Veronica J. Santos

March 21, 2005

CONTACT INFORMATION

Address: Sibley School of Mechanical and Aerospace Engineering
Neuromuscular Biomechanics Laboratory
130 Upson Hall
Cornell University
Ithaca, New York 14853, USA
E-mail: vjl4@cornell.edu
Web: www.mae.cornell.edu/nmbl
Phone: (607) 255-0581 (office) (607) 255-1222 (fax)

EDUCATION

2001-present *Ph.D. candidate*, **Cornell University**, Ithaca, New York
- Mechanical and Aerospace Engineering with Biometry Minor

Jan. 2004 *M.S.*, **Cornell University**, Ithaca, New York
- Mechanical and Aerospace Engineering

1999 *B.S.*, **University of California, at Berkeley**, Berkeley, California
- Mechanical Engineering with Music Minor

RESEARCH INTERESTS

Bayesian methods, Clinical applications of biomechanical modeling; Computer modeling of biomechanical systems; Hand biomechanics; Markov Chain Monte Carlo simulations; Neuromuscular control of the hand; Robotics; Stochastic effects of anatomical variability and parameter uncertainty

RESEARCH AND PROFESSIONAL EXPERIENCE

Spring 2005 **Graduate Teaching Assistant**, "Mechanical Property and Performance Laboratory," Mechanical and Aerospace Engineering Department, *Cornell University*, Ithaca, NY
- Assisted with a 120-student undergraduate course emphasizing the integration of theory and experimental methods to determine material properties and mechanical behavior of materials.
- Taught lab sessions on techniques such as tensile testing and transducer construction.

Fall 2004 **Graduate Teaching Assistant**, "Modeling and Simulation of Mechanical and Aerospace Systems," Mechanical and Aerospace Engineering Department, *Cornell University*, Ithaca, NY

- Assisted with a 30-student undergraduate/ graduate course emphasizing the use of computational tools to analyze and simulate linear and nonlinear systems.
- Assisted with assignment preparation, grading, course website, interactive MATLAB simulation webserver for final project.
- http://mae.cornell.edu/mae479

Summer 2004 **Selected Participant**, First Motor Control Summer School held in Jim Thorpe, PA

- Selected as one of 30 advanced graduate students to attend an exclusive week-long course in motor control theory.

Spring 2004, Fall 2004 **Co-chair**, "Machines and Organisms Group: Locomotion and Manipulation" seminars, *Cornell University*, Ithaca, NY

- Organized weekly interdisciplinary seminars sponsored by the National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) Program.
- Arranged for multidisciplinary guest speakers from various universities.
- www.mae.cornell.edu/igert; www.mae.cornell.edu/igert/animals

Summer 2002 **Intern**, Immersion Term at the Laboratory for Biomedical Mechanics and Materials, *Hospital for Special Surgery*, New York, NY

- Analyzed failed orthopedic implants and studied the mechanics of soft tissue.
- Observed orthopedic surgical procedures and toured clinical and research laboratory facilities.

Feb. 2001- June 2001 **Research and Development Engineer**, *Guidant Corporation - Vascular Intervention*, Santa Clara, CA

- Designed and tested coronary stent delivery systems.
- Supervised a Research and Development Technician.

Feb. 2000- Feb. 2001 **Quality Engineer**, *Guidant Corporation - Vascular Intervention*, Santa Clara, CA

- Maintained compliance with regulatory requirements associated with coronary stents and stent delivery systems.

Summer 1999 **Intern**, *Lucile Packard's Children's Hospital, Rehabilitation Technology and Therapy Center*, Palo Alto, CA

- Designed and constructed strap-on-tray for disabled users of a communication device.
- Designed and constructed mock hallway structure for studies on walkers for disabled children.

Fall 1998, Summer 1998, Summer 1997 **Intern**, Robotics and Human Engineering Laboratory, *University of California, at Berkeley, Berkeley, CA*; Under the supervision of Professor Homayoon Kazerooni

- Designed chassis for embedded computer components and compact layout of those components for mounting within the chassis.
- Assembled pneumatic circuitry and wired electronic devices for pneumatics-powered human-assist lifting devices.

Summer 1997 **Intern**, Electro-Mechanical Design Laboratory, University *of California, at Berkeley*, Berkeley, CA; Under the supervision of Professor Dennis K. Lieu

- Performed experiments on the effectiveness of Taekwondo helmets.

Summer 1996 **AutoCAD Drafter**, *Fard Engineers, Inc.*, Walnut Creek, CA

- Revised mechanical, plumbing, and electrical plans for clients.

PUBLICATIONS

Peer-reviewed Journal Articles

1. Miller, A., Allen, P., **Santos, V. J.**, and Valero-Cuevas, F. J. "From robotic hands to human hands: A visualization and simulation engine for grasping research." *Industrial Robot 2005:32(1): pp. 55-63.*
2. **Santos, V. J.** and Valero-Cuevas, F. J. "Reported anatomical variability naturally leads to multimodal distributions of Denavit-Hartenberg parameters for the human thumb." *IEEE Transactions on Biomedical Engineering (In review).*
3. **Leong V. J.** "The physics of piano string vibrations." *California Engineer*, May 1999.

Manuscripts in Preparation

4. **Santos, V. J.**, Bustamante, C., and Valero-Cuevas, F. J. "Markov Chain Monte Carlo methods for searching large parameter spaces in musculoskeletal models of the human thumb in the presence of anatomical variability and parameter uncertainty."
   Target Journal: IEEE Transactions on Biomedical Engineering.

Peer-reviewed Conference Proceedings Articles (full-length abstracts)

5. **Santos, V. J.** and Valero-Cuevas, F. J. "A Bayesian approach to biomechanical modeling to optimize over large parameter spaces while considering anatomical variability." *Proceedings of the 26th Annual International Conference of the IEEE Engineering in Medicine and Biology Society,* San Francisco, CA, Sept. 2004. Podium presentation.
6. Miller, A., Allen, P., **Santos, V. J.**, and Valero-Cuevas, F. J. "From robotic hands to human hands: A visualization and simulation engine for grasping research." *Proceedings of the International Conference on Intelligent Manipulation and Grasping*, Genoa, Italy, 2004.
7. **Santos, V. J.** and Valero-Cuevas, F. J. "Anatomical variability naturally leads to multimodal distributions of Denavit-Hartenberg parameters for the human thumb." *Proceedings of the 25th Annual International Conference of the IEEE Engineering in Medicine and Biology Society,* Cancun, Quintana Roo, Mexico, Sept. 2003. Poster presentation.

Peer-reviewed Conference Proceedings Abstracts

8. **Santos, V. J.** and Valero-Cuevas, F. J. "Thumb kinematics with non-orthogonal and non-intersecting axes of rotation may be necessary to predict realistic isometric thumbtip forces in multiple directions." *Proceedings of the 28th Annual Meeting of the American Society of Biomechanics*, Portland, OR, Sept. 2004. Poster presentation.

9. **Santos, V. J.** and Valero-Cuevas, F. J. "Thumb kinematics with non-orthogonal and non-intersecting axes of rotation may be necessary to predict realistic isometric thumbtip forces in multiple directions." *Proceedings of the 5th Triennial International Hand and Wrist Biomechanics Symposium*, Syracuse, NY, Sept. 2004. Podium presentation.

10. **Santos, V. J.** and Valero-Cuevas, F. J. "Anatomical variability naturally leads to different types of thumb kinematics." *Proceedings of the 5th Triennial International Hand and Wrist Biomechanics Symposium*, Syracuse, NY, Sept. 2004. Podium presentation.

11. **Santos, V. J.** and Valero-Cuevas, F. J. "Investigating the interaction between variability in both musculoskeletal structure and muscle coordination for maximal voluntary static thumb forces." *Proceedings of the Neural Control of Movement Annual Meeting,* Sitges, Spain, March 2004. Poster presentation.

12. Valero-Cuevas, F. J., **Santos, V. J.**, Song, S., and Venkadesan, M. "During abrupt transitions from finger motion to static force, errors in force direction are tuned to exploit the allowable margin of error afforded by surface friction." *Proceedings of the Neural Control of Movement Annual Meeting*, Sitges, Spain, March 2004.

13. **Santos, V. J.** and Valero-Cuevas, F. J. "Stochastic analysis of anatomical data suggests three characteristic kinematic descriptions of the thumb." *Proceedings of the 27th Annual Meeting of the American Society of Biomechanics,* Toledo, OH, Sept. 2003. Poster presentation.

14. **Santos, V. J.** and Valero-Cuevas, F. J. "Stochastic analysis of anatomical data suggests three characteristic types of thumb kinematics." *Proceedings of the American Society of Mechanical Engineers Summer Bioengineering Conference*, Key Biscayne, FL, June 2003. Poster presentation.

INVITED PRESENTATIONS

2004 "Thumb kinematics with non-orthogonal and non-intersecting axes of rotation may be necessary to predict realistic isometric thumbtip forces in multiple directions"

- Guest speaker in undergraduate/graduate Mechanical and Aerospace Engineering course "Modeling and simulation of mechanical and aerospace systems," **Cornell University**, Ithaca, NY, November 23.

2004 "Effects of anatomical variability on a model of the thumb"

- Guest speaker in Machines and Organisms Group: Locomotion and Manipulation seminar, sponsored by a National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) grant, **Cornell University**, Ithaca, NY, February 12.

RESEARCH SUPPORT

2004-2008 **Co-author as graduate student**, "Control of finger movement and force for precision pinch," Dr. Francisco J. Valero-Cuevas (PI)
$953,500 total cost
National Institutes of Health, R01-AR050520-01A1
Priority score: 0.8%
Goal: To describe and explain how the musculature of the index finger is coordinated to orchestrate fingertip motion and force, a fundamental requirement of dexterous manipulation.

HONORS & AWARDS

Sept. 2004 **American Society of Biomechanics Travel Award**, to attend the 28th Annual Meeting in Portland, OR
- Selected as one of 28 graduate students to receive this highly competitive $150 award.

Sept. 2004 **Cornell University Graduate School Conference Grant Award**, to attend the 26th Annual International Conference of the IEEE Engineering in Medicine and Biology Society in San Francisco, CA
- Selected for a $400 award.

Sept. 2003 **Cornell University Graduate School Conference Grant Award**, to attend the 25th Annual International Conference of the IEEE Engineering in Medicine and Biology Society in Cancun, Quintana Roo, Mexico
- Selected for a $450 award.

June 2003 **Cornell University Graduate School Conference Grant Award**, to attend the American Society of Mechanical Engineers Summer Bioengineering Conference in Key Biscayne, FL
- Selected for a $325 award.

2001-2004 **National Science Foundation Graduate Research Fellow**
- Selected as one of 40 mechanical engineering students (based on 2000-2001 statistics) for this highly competitive three-year fellowship for graduate study in science, mathematics, and engineering fields.

2000 **Selected for National Physical Science Consortium Fellowship**
- Selected for this highly competitive three-year fellowship for graduate study in the physical sciences.
- Declined this fellowship in order to accept the National Science Foundation Graduate Research Fellowship.

1997 **Society of Women Engineers/ Chevron Scholarship**, *University of California, at Berkeley*, Berkeley, CA
- Selected by SWE faculty advisors and treasurer, and Chevron liaison for this award based on contribution to SWE, extracurricular activities, and academic record.

1995-1999 **Mary C. and William G. Drake Scholar**, *University of California, at Berkeley*, Berkeley, CA

- Selected as one of three freshmen by U.C. Berkeley's Mechanical Engineering Department for a four-year, full-tuition stipend. Required maintenance of 3.3 GPA.

1995-1999 **Regents' and Chancellor's Scholar**, *University of California, at Berkeley*, Berkeley, CA

- Selected to receive U.C. Berkeley's most prestigious scholarship for incoming undergraduates. Awards are limited to approximately 200 students per class.

1995-1999 **Robert C. Byrd Honors Scholar**, *State of California*

- Selected to receive this federally funded scholarship, administered by the California Student Aid Commission, designed to promote academic excellence and achievement.

OUTREACH & EXTRACURRICULAR ACTIVITIES

Present (in prep. for April 2005) **Workshop Chair**, "Expanding Your Horizons," *Cornell University*, Ithaca, NY

- Will organize hands-on workshop as part of a one-day conference designed to introduce 7^{th}-9^{th} grade girls to science.

April 2004 **Workshop Chair**, "Expanding Your Horizons," *Cornell University*, Ithaca, NY

- Organized hands-on workshop on center of gravity, "Can You Believe Your Eyes?," as part of a one-day conference designed to introduce 7^{th}-9^{th} grade girls to science.

2001-present **Volunteer**, Mechanical and Aerospace Engineering Department Recruiting, *Cornell University*, Ithaca, NY

- Spend time with prospective graduate students and professors to share my experiences in the department (e.g., lunches, lab tours).
- Member of the newly-formed student committee for the 2005 prospective student visit weekend.

2000 **Member**, Engineering Recruiting Team - University of California, at Berkeley, *Guidant Corporation*, Santa Clara, CA

- Recruited engineering students at a U.C. Berkeley career fair and presented an overview of Guidant Corporation to a student society meeting.

1999-present **Member**, Tau Beta Pi, *University of California, at Berkeley*, Berkeley, CA

- Selected for membership of this National Engineering Honor Society for engineering seniors in the top fifth of their class.

1998-present **Member**, Mortar Board, *University of California, at Berkeley*, Berkeley, CA

- Selected as one of 36 college seniors for membership in the U.C. Berkeley chapter of this National Senior Honor Society. Acceptance is based on achievements in scholarship, leadership, and service.

1998-present **Member**, Pi Tau Sigma, *University of California, at Berkeley*, Berkeley, CA

- Selected for membership in this National Honorary Mechanical Engineering Fraternity for engineering seniors in the top third of their class.

Fall 1998-Spring 1999 **President and Regional Conference Co-chair**, Society of Women Engineers, *University of California, at Berkeley*, Berkeley, CA

- Supervised activities and goals of the 100-member U.C. Berkeley SWE chapter.
- Organized the Region A Conference - day of workshops and tours for professionals, college, and high school students; over 100 attendees.

Fall 1997-Spring 1998 **Chair**, Elementary School Outreach Program, Society of Women Engineers, *University of California, at Berkeley*, Berkeley, CA

- Coordinated visits to local elementary schools, created hands-on activities, and organized a Young Inventors' Contest to introduce the field of engineering to young minds.

Fall 1996-Spring 1997 **Co-chair**, Junior Solar Sprint Challenge, Society of Women Engineers, *University of California, at Berkeley*, Berkeley, CA

- Coordinated a model solar-car competition for middle school students.

Spring 1996 **Member**, Junior Solar Sprint Challenge Committee, Society of Women Engineers, *University of California, at Berkeley*, Berkeley, CA

- Contributed to the organization of a model solar-car competition for middle school students.

Fall 1996-Fall 1999 **Volunteer**, Cal Performances, *University of California, at Berkeley*, Berkeley, CA

- Ushered patrons at the renowned Zellerbach performance hall.

Spring 1996-Fall 1997 **Member**, Alpha Phi Omega, *University of California, Berkeley*, Berkeley, CA

- Volunteered for over 20 events ranging from shoreline clean-ups to carnivals for underprivileged children as part of this National Community Service Organization.
- Received two "Sturdy Oak" awards for outstanding community service, which is typically awarded to ten members of the 100+ members of the UC Berkeley chapter each semester.

Fall 1995-Spring 1996 **Member**, Super Mileage Vehicle Team, *University of California, at Berkeley*, Berkeley, CA

- Contributed to the construction of a fuel-efficient vehicle for intercollegiate racing; "High Calibear" placed second in its fuel class for fuel efficiency.

PROFESSIONAL MEMBERSHIPS

American Society of Biomechanics
American Society of Mechanical Engineers
Institute of Electrical and Electronics Engineers,
Engineering and Medicine in Biology Society
International Society of Biomechanics
Society of Women Engineers
Society for Neural Control of Movement

PATENTS

Two proprietary patents pending for coronary stent design.

REFERENCES

Prof. Donald Bartel
Sibley School of Mechanical and Aerospace Engineering
219 Upson Hall
Cornell University, Ithaca, NY 14853, USA
DLB13@cornell.edu, (607) 255-4918

Prof. Carlos Bustamante
Department of Biological Statistics and Computational Biology
101 Biotechnology Building
Cornell University, Ithaca, NY 14853, USA
CDB28@cornell.edu, (607) 255-1640

Prof. Francisco J. Valero-Cuevas
Sibley School of Mechanical and Aerospace Engineering
220 Upson Hall
Cornell University, Ithaca, NY 14853, USA
FV24@cornell.edu, (607) 255-3575