

M. Alba Pérez Gracia

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Education

3/99 – 9/03 Ph. D. Mechanical Engineering, Department of Mechanical and Aerospace Engineering, University of California, Irvine, CA, USA.
9/97 – 3/99 Masters of Science, Mechanical Engineering, Department of Mechanical and Aerospace Engineering, Univ. of California, Irvine, CA, USA.
9/86 – 1/97 Bachelor of Science, Industrial Engineering (BSIE 1996), specialized in Mechanical Engineering, ETSEIB, Universitat Politècnica de Catalunya, (*BarcelonaTech*), Barcelona, Spain.

Experience

07/04 – present Assistant Professor -- Department of Mechanical Engineering, College of Science and Engineering, Idaho State University.
11/08 – 08/11 Ramon y Cajal Researcher – Institut de Robòtica i Informàtica Industrial, UPC-CSIC, Barcelona, Spain.
11/03 – 07/04 Postgraduate Researcher -- Robotics and Automation Laboratory, UCI: applied research in kinematic synthesis. Professor J. M. McCarthy.
3/97 – 8/97 Design Engineer -- MAI, United Technologies Automotive. Design of housings for electrical automotive components. Contact address: Ctra. Igualada, km 1,5 Pol. Industrial - P.O. Box 106, 43800 Valls (Spain).
12/96 – 3/97 Design Engineer -- Bitron Industrie España, S.A. Design of temperature and pressure sensors for appliances and automotive industry. Contact address: Bitron Industrie España, C/ Ifni, 24 30, 08930 Sant Adria del Besos, Barcelona (Spain).
1/94 – 6/96 Planning engineer -- Waste Agency, Departament de Medi Ambient, Catalonia, Spain. Supervisor: Mr. Carles Viñolas, head of the Planning Department. Development of the regional planning for the minimization, recycling and disposal of the industrial waste. Contact address: C/ Doctor Roux, 80, 08017 Barcelona (Spain).

Publications

Refereed Journal Articles

1. Perez Gracia, A., "Synthesis of Spatial RPRP Closed Linkages for a Given Screw System", *ASME Journal of Mechanisms and Robotics*, 3(2), 2011.

2. Sato, C., Martinez, R.G., Shields, M.S., Perez Gracia, A., and Schoen, M.P., "Behavior of Microbial Fuel Cell in a Startup Phase", *Int. Journal of Environmental Engineering*, 1(1):36-51, 2009.
3. Lai, J.C.K., Schoen, M.P., Perez Gracia, A., Naidu, D.S., and Leung, S.W., "Prosthetic Devices: Challenges and Implications of Robotic Implants and Biological Interfaces", *Proc. of the Institution of Mechanical Engineers, Vol. 221, Part H: Journal of Engineering in Medicine, Special Issue on Micro and Nano Technologies in Medicine*, 210:173-183. London, UK, 2007.
4. Perez Gracia, A. and McCarthy, J.M., "The Kinematic Synthesis of Spatial Serial Chains Using Clifford Algebra Exponentials", *Proceedings of the Institution of Mechanical Engineers, Part C, Journal of Mechanical Engineering Science*, 220(7): 953-968, 2006.
5. Perez, A. and McCarthy, J.M., "Clifford Algebra Exponentials and Planar Linkage Synthesis Equations", *ASME Journal of Mechanical Design*, 127(5): 931-940, September 2005.
6. Perez, A. and McCarthy, J.M., "Geometric Design of RRP, RPR and PRR Serial Chains", *Mechanism and Machine Theory*, 40(11):1294-1311, November 2005.
7. Perez, A. and McCarthy, J.M., "Dual Quaternion Synthesis of Constrained Robotic Systems", *ASME Journal of Mechanical Design*, 126(3): 425-435, 2004.
8. Perez, A. and McCarthy, J.M., "Dimensional Synthesis of Bennett Linkages," *ASME Journal of Mechanical Design*, 125(1): 98-104, March 2003.
9. Collins, C.L., McCarthy, J.M., Perez, A. and Su, H., "The Structure of an Extensible Java Applet for Spatial Linkage Synthesis," *ASME Journal of Computing and Information Science and Engineering*, 2(1): 45-49, 2002.
10. Perez, A. and McCarthy, J.M., "Bennett's Linkage and the Cylindroid," *Mechanism and Machine Theory*, 37(11): 1245-1260, November 2002.

Refereed Conference Proceedings:

11. Simo-Serra, E., Perez-Gracia, A., Moon, H. and Robson, N., "Design of Multifingered Robotic Hands for Finite and Infinitesimal Tasks Using Kinematic Synthesis", *submitted to the 2012 IEEE International Conference on Robotics and Automation*.
12. Simo-Serra, E., Moreno-Noguer, F., and Perez-Gracia, A., "Design of Non-anthropomorphic Robotic Hands for Anthropomorphic Tasks", *ASME International Design Engineering Technical Conferences, IDETC 2011*, Washington DC, USA, August 29-31, 2011.
13. Wolbrecht, E.T., Reinkensmeyer, D.J., and Perez-Gracia, A., "Single Degree-of-Freedom Exoskeleton Mechanism Design for Finger and Thumb Rehabilitation", *ICORR 2011: Int. Conference on Rehabilitation Robotics*, Zurich, Switzerland, June 29-July 1, 2011.
14. Sands, D., Perez Gracia, A., McCormack, J., and Wolbrecht, E.T., "Design of a Scalable Mechanism for Finger Rehabilitation", *15th IASTED International Conference on Robotics and Applications*, Cambridge, MA, USA, November 1-3, 2010.
15. Crawford, A.L., Molitor, J., Perez Gracia, A., and Chiu, S., "Design of a Robotic Hand and Simple EMG Input Controller with a Biologically-Inspired Parallel Actuation System for Prosthetic Applications", *1st International Conference on Applied Bionics and Biomechanics (ICABB)*, Venice, Italy, October 14-16, 2010.
16. Perez Gracia, A., "Synthesis of Spatial RPRP Loops for a Given Screw System", *Proc. of the EuCoMeS, 3rd European Conference on Mechanism Science*, Cluj-Napoca, Romania, September 14-18, 2010.
17. Crawford, A.L., and Perez Gracia, A., "Design of a Robotic Hand with a Biologically-Inspired Parallel Actuation System for Prosthetic Applications", *Proc. of the ASME 2010 International Design Engineering Technical Conferences (IDETC/CIE 2010)*, Montreal, Quebec, Canada, August 15-18, 2010.
18. Chen, C.-H., Naidu, D. S., Perez Gracia, A., and Schoen, M. P., "A hybrid adaptive control strategy for a smart prosthetic hand", *31st Annual International Conference of the*

- IEEE Engineering in Medicine and Biology Society Conference (IEEE EMBC'09)*, Minneapolis, Minnesota, USA, September, 2-6, pp. 5056-5059, 2009.
19. Chen, C-H., Naidu, D.S., Perez, A., and Schoen, M.P., "Fusion of Hard and Soft Control Techniques for Prosthetic Hand", *Proceedings of the IASTED International Conference on Intelligent Systems and Control (ISC 2008)*, Orlando, FL, USA, November 16-18, 2008.
 20. Chen, C-H., Bosworth, K.W., Schoen, M.P., Bearden, S.E., Naidu, D.S., and Perez, A., "A Study of Particle Swarm Optimization on Leukocyte Adhesion Molecules and Control Strategies for Smart Prosthetic Hand", *IEEE Swarm Intelligence Symposium*, St Louis, MO, September 21-23, 2008.
 21. Knight, B.M., Schoen, M.P., and Perez Gracia, A., "Distributed Actuation and Shape Control of Ionic Polymer Metal Composites", *Proc. of IMECE, Int. Mechanical Engineering Congress and Exposition*, Chicago, IL, November 2006.
 22. Duraisamy, K., Perez Gracia, A. and Schoen, M.P., "Vision-Based Kinematic Synthesis of Hand Motion", *Proc. of IMECE, Int. Mechanical Engineering Congress and Exposition*, Chicago, IL, November 2006.
 23. Villa-Uriol, M.C., Perez Gracia, A. and Kuester, F., "Humanoid Synthesis Using Clifford Algebra", *2006 IEEE International Conference on Robotics and Automation*, Orlando, Florida, May 15-19, 2006.
 24. Duraisamy, K., Isebor, O., Perez, A., Schoen, M.P. and Naidu, D.S., "Kinematic Synthesis for Smart Hand Prosthetics", *BioRob 2006: 1st IEEE/RAS Int. Conf. on Biomedical Robotics and Biomechatronics*, Pisa, Italy, February 20-22, 2006.
 25. Soh, G.S., Perez Gracia, A. and McCarthy, J.M., "The Kinematic Synthesis of Mechanically Constrained Planar 3R Chains", *Proc. of the EuCoMeS, 1st European Conference on Mechanism Science*, Obergurgl, Austria, February 21-26, 2006.
 - 26.** Perez, A. and McCarthy, J.M., "Sizing a Serial Chain to Fit a Task Trajectory Using Clifford Algebra Exponentials", *2005 IEEE International Conference on Robotics and Automation*, April 18-22, 2005, Barcelona.
 27. Wolbrecht, E., Su, H.-J., Perez, A. and McCarthy, J.M. "Geometric Design Of Symmetric 3-RRS Constrained Parallel Platforms," *ASME International Mechanical Engineering Congress and Exposition*, Anaheim, CA, November 13-19, 2004.
 28. Perez, A., Su, H.J. and McCarthy, J.M., "Synthetica 2.0: Software for the Synthesis of Constrained Serial Chains", *2004 ASME Design Engineering Technical Conferences, Salt Lake City, September 2004*.
 29. Villa-Uriol, M.C., Kuester, F., Bagherzadeh, N., Perez, A. and McCarthy, J.M., "Kinematic Synthesis of Avatar Skeletons from Visual Data", *Advances in Robot Kinematics*, June 2004, J. Lenarcic and C. Galletti, eds., Kluwer Academic Publishing, 2004.
 30. Perez, A. and McCarthy, J.M., "Dimensional Synthesis of CRR Serial Chains", *ASME Design Engineering Technical Conferences*, Chicago, IL, September 2003.
 31. Perez, A. and McCarthy, J.M., "Dimensional Synthesis of RPC Serial Robots", *International Conference on Advanced Robotics, ICAR 2003*, Coimbra, Portugal, June 2003.
 32. Perez, A. and McCarthy, J.M., "Dual Quaternion Synthesis of a Parallel 2-TPR Robot," *Proc. of the Workshop on Fundamental Issues and Future Research Directions for Parallel Mechanisms and Manipulators*, October 3-4, 2002, Quebec City, Quebec, Canada.
 33. Perez, A., McCarthy, J.M. and Bennett, B., "Dual Quaternion Synthesis of Constrained Robots," *Advances in Robot Kinematics*, (J. Lenarcic and F. Thomas, eds.), pp. 443-452, Kluwer Academic Publ., Netherlands, 2002.
 34. Perez, A., and McCarthy, J.M., "Dimensional Synthesis of Bennett Linkages," *Proceedings of the ASME Design Engineering Technical Conferences*, Baltimore, MD, Sept. 10-13, 2000.
 35. Perez, A. and McCarthy, J.M., "Dimensional Synthesis of Spatial RR Robots," *Advances in Robot Kinematics*, (J. Lenarcic and M.M. Stanisic, eds.), pp. 93-102, Kluwer Academic Publ., Netherlands, June 2000.

Presentations and Invited Seminars:

- Invited seminar, Technical University of Catalonia (UPC), Barcelona, Spain, *Challenges in the Design of Better Prosthetic Hands*, February 2011.
- Invited seminar, Institut de Robotica i Informatica Industrial, Barcelona, Spain: *Open Problems in Kinematic Synthesis*, February 2009.
- Invited seminar, Mechanical Engineering Dept., Univ. of Utah: *Kinematic Synthesis Using Clifford Algebras: Theory and Applications*. Speaker: Alba Perez. October 2007.
- Tutorial, IEEE ICRA 2005 Conference: *Robot Design Using Mechanism Synthesis Theory*. Organizer: J.M. McCarthy. Speakers: J.M. McCarthy, Hai Jun Su, Alba Perez. April 2005.
- Tutorial, ASME DETC 2004 Conference: *Robot Design Using Mechanism Synthesis Theory*. Organizer: J.M. McCarthy. Speakers: J.M. McCarthy, Hai Jun Su, Alba Perez. September 2004.

Awards and Research Grants

Research Grants and Contracts:

- *Acciones Complementarias para Proyectos de Investigación Fundamental no Orientada 2011, Subprograma EXPLORA, Ministerio de Ciencia e Innovación, convocatoria 2011 (Spain)*, submitted April 2011: “PRO-FACES: Programmable Surfaces”, PI: Alba Pérez Gracia, research team: Federico Thomas Arroyo and Carme Torras Genis.
- *National Institute of Health, USA*: Sub-contract from project: “Determinants of the Effectiveness of Robot-Assisted Hand Movement Training”, PI: David Reinkensmeyer, 1-year (2010-2011) agreement: Alba Pérez Gracia, UPC, and sub-award holder Eric Wolbrecht, Univ.of Idaho.
- *Subprograma de proyectos de investigación fundamental no orientada del Ministerio de Ciencia e Innovación, convocatoria 2010 (Spain)*, September 2010 – September 2012: “An Extension of Branch and Prune Techniques for the Synthesis and Analysis of Motion of Complex Robotic Systems”, PI: Lluís Ros Giralt, research team: Alba Perez Gracia and 9 more.
- *US Army Medical Research and Materiel Command*, June 2010 – June 2012: “Smart Prosthetic Hand Technology”. PI: D. Subbaram Naidu, co-PIs: Jim Lai, Solomon Leung, Marco P. Schoen, Alba Perez Gracia, Alex Urfer and Steve Chiu.
- *US Army Medical Research and Materiel Command*, June 2007 – June 2009: “Smart Prosthetic Hand Technology”. PI: D. Subbaram Naidu, co-PIs: Jim Lai, Solomon Leung, Marco P. Schoen and Alba Perez Gracia.
- *CAES-LDRD*, April 2007 – September 2008 : “Development of Microbial Fuel Cell, fueled by domestic, agricultural, and food processing wastewaters”, PI: Dr Chikashi Sato, co-PIs: Malcolm Shields, Marco Schoen, Alba Perez-Gracia
- *NASA Idaho EPSCOR 2006-2007*: “Tumbleweed Microrobots Using Electroactive Polymers”, PI: Marco P. Schoen, co-PI: Brian Williams, Alba Perez Gracia.
- *ISU Faculty Research Committee Grant*, May 2005 - May 2007, project: “Use of Robot Synthesis Theory for Characterization of Protein Kinematics”. PI: Alba Perez Gracia.

Graduate Research Directed (Master’s Theses and PhD Dissertations)

- Yihun, Y., *Novel Prosthetic Hand Design*, PhD Dissertation, ISU, ongoing.

- Batbold, B., *Design of 1-dof Parallel Robots Using a Finite-Screw Description of their Workspace*, Master's Thesis, IRI, ongoing.
- A. Crawford, *Design of a Novel Hierarchical Prosthetic Hand Actuation System*, PhD Dissertation, ISU, April 2010.
- D. Alder, *Dynamic Simulation of a Human Hand for Prosthetic Applications*, Master's Thesis, ISU, February 2009.
- H. Ahsan, *3D Computer Vision System for Hand Joint Motion Calculation*, Master's Thesis, ISU, December 2008.
- K. Duraisamy, *Kinematic Synthesis for Smart Hand Prostheses*, Master's Thesis, ISU, December, 2006.
- R. Isaak, *A Study of Overconstrained Linkage Networks*, Master's Thesis, ISU, June, 2006.

Teaching Experience (ISU)

- Fall 2004, 2005, 2006, 2007, 2008, 2011 **Kinematics and Dynamics of Machinery:** Kinematic analysis and design of cams, gears, and linkages; velocity, acceleration and force analysis; kinematic synthesis; balancing; computer-aided analysis and synthesis. *College of Engineering, Idaho State University.*
- Fall 2004, 2005, 2006, 2008 **Measurement Systems Laboratory:** Principles of measurement, standards and accuracy, detectors and transducers, digital data acquisition, signal conditioning systems and devices, statistical concepts in measurement, experimental investigation of engineering systems. *College of Engineering, Idaho State University.*
- Fall 2005, 2007, 2011 **Robot Kinematics:** A graduate level course which introduces the students to several mathematical tools for robot analysis and design: homogeneous matrices, Lie algebras and Clifford algebras. . *College of Engineering, Idaho State University*
- Spring 2005, 2006, 2007 **Machine Design:** Design of mechanical components subject to static and fatigue loads. Design using screws, fasteners, springs, bearings, and welds. Computer-aided design using finite element methods. *College of Engineering, Idaho State University.*
- Spring 2005, 2006, 2008 **Mechatronics:** Basic kinematics, sensors, actuators, measurements, electronics, microprocessors, programmable logic controllers, feedback control, robotics and intelligent manufacturing. *College of Engineering, Idaho State University.*
- Spring 2006 **Statics:** Concepts of force vectors and equilibrium with emphasis on free body diagrams. Trusses, beams, frames, centroids, fluid statics, and friction. *College of Engineering, Idaho State University.*
- Spring 2007, 2008 **Symbolic Programming:** Introduces symbolic programming language, with emphasis on algebraic, calculus, and linear algebraic manipulations and visualization, with engineering applications. *College of Engineering, Idaho State University.*

Professional Activities and Affiliations

- Member of the American Society of Mechanical Engineers (ASME).
- Member of the Institute of Electrical and Electronic Engineers (IEEE).
- Associated Editor, *IFAC Mechatronics* journal (since 2010).
- Symposium co-organizer, ASME 2011 IDETC/CIE Conference (2011).

University Service Activities

- University Library Committee, Idaho State University, 2004-2005.
- Campus Planning Council, Idaho State University, 2005-2008.
- Research Coordinating Council, Idaho State University, 2006-2008.
- General Education Requirements Committee, Idaho State University, 2007-2008.