Symposium on Artificial Intelligence, Robotics, and Automation in Space*, Montreal Canada, June 2001.
- **Robotic System Sensitivity to Neural Network Learning Rate.** Clark, C., Chen, P.C.Y. and Mills, J.K., *Proceedings IEEE Hong Kong Symposium on Robotics and Control*, Hong Kong, July, 1999.

- **Comparison of Performance of Neural Network Controller Architectures: Error Back Propagation, Mixture of Expert, and 'Move' Neural Network Architectures on Industrial Robot Trajectory Following Tasks.** Clark, C. and Mills, J.K., *Proceedings of International Conference on Advanced Manufacturing Technology*, Xi'an, P.R.C., June, 1999.
- **Increasing Production of Robot Manipulators with Neural Networks.** Clark, C. and Mills, J.K., *Proceedings CSME FORUM*, Toronto, Ontario, May 19-22, 1998.
- **Development of a Neural Network Module for Improving the Performance of a Commercial Robot.** Chen, P.C.Y., Ogilvie, A., Clark, C., Zhou, K., Mills, J.K., *Proceeding of World Automation Congress*, Anchorage, Alaska, May, 1998.

Theses

- **A Decentralized Approach to Dynamic Collaborative Driving Coordination,** Dao, T.S., University of Waterloo, *Ph.D. Thesis*, 2008.
- **Reinforcement Learning for Dynamic Collaborative Driving,** Ng, L., University of Waterloo, *Ph.D. Thesis*, 2008.
- **State Estimation Strategies For Autonomous Underwater Vehicle Fish Tracking Applications,** Zhou, J., University of Waterloo, *M.Sc. Thesis*, 2007.
- **Cooperative Navigation for teams of Mobile Robots.** Peasgood, M., University of Waterloo, *Ph.D. Thesis*, 2007.
- **Multi-Frame Measurement Fusion for State Estimation .** Kroetsch, D., University of Waterloo, *M.Sc. Thesis*, 2007.
- **Design of a Mobile Robotic Platform with Variable Footprint.** Wilhelm, A., University of Waterloo, *M.Sc. Thesis*, 2007.
- **Monocular Vision Based Particle Filter Localization in Urban Environments.** Leung, K., University of Waterloo, *M.Sc. Thesis*, 2007.
- **Development and Control of a Modular and Reconfigurable Robot with Harmonic Drive Transmission System.** Li, Z., University of Waterloo, *M.Sc. Thesis*, 2007.
- **Autonomous Control of a Differential Thrust Micro ROV.** Wang, W., University of Waterloo *M.Sc. Thesis*, 2006.
- **Dynamic Robot Networks: A Coordination Platform for Multi-Robot Systems.** Clark, C., *Ph.D. Thesis*, 2004.

Academic & Leadership Service

- **2008** Jet Propulsion Lab Area 982 Annual Program Board Member
- **2008** Computer Engineering Curriculum Committee
- **2007-2008** Computer Science Curriculum Committee
- **2007-2008** Cal Poly Robotics Club Faculty Advisor
- **2008** College of Engineering task force to create relationships with industry
- **2006** Engineering Faculty Council Rep. to the Arts Faculty Council
- **2006** Mechanical Engineering Chair Selection Committee
- **2005** Univ. of Waterloo Robotics Team Faculty Advisor

- **2005** Autonomous Robot Racing Competition Organizer
- **2005** Univ. of Waterloo Engineering Faculty Council
- **2005** Univ. of Waterloo Engineering Faculty Nomination Committee
- **2005** Univ. of Waterloo Engineering SFF Debate Facilitator
- **2005** IEEE IROS Program Committee
- **2005** U. of Waterloo Mech. Eng. Faculty Evaluation Planning Committee
- **2005** U. of Waterloo Mech. Eng. Mechatronics Planning Committee
- **2004** U. of Waterloo Mech. Eng. Industrial Training Program Committee
- **1999-2001** Co-President, Stanford Friends of Tibet, Stanford University
- **1999** Volunteer, Child Haven International Children's Hostel, India

Publication Review Service

- Reviewer for IEEE International Conference on Robotics and Automation (ICRA)
- Reviewer/Program Committee for IEEE International Conference on Intelligent Robotic Systems (IROS)
- Reviewer for IEEE OCEANS conference
- Reviewer for IEEE Industrial Electronics Society Conference (IECON)
- Reviewer for IEEE International Conference on Autonomy, Robotics, Control and Vision (ICARCV)
- Grant reviewer or National Science and Engineering Research Council of Canada (NSERC)
- Reviewer for Journal of Autonomous Robot Systems (ARS)
- Reviewer for International Journal of Social Robots (IJSR)
- Program Committee for Robotics Science and Systems (RSS)

Courses Instructed

- CPE 103 – Fundamentals of Computer Science III
- CPE 485 – Autonomous Robot Navigation (Developed this as a new course)
- CPE 350 – Capstone Course I
- CPE 480 – Artificial Intelligence
- CPE 482 – Multi-Robot Systems (Developed this as a new course)
- CPE 580 – Probabilistic Robotics (Developed this as a new course)
- MTE 201 – Experimental Measurement and Statistical Analysis
- MTE 221 - Introduction to Digital Design and Logic (Developed this as a new course)

Grants Awarded

- 2008 – ONR C3RP Grant - "Tracking Shallow Water Squid via an Underwater Robot System", \$35,000.
- 2008 – ONR C3RP Grant - "Efficient Assimilation of AUV Data in a High-Resolution Coastal Ocean Model", \$88,000.
- 2008 - Partnerships in Higher Education Norway - North America Grant - "Technology for marine monitoring and ocean observation", \$170,000.
- 2007 – ONR C3RP Grant - "Multi-AUV Path Optimization for improved Ocean Model Forecasting", \$35,000.
- 2007 - Center for Teaching and Learning Grant - "Probabilistic Robotics", \$6,000.
- 2007 - State Faculty Support Grant - "Simultaneous Localization and Mapping of Underwater Tunnel Systems", \$8,000.
- 2007 - Extramural Funding Grant - "Autonomous Underwater Robotic Systems for Distributed Sampling Applications", \$11,000.
- 2007 - Lockheed Martin Grant - "Mars Sandbox", \$25,000.
- 2006 - Ontario Centers of Excellence (OCE) Collaborative Grant - "Mobile Robot Surveillance System", \$250,000.
- 2006 – Canadian Foundation for Innovation (CFI) Leader's Opportunity Fund - "Facility for the testing of Underwater Sampling Technology", \$440,000.
- 2006 – Ontario Centers of Excellence (OCE) Collaborative Grant - "Dynamics of Off-road Vehicles ", \$15,500.
- 2005 – National Science & Engineering Research Council of Canada (NSERC) CRD Grant - " An Intelligent Semi-Active Suspension System", \$95,000.
- 2005 - Auto 21 Grant - "Dynamic Collaborative Driving", \$125,000.
- 2005 – National Science & Engineering Research Council of Canada (NSERC) Discovery Grant - "Cooperative Submersible Robots", \$96,000.
- 2005 - Ontario Centers of Excellence (OCE) Collaborative Grant - "Development of a Modular Reconfigurable Robot Manipulator for Auto part Assembly", \$330,000.
- 2005 – Ontario Centers of Excellence (OCE) Collaborative Grant - "An Intelligent Sensing System for Road Vehicles", \$15,500.
- 2004 – Ontario Centers of Excellence (OCE) Collaborative Grant - " Navigation Capabilities for Automatic Guided Vehicle Systems ", \$15,500.

Past Graduate Students

- Thanh-Son Dao – PhD 2008, University of Waterloo, ON, Canada
- Luke Ng – PhD 2008, University of Waterloo, ON, Canada
- Dave Kroetsch - MSc 2007, University of Waterloo, ON, Canada
- Zai Li - MSc 2007, University of Waterloo, ON, Canada
- Mike Peasgood - PhD 2007, University of Waterloo, ON, Canada
- Alex Wilhelm - MSc 2007, University of Waterloo, ON, Canada
- Beverley Chow – MSc Candidate, University of Waterloo, ON, Canada
- Wei Wang - MSc 2006, University of Waterloo, ON, Canada
- Jun Zhou - MSc 2007, University of Waterloo, ON, Canada

Current Graduate Students

- Chi-Yeh Hsu - (MS Candidate, Cal Poly)
- Matthew Schlactman - (MS Candidate, Cal Poly)
- Michael Boardman - (MS Candidate, Cal Poly)
- Beverley Chow - (MS Candidate, University of Waterloo)
- Saleh Tabandeh - (PhD Candidate, University of Waterloo)
- Hamid Bolandhemmat - (PhD Candidate, University of Waterloo)

Contact Information

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