GABRIEL HUGH ELKAIM

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EXPERIENCE

8/2003—present

University of California at Santa Cruz, Santa Cruz, CA
Associate Professor

Tenured engineering faculty in the Computer Engineering Department focusing on the areas of Robotics, Controls, and Embedded/Autonomous Systems. Research work focused on practical applications and improvements to intelligent autonomous vehicles. Founded the Santa Cruz Autonomous Systems Laboratory (ASL) to explore cooperative/distributed control, robust control and navigation, and unique vehicle configurations. Areas of research are concentrated in Sensor Fusion and Filtering, Applied Control Strategies, and Robust Real-Time Software Architectures. Current funded research from NSF, NASA, CITRIS, and private industry include development of a Accelerometer Network Integrator for Mobile Animals (ANIMA), FastNav: biologically inspired robuts navigation, Mixed UAV Air Traffic Management, Energy Scavenging Autonomous Surface Vehicles, and Robust Low-Cost Minature Autopilot for UAVs. Promoted from **Assitant Professor** (Tenure) in 6/2009.

9/1999—9/2003

Delta Technology Associates, Palo Alto, CA
Founding Partner

Engineering consulting group founded by three Stanford University colleagues. Projects included embedding a GPS receiver in a cell-phone battery pack, improving the dynamic response of a chemical (NOx) sensor through System Identification, and the system design and implementation of a medium-scale terrestrial autonomous robot for a Fortune 500 company.

9/1995—4/2002

Stanford University, Palo Alto, CA
Research Assistant

Research on Robust Control and System Identification leading to Ph.D. thesis on the control of an autonomous full-scale catamaran. Developed and experimentally validated generalized algorithms for solving for attitude from vector observations in the quaternion domain. Developed and experimentally validated generalized calibration algorithms for any three-axis sensor without a truth reference. Developed robust controllers and experimentally demonstrated unmanned farm vehicle guidance to better than 3 cm., 400% better than an expert human driver.

9/1990—8/1992

Schlumberger Wireline Logging and Testing, Montrouge, France
Field Engineer

Provided oil field services for a variety of clients in Algeria, Nigeria, Cameroon, Cote d'Ivoire, France and Italy.

EDUCATION

9/1995—4/2002

Stanford University, Palo Alto, CA
Ph.D.: ***School of Engineering—Department of Aeronautics and Astronautics***

Thesis: *System Identification for Precision Control of a WingSailed GPS-Guided Catamaran*
Awarded the **William F. Ballhaus Prize** for best Aeronautics/Astronautics Ph.D. Thesis for 2002.
Conceived, designed, analyzed, implemented and built a wing-sailed full-scale catamaran which demonstrated autonomous control to better than 0.3 meters. Project included structural analysis and aerodynamic design of symmetric wing-sail section, implementing a real time control system with over 17 different sensors, 9 microcontrollers, and a high speed serial (CAN) bus link to the subsystems. Programmed over 80,000 lines of C-code on Pentium computer and 8051-derivative microcontrollers. Implemented prototype based on a 19' Prindle catamaran.

9/1993—6/1995

Stanford University, Palo Alto, CA
MSE: ***School of Engineering—Department of Aeronautics and Astronautics***

Received June 1995. GPA 3.92/4.0.
Coursework includes: Optimal Control, Robust Control, Convex Optimization, Non-linear Control, Optimal Estimation, Digital Filtering, Neural Networks, Digital Control, Radio-Navigation, Satellite Navigation, Aircraft Propulsion, Aircraft Structures, Smart Product Design, Flight Mechanics, Aeroelasticity, Feedback Control of Aircraft and Spacecraft, Composite Structures.

9/1985—6/1990

Princeton University, Princeton, NJ
BSE: ***School of Engineering—Mechanical and Aerospace Engineering,*** Received June 1990

SPECIAL SKILLS

Private Pilot, Open Water Diver, Hang Gliding (III), Bujinkan (Ni-Dan), Photography/Video, Fluent in Portuguese, verbal skills in Hebrew, Italian, and French.

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AWARDS

Committee on Teaching Excellence in Teaching Award, 2011-2012. Campus wide teaching award by student nomination and Committee on Teaching selection.

Education Award, "Slug-o-Lete: UCSC Mechatronics 2011," MakerFaire 2011, San Mateo, CA, May 21-22. Awarded to 10 best educational projects presented at MakerFaire.

AIAA Model-based Aerospace Challenge (MACH-1) Contest, 3rd place finish, 2008. Led a team of 3 engineering graduate students in the control design contest of a Mars flyer.

CyberSlug Excellence In Teaching Award, 2007-2008, awarded annually by graduating student vote for best teaching in School of Engineering.

CyberSlug Excellence In Teaching Award, 2006-2007, awarded annually by graduating student vote for best teaching in School of Engineering.

William F. Ballhaus Prize, awarded annually for best Ph.D. thesis in the Aeronautics and Astronautics department. Winner, 2002, for "*GPS-based System Identification for Precision Control of a WingSailed Catamaran*."

PUBLICATIONS

Choi, J., Curry, R., **Elkaim, G.**, "Minimizing maximum curvature of quadratic Bézier curves with a tetragonal concave polygonal boundary constraint," *Journal of Computer Aided Design*, Vol. 44, No. 4, April 2012, pp. 311-319, doi:10.1016/j.cad.2011.10.008

Lizarraga, M., Curry, R., **Elkaim, G.**, "Reprogrammable UAV Autopilot System (Part 2)—Testing and Results," Circuit Cellar Magazine, Vol. 250, May 2011, pp. 36-43. [not peer reviewed]

Lizarraga, M., Curry, R., **Elkaim, G.**, "Reprogrammable UAV Autopilot System (Part 1)—System Hardware and Software," Circuit Cellar Magazine, Vol. 249, April 2011, pp. 24-35. [not peer reviewed]

Vasconcelos, J., **Elkaim, G.**, Silvestre, C., Oliveira, P., Cardeira, B., "Geometric Approach to Strapdown Magnetometer Calibration in Sensor Frame," *IEEE Transactions on Aerospace Electronic Systems*, Vol. 47, No. 2, April 2011, pp. 1293-1306, doi:10.1109/TAES.2011.5751259.

Choi, J., Curry, R., **Elkaim, G.**, "Continuous Curvature Path Generation Based on Bezier Curves for Autonomous Vehicles," IAENG *International Journal of Applied Mathematics*, Vol. 40, No. 2, May 2010, pp. 91-101.

Elkaim, G. H., "System Identification based Control of an Unmanned Autonomous Wind-Propelled Catamaran," *Control Engineering Practice,* Vol. 17, No. 1, January 2009, pp. 158-169, doi:10.1016/j.conengprac.2008.05.014.

Elkaim, G. H., "Airfoil Section Design and Configuration Analysis of a Free-Rotating Wing-Sail for an Autonomous Marine Surface Vehicle," *AIAA Journal of Aircraft*, Vol. 45, No. 6, November/December 2008, pp. 1835-1852, doi:10.2514/1.27284

Elkaim, G. H., Foster, C., "Extension of a Non-Linear, Two-Step Calibration Methodology to Include Non-Orthogonal Sensor Axes," *IEEE Transactions on Aerospace Electronic Systems*, Vol. 44, No. 3, July 2008, pp. 1070-1078, doi:10.1109/TAES.2008.4655364

Gebre-Egziabher, D., **Elkaim, G. H.**, "MAV Attitude Determination from Observations of Earth's Magnetic and Gravity Field Vectors," *IEEE Journal of Aerospace Electronic Systems*, Vol. 44, No. 3, July 2008, pp. 1012-1028, doi:10.1109/TAES.2008.4655360

Elkaim, G. H., "The Atlantis Project: A GPS-Guided Wing-Sailed Autonomous Catamaran," Navigation, *Journal of the Institute of Navigation*, Vol. 53, No. 4, Winter 2006, pp. 237-247.

Elkaim, G. Decker, E., Oliver, G., Wright, B., "Go Deep: Marine Mammal Marker for At-Sea Monitoring," *GPS World*, Cover Story, Vol. 18, No. 8, Aug. 2006, pp. 30-33. [not peer reviewed]

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PUBLICATIONS (CON'T)

Gebre-Egziabher, D., **Elkaim, G. H.**, "Calibration of Strapdown Magnetometers in the Magnetic Field Domain," *ASCE Journal of Aerospace Engineering*, Vol. 19, No. 2., April 2006, pp. 1-16

Elkaim, G. H., "An Autonomous Wing-Sailed Catamaran, Part II: Wingsail Construction" Catalyst, *Journal of the Amateur Yacht Research Society,* Vol. 17, Sept. 2004, pp. 28-35. [not peer reviewed]

Elkaim, G. H., "An Autonomous Wing-Sailed Catamaran," Catalyst, *Journal of the Amateur Yacht Research Society,* Vol 16, April 2004, pp. 21-36. [not peer reviewed]

Elkaim, G. H., Parkinson, B. W., "System Identification for Precision Control of a GPS-Autonomous Catamaran," *Journal of Gyroscopy and Navigation*, Vol 36, No. 1, 2002, pp. 75-87. [in Russian]

T. Bell, M. O'Connor, **G. Elkaim**, B. Parkinson, "Realistic Autofarming: Closed-Loop Tractor Control over Irregular Paths using Kinematic GPS," *Journal of Navigation*, Vol. 51, No. 3 1998, pp. 327-335

O'Connor, M. L., **Elkaim, G. H.**, and Parkinson, B. W., "Carrier Phase DGPS for Closed-Loop Control of Farm and Construction Vehicles," Navigation, *Journal of the Instititute of Navigation*, Vol 43, No. 2, Summer 1996, pp. 167-178.

PATENTS

"Method and system for automatic control of vehicles based on carrier phase differential GPS," Parkinson, B. W., O'Connor, M. L., **Elkaim, G. H.**, and Bell, T., *United States Patent #6,052,647*, granted April 18, 2000.

BOOK CHAPTERS

Elkaim, G., Lie, F. A., and Gebre-Egziabher, D., "Principles of Guidance, Navigation and Control of UAVs," in *Handbook of Unmanned Aerial Vehicles*, ISBN 978-90-481-9708-8, Springer, July 2013

Choi, J., Curry, R., **Elkaim, G.**, "Piecewise Bezier Curves Path Planning with Continuous Curvature Constraint for Autonomous Driving, Machine Learning and Systems Engineering," *Lecture Notes in Electrical Engineering* 68, Springer Science+Business Media B.V., 2010.

Choi, J., Curry, R., **Elkaim, G.**, "Path Planning based on Bezier Curve for Autonomous Ground Vehicles," in *Proceedings of the Advances in Electrical and Electronics Engineering* - IAENG Special Edition of the World Congress on Engineering and Computer Science 2008 (WCECS 2008), pp. 158-166, IEEE Computer Society 2009, doi:10.1109/WCECS.2008.27

Parkinson, B. W., Spilker, J. J., and **Elkaim, G. H.**, "Global Navigation Satellite System," *Encyclopedia of Space Science and Technology*, Wiley and Sons, 2003. pp. 730-759.

CONFERENCE PAPERS (PEER REVIEWED)

Lizarraga, M., **Elkaim, G.**, Curry, R., "SLUGS UAV: A Flexible and Versatile Hardware/Software Platform for Guidance Navigation and Control Research," Invited Tutorial Session, *Airborne Experimental Test Platforms: From Theory to Flight*, American Control Conference, ACC13, Washington D.C., 17-19 June 2013, submitted

Lizarraga, M., Curry, R., **Elkaim, G.**, "Flight Test Results for An Improved Line of Sight Guidance Law for UAVs" American Control Conference, ACC13, Washington D.C., 17-19 June 2013, submitted

Mairs, B., **Elkaim, G.**, "SeaSlug: A High-Uptime, Long-Deployment Marine Sensor Platform" American Control Conference, ACC13, Washington D.C., 17-19 June 2013, submitted

CONFERENCE PAPERS (CON'T)

Curry, R., Lizarraga, M., **Elkaim, G.**, Mairs, B., "L_2+, an Improved Line of Sight Guidance Law for UAVs" American Control Conference, ACC13, Washington D.C., 17-19 June 2013, submitted

Loh, J., **Elkaim, G.**, "Roughness Map for Autonomous Rovers" American Control Conference, ACC13, Washington D.C., 17-19 June 2013, submitted

Elkaim, G., "Misalignment Calibration Using Body Frame Measurements" American Control Conference, ACC13, Washington D.C., 17-19 June 2013, submitted

Williams T., Wolfe L., Davis T., Kendall T., Richter B., **Elkaim G.**, Wilmers C., "Energetics and mechanics of mountain lions: a step by step analysis for carnivore conservation," *Integrative and Comparative Biology*, Vol. 52, Supplement 1, April 2012, pp. E193-E193, doi:10.1093/icb/ics078

Gottlieb, J., Graham, R., Maughan, T., Py, F., Ryan, J., **Elkaim, G.**, Rajan, K., "An Experimental Momentum-based Front Detection for Autonomous Underwater Vehicles," IEEE Conference on Robotics and Automation, 2012, ICRA 2012, St. Paul, MN, USA, May, 2012, pp. 5322-5327.\, doi:10.1109/ICRA.2012.6225115

Elkaim, G., "A Hole in One: A Project-Based Class on Mechatronics," IEEE Conference on Microelectronic Systems Education, 2011, MSE 2011, San Diego, CA, USA, June 5-6, 2011, pp. 35-38, doi:10.1109/MSE.2011.5937086

Choi, J., Curry, R., **Elkaim, G.**, "Curvature-Continuous Trajectory Generation with Corridor Constraint for Autonomous Ground Vehicles," The 49th IEEE Conference on Decision and Control, *CDC 2010*, Atlanta, Georgia, USA, Dec. 15-17, 2010, pp. 7166-7171, doi:10.1109/CDC.2010.5718154

Choi, J., Curry, R., **Elkaim, G.**, "Real-Time Obstacle Avoiding Path Planning for Mobile Robots," AIAA Guidance, Navigation and Control Conference, *AIAA GNC 2010*, Toronto, Ontario, Canada, Aug. 2-5, 2010.

Curry, R., Lizarraga, **Elkaim, G.**, "The Design of Rapidly Reconfigurable Filters for Attitude and Position Determination " AIAA Infotech Conference, Atlanta, GA, Apr. 20-22, 2010

Choi, J., Curry, R., **Elkaim, G.**, "Smooth Path Generation Based on Bezier Curves for Autonomous Vehicles," World Congress on Engineering and Computer Science, *WCECS 2009*, San Francisco, CA, Oct. 20-22, 2009. (*Best Student Paper*)

Muldoon, A., **Elkaim, G**., and Wheeden, B, "Improved Orbital Debris Trajectory Estimation Based on Sequential TLE Processing," 60th International Astronautical Congress, *IAC2009*, Daejeon, Korea, Oct. 16-19, 2009

Lizarraga, M., **Elkaim, G.**, Horn, G., Curry, R., Dobrokhodov, V., and Kaminer, I., "Low Cost Rapidly Reconfigurable UAV Autopilot for Research and Development of Guidance, Navigation and Control Algorithms," International Conference on Mechatronic and Embedded Systems and Applications, *ASME/IEEE MESA09*, San Diego, CA, Aug. 30-Sept. 2, 2009.

Choi, J., Curry, R., and **Elkaim, G.**, "Collision Free Real-Time Motion Planning for Omnidirectional Vehicles," European Control Conference, *ECC'09*, Budapest, Hungary, Aug. 23-26, 2009

Choi, J., Curry, R., and **Elkaim, G.**, "Obstacle Avoiding Real-Time Trajectory Generation of Omnidirectional Vehicles," American Control Conference, *ACC 2009*, St. Louis, MI, June 10-12, 2009, pp. 5510-5515, doi:10.1109/ACC.2009.5160683

Lizarraga, M., Dobrokhodov, V., **Elkaim, G.**, Curry, R., and Kaminer, I., "Simulink Based Hardware-in-the-Loop Simulator for Rapid Prototyping of UAV Control Algorithms," AIAA Infotech Conference, Seattle, WA, Apr. 6-9, 2009

Ilstrup, D., Lizarraga, M., **Elkaim, G.**, and Davis, J., "Aerial Photography using a Nokia N95," World Congress on Engineering and Computer Science, *WCECS2008*, San Francisco, CA, Oct. 22-24, 2008 (*Certificate of Merit Award*)

CONFERENCE PAPERS (CON'T)

Choi, J., **Elkaim, G.**, "Bézier Curves for Trajectory Guidance," World Congress on Engineering and Computer Science, *WCECS2008*, San Francisco, CA, Oct. 22-24, 2008 (*Best Student Paper*)

Elkaim, G., and Boyce, C. O., "Energy Scavenging and Aerodynamic Performance of a Rigid Wing Propulsion System for an Autonomous Surface Vessel," ION Global Navigation Satellite Systems Conference, *ION GNSS 2008*, Savannah, GA, Sept. 16-19, 2008

Muldoon, A., and **Elkaim, G.**, "Improved Orbit Estimation using GPS Measurements for Conjunction Analysis," ION Global Navigation Satellite Systems Conference, *ION GNSS 2008*, Savannah, GA, Sept. 16-19, 2008

Connors, J., and **Elkaim, G.**, "Trajectory Generation and Control Methodology for an Autonomous Ground Vehicle," AIAA Guidance, Navigation and Control Conference, *AIAA GNC 2008*, Honolulu, HI, Aug. 18-21, 2008

Elkaim, G., Choi, J., Garalde, D., and Lizarraga, M., "MACH-1: Control System Modeling and Design for a Mars Flyer," AIAA Guidance, Navigation and Control Conference, *AIAA GNC 2008*, Honolulu, HI, Aug. 18-21, 2008

Ilstrup, D., **Elkaim, G.**, "Low Cost, Low Power Structured Light Based Obstacle Detection," ION/IEEE Position, Location, and Navigation Symposium, *ION/IEEE PLANS 2008*, Monterey, CA, May 5-8, 2008, pp. 865-870

Elkaim, G. Decker, E., Oliver, G., Wright, B., "Initial Results from an In-Situ Environmental Monitoring Marine Mammal Tag," ION/IEEE Position, Location, and Navigation Symposium, *ION/IEEE PLANS 2008*, Monterey, CA, May 5-8, 2008, pp. 912-922, doi:10.1109/PLANS.2008.4570033

Lizarraga, M., **Elkaim, G**., "Spatially Deconflicted Path Generation for Multiple UAVs in a Bounded Airspace," ION/IEEE Position, Location, and Navigation Symposium, *ION/IEEE PLANS 2008*, Monterey, CA, May 5-8, 2008, pp. 1213-1218, doi:10.1109/PLANS.2008.4570041

Elkaim, G., Lizarraga, M., Pedersen, L., "Comparison of Low-Cost GPS/INS Sensors for Autonomous Vehicle Applications," ION/IEEE Position, Location, and Navigation Symposium, *ION/IEEE PLANS 2008*, Monterey, CA, May 5-8, 2008, pp. 1133-1144, doi:10.1109/PLANS.2008.4570000

Vasconcelos, J., **Elkaim, G.**, Silvestre, C., Oliveira, P., Cardeira, B., "A Geometric Approach to Strapdown Magnetometer Calibration in Sensor Frame," IFAC Workshop on Navigation, Guidance, and Control of Underwater Vehicles, *IFAC NGCUV 2008*, Ireland, Apr. 8-10, 2008.

Ilstrup, D., **Elkaim, G.**, "Single Frame Processing for Structured Light Based Obstacle Detection," ION National Technical Meeting, *ION NTM 2008*, San Diego, CA, Jan. 28-30, 2008, pp. 514-520

Connors, J., **Elkaim, G.**, "Experimental Results for Spline Based Obstacle Avoidance of an Off-Road Ground Vehicle," ION Global Navigation Satellite Systems Conference, *ION GNSS 2007*, Fort Worth, TX, Sept. 25-28, 2007, pp. 1484-1490

Elkaim, G., Boyce, C. O., "Experimental Validation of GPS-Based Control of an Unmanned Wing-Sailed Catamaran," ION Global Navigation Satellite Systems Conference, *ION GNSS 2007*, Fort Worth, TX, Sept. 25-28, 2007, pp. 1950-1956

Boyce, C. O., **Elkaim, G.**, "Control System Performance of an Unmanned Wind-Propelled Catamaran," IFAC Conference on Control Applications in Marine Systems, *IFAC CAMS 2007*, Bol, Croatia, Sept. 19-21, 2007

Elkaim, G., Boyce, C. O., "Experimental Aerodynamic Performance of a Self-Trimming Wing-Sail for Autonomous Surface Vehicles," IFAC Conference on Control Applications in Marine Systems, *IFAC CAMS 2007*, Bol, Croatia, Sept. 19-21, 2007

Connors, J., **Elkaim, G.**, "Analysis of a Spline Based, Obstacle Avoiding Path Planning Algorithm," IEEE Vehicle Technology Conference, *IEEE VTC 2007*, Dublin, Ireland, Apr. 22-25, 2007, pp. 2565-2569, doi:10.1109/VETECS.2007.528

CONFERENCE PAPERS (CON'T)

Connors, J., **Elkaim, G.**, "Manipulating B-Spline Based Paths for Obstacle Avoidance in Autonomous Ground Vehicles," ION National Technical Meeting, *ION NTM 2007*, San Diego, CA, Jan. 22-24, 2007, pp. 1081-1088

Elkaim, G., Foster, C., "Sensor Stability of a Low-Cost Attitude Sensor Suitable for Micro Air Vehicles," ION National Technical Meeting, *ION NTM 2007*, San Diego, CA, Jan. 22-24, 2007, pp. 756-770

Elkaim, G., Kelbley, R., "Station Keeping and Segmented Trajectory Control of a Wind-Propelled Autonomous Catamaran," IEEE Conference on Decision and Control, *IEEE CDC 2006*, San Diego, Dec. 13-15, 2006, pp. 2424-2429, doi:10.1109/CDC.2006.377466

Elkaim, G., Kelbley, R., "Direct Measurement Based H-infinity Controller Synthesis for an Autonomous Surface Vehicle," Proceedings of the ION Global Navigation Satellite Systems Conference, *ION GNSS 2006*, Fort Worth, TX, Sept. 22-24, 2006, pp. 1973-1982 (*Best Presentation Award*)

Elkaim, G., Connors, J., and Nagel, J., "The Overbot: An Off-Road Autonomous Ground Vehicle Testbed," Proceedings of the ION Global Navigation Satellite Systems Conference, *ION-GNSS 2006*, Fort Worth, TX, Sept. 22-24, 2006, pp. 1449-1456

Elkaim, G., Foster, C., "Development of the Metasensor: A Low-Cost Attitude Heading Reference System for use in Autonomous Vehicles," Proceedings of the ION Global Navigation Satellite Systems Conference, *ION-GNSS 2006*, Fort Worth, TX, Sept. 22-24, 2006, pp. 1124-1135.

Elkaim, G., Kelbley, R.., "Control Architecture for Segmented Trajectory Following of a Wind-Propelled Autonomous Catamaran," Proceedings of the AIAA Guidance, Navigation, and Control Conference, *AIAA GNC 2006*, Keystone, CO, Aug. 24-26, 2006.

Elkaim, G., Woodley, B., Kelbley, R.., "Model Free Subspace H-infinity Control for an Autonomous Catamaran," Proceedings of the ION/IEEE Position, Location, and Navigation Symposium, *ION/IEEE PLANS 2006*, San Diego, CA, Apr. 25-27, 2006, pp. 1005-1013, doi:10.1109/PLANS.2006.1650702

Elkaim, G. Decker, E., Oliver, G., Wright, B., "Marine Mammal Marker (MAMMARK) Dead Reckoning Sensor for In-Situ Environmental Monitoring," Proceedings of the ION/IEEE Position, Location, and Navigation Symposium, *ION/IEEE PLANS 2006*, San Diego, CA, Apr. 25-27, 2006, pp. 976-987, doi:10.1109/PLANS.2006.1650699

Elkaim, G. H., Kelbley, R. J., "A Lightweight Formation Control Methodology for a Swarm of Non-Holonomic Vehicles," *IEEE Aerospace Conference*, Big Sky, MT, March 4-11, 2006, doi:10.1109/AERO.2006.1655803

Elkaim, G. H., Decker, E., Oliver, G., and Wright, B., "Development of a Marine Mammal Marker (MAMMARK) for In-Situ Environmental Monitoring," Institute of Navigation National Technical Meeting, *ION NTM 2006*, Monterey, CA, January 18-20, 2006, pp. 206-216

Elkaim, G. H., Kelbley, R. J., "Extension of a Lightweight Formation Control Methodology to Groups of Autonomous Vehicles," 8th International Symposium on Artificial Intelligence, Robotics and Automation in Space, *iSAIRAS 2005*, Munich, Germany, Sept. 5-9, 2005.

Elkaim, G. H., Siegel, M., "A Lightweight Control Methodology for Formation Control of Vehicle Swarms," 16th IFAC World Congress, *IFAC 2005*, Prague, Czech Republic, July 4-8, 2005.

Elkaim, G. H., Parkinson, B. W., "System Identification for Precision Control of a GPS-Autonomous Catamaran," *8th International St. Petersburg Conference on Integrated Navigation Systems (IEEE/AIAA)*, St.Petersburg, Russia, May 27-31, 2001.

Gebre-Egziabher, **Elkaim, G.H.**, D., Powell, J.D., Parkinson, W.B., "A Non-Linear, Two-Step Estimation Algorithm for Calibrating Solid-State Strapdown Magnetometers," *8th International St. Petersburg Conference on Navigation Systems (IEEE/AIAA)*, St. Petersburg, Russia, May 27-31, 2001.

CONFERENCE PAPERS (CON'T)

Gebre-Egziabher, D., **Elkaim, G.H.**, Powell, J.D., Parkinson, W.B., "A Gyro-Free Quaternion-Based Attitude Determination System Suitable for Implementation using Low-Cost Sensors," IEEE Position Location and Navigations Symposium, *IEEE PLANS 2000*, San Diego, CA, Mar. 13-16, 2000, pp. 185-192, doi:10.1109/PLANS.2000.838301

Bell, T., O'Connor, M. L., **Elkaim, G. H**., "Realistic Autofarming: Closed-Loop Tractor Control over Irregular Paths using Kinematic GPS," ION Global Positioning System Conference, *ION GPS 1998*, Nashville, TN, Sept. 15-18, 1998.

Elkaim, G.H., O'Connor, M.L., Parkinson, W.B., "System Identification and Robust Control of Farm Vehicles using CDGPS," ION Global Positioning System Conference, *ION GPS 1997*, Kansas City, MO, Sept. 16-19, 1997, pp. 1415-1426.

Evans, J., **Elkaim, G. H.**, Lo, S., and Parkinson, B. W., "System Identification of an Autonomous Aircraft Using GPS," ION Global Positioning System Conference, *ION GPS 1997*, Kansas City, MO, Sept. 16-19, 1997, pp. 1065-1074.

O'Connor, M., **Elkaim, G. H.**, Bell, T., and Parkinson, B. W., "Real-Time CDGPS Initialization for Land Vehicles Using a Single Pseudolite," ION National Technical Meeting, *ION NTM 1997*, Santa Monica, CA, Jan. 14-16, 1997, pp. 717-730.

Elkaim, G. H., O'Connor, M., Bell, T., and Parkinson, B. W., "System Identification of a Farm Vehicle Using Carrier-Phase Differential GPS," ION Global Positioning System Conference, *ION GPS 1996*, Kansas City, MO, Sept. 17-20, 1996, pp. 485-494.

O'Connor, M., Bell, T., **Elkaim, G. H.**, and Parkinson, B. W., "Automatic Steering of Farm Vehicles Using GPS," *3rd International Conference on Precision Agriculture*, Minneapolis, Minnesota, June 1996.

O'Connor, M., **Elkaim, G. H.**, and Parkinson, B. W., "Kinematic GPS for Closed-Loop Control of Farm and Construction Vehicles," ION Global Positioning System Conference, *ION GPS 1995*, Palm Springs, CA, Sept. 12-15, 1995, pp.1261-1268

Cohen, Cobb, Lawrence, Pervan, Barrows, O'Connor, Gromov, **Elkaim**, Christie, Powell, Parkinson, et. al., "Automatic Landing of a 737 using GNSS Integrity Beacons," *International Symposium on Precision Approach*, Braunschweig Germany, February 1995.

ADDITIONAL PAPERS

Elkaim, G., "A Technological Approach to RealTime Course Recording," UC Santa Cruz Faculty Focus, Vol. 11:1, Spring 2005, pp. 1,4.

Elkaim, G., "An Autonomous Wing-Sailed Catamaran: Ph.D. Thesis," Newsletter of the Junk Rig (and Advanced Cruising Rig) Association, Issue #44, Jan. 2005

MEMBERSHIPS

IEEE, **AIAA, ION**, **AYRS**, **PRA**, **EAA**