

Dr. ANDRES JARAMILLO-BOTERO

Telephone: (626) 529-3460 / e-mail: ajaramil@caltech.edu or gmail.com

Professional Experience

<i>Research Scientist</i>	<p>California Institute of Technology (Caltech), Chemistry and Chemical Engineering division, Pasadena, California, United States.</p> <ul style="list-style-type: none"> ▪ Director, Multiscale Science and Simulation at the Materials and Process Simulation Center (MSC). Advice, supervise and manage 12+ students/postdocs/staff. Responsible for all phases of project life cycle including planning, securing funds, attracting/retaining key members, research, and communicating strategy/results. ▪ Lecturer in Chemistry. CH121A/B Atomic Level Simulations of Materials and Molecules. ▪ Mentor/co-mentor. Several Ph.D. thesis in Chemistry, Materials Science, and Engineering; SURF and MURF (Summer/Minority Undergraduate Research Fellowship). <p>Other activities:</p> <ul style="list-style-type: none"> ○ Author/co-author in over 25 successful research proposals. Secured and maintained research funds as Co-I/Co-PI. These funds also leverage other research efforts and personnel at MSC. 2006-Present ○ Day-to-day lead in over 10 highly rated government and privately funded research efforts. <ul style="list-style-type: none"> ○ Funding sources: NASA-JPL (Jet Propulsion Laboratory), DOE (NNSA, LLNL), DOD (DARPA, ARL, ONR-DURIP), DOT (FHWA), NSF (Major Research Instrumentation –MRI program, Civil, Mechanical and Manufacturing – CMMI program), Samsung Advanced Technology Institute (Korea), Toshiba (Japan), DOW Chemical and Intel Corporation. 2006-Present ○ Research interests: predicting material properties and phenomena in extreme conditions (e.g. mechanical and thermal shock, radiation, high pressure and temperature.); design/characterization of molecular nano-sensors (electrochemical, field effect and tunneling devices, and Förster resonance energy transfer based); design/characterization of polymer systems (tissue scaffolding, drug delivery systems, polyelectrolyte membrane fuel cells); low-temperature crystalline thin film growth (GaN, Diamond, and silicon); first-principles based adiabatic and non-adiabatic multiscale simulations. ○ Author/co-author in over fifty refereed scientific publications (Q1 ISI-level journals, books, book chapters) 2006-Present ○ 3 recently USPTO patents US9234882B2, US9090936B2, US8951727B2 on 4th generation DNA/RNA nano-sequencers; capture, translocation control, identification and reading mechanisms. 1/12/2016, 7/28/15, and 2/10/2015 	6/2006-Present
<i>Professor</i>	<p>Pontificia Universidad Javeriana (PUJ), Engineering Faculty, Cali, Colombia.</p> <ul style="list-style-type: none"> ▪ Professor (reached tenure in 1999), Electronics and Computer Science Department. Areas: Robotics, Control Theory, Computational Science/Nanoscience, and Computer Architecture Design (VLSI) 1990-2006 ▪ Founding Director (PI) of the Robotics and Automation Research Group (GAR) 1995-2006 ▪ Founding Director of the Process Automation technology transfer Center (CAP) 1999-2004 ▪ University Board Council member 1998-2004 ▪ Faculty Engineering Dean (Youngest ever). Faculty + staff: ~3000+. Student population: ~2,500 (2004) 1998-2004 ▪ Chair Electronics Engineering. Faculty + staff: ~35. Student population: ~300 (1998). Lead undergraduate curriculum design and named 1st program Chair. 1993-1998 ▪ Chair Systems and Computer Engineering. Faculty + staff: ~40. Student population: ~300 (1998) 1992-1998 ▪ Advisor for over 70 successfully undergraduate/graduate students (>90% graduating with honors) 1998-2006 	1/1990-5/2006
<i>Research Associate</i>	<p>Caltech, Chemistry and Chemical Engineering, Pasadena, CA, United States. Host: William A. Goddard III.</p> <ul style="list-style-type: none"> ▪ NSF funded fellow on Computational Nanotechnology. NSF Pan American Advanced Institute (PASI) on Molecular Engineering and Computational Nanotechnology program co-I and co-organizer. 9/2004-6/2005 	9/2004-6/2005
<i>NSF Research Fellow</i>	<p>University of California at Los Angeles (UCLA), Institute of Pure and Applied Mathematics (IPAM), Los Angeles, CA, United States. Host: Mark Green.</p> <ul style="list-style-type: none"> ▪ Proponent of nanoscale positioners with optimized dynamic-response based on photoisomerizable oligomer joints and nanotube parallel-bar mechanism. Nanoscale Science and Engineering program. 8/2002-12/2002 	8/2002-12/2002
<i>Invited Faculty Associate</i>	<p>Jet Propulsion Laboratory (JPL-NASA), Ultracomputing group, Engineering and Science Directorate, and Caltech, Chemistry and Chemical Engineering division, Pasadena, CA, United States. Hosts: Amir Fijany (JPL) and William A. Goddard III (Caltech)</p> <ul style="list-style-type: none"> ▪ Proposed and developed novel algorithms for large-scale multibody dynamics still used in robotics control/simulation and coarse-grain constrained molecular dynamics modeling of nanoscale systems. 9/1996-12/1997 	9/1996-12/1997
<i>Invited Researcher /Trainee</i>	<p>Mechanical Engineering Laboratory (MEL), Autonomous Machinery Division, Robotics Department, Tsukuba, Japan. Ministry of Trade and Industry (MITI). Host: Katsuo Yamaba</p> <ul style="list-style-type: none"> ▪ Fellow from the Advanced Industrial Science and Technology (AIST) and Japan Industrial Technology Association (IITA) in research/training on advanced robotic technologies. 6/1992-5/1993 	6/1992-5/1993

	<ul style="list-style-type: none"> ▪ Principal author of real-time pattern recognition algorithms that were successfully transferred to Matsushita Denki's (Factory Automation division, Kyushu prefecture) automatic printed circuit board (PCB) checkers. ▪ Co-developer of first programmable analog fuzzy logic controller for parallel bar arc welding robot. 	
<i>Other</i>	<ul style="list-style-type: none"> ▪ Systems Engineer. Sistemas de Tecnología Avanzada, Digital Equipment Corporation (DEC), Cali, Colombia. ▪ Electronic Control Systems Designer. Sincron Diseño Electrónico Ltda, Cali, Colombia 	1-9/1988 12/86-12/87

Formal Education

- **Doctor of Engineering (Dynamics)**, Universidad Politécnica de Valencia (UPV), Valencia, Spain. 1998. Outstanding *cum-laude*, ranked 1st in class. Thesis: Time-lower bound multibody dynamics control and simulation methods (from robots to molecules). Advisor: Alfons Crespo (UPV, Informatics and Automatics division, Spain), Co-Advisor: William A. Goddard III (Caltech, Chemistry, USA.)
- **Master of Science (Computer Science)**, State University of New York (SUNY), Binghamton, New York, USA. 1989. Fulbright scholar. Thesis: Reduced Instruction Set Parallel VLSI architecture and prototype. Advisors: Kanad Ghose (CS Chair, SUNY) and Peter Kogge (IBM Senior Fellow).
- **Bachelor of Science (Electrical Engineering)**, Boston University, Boston, Massachusetts, USA. 1986.
- **International Baccalaureate High-level Degree Physics**, International Baccalaureate Office, UK. 1982.

Recent Relevant Publications (* denotes contact author/s, full publication list linked [here](#))

- Nidzworski, D., Siuzdak, K., Niedziałkowski, P., Bogdanowicz*, R., Sobaszek, M., Ryl, J., Weiher, P., Sawczak, M., Wnuk, E., Goddard III, W.A., Jaramillo-Botero*, A., and T. Ossowski, "A novel ultrasensitive biosensor for influenza virus detection," submitted to Nature, 2016
- Darrach*, M., Madzunkov, S., Schaefer, R., Nikolic, D., Simic, J., Kidd, R., Neidholdt, E., Pilinski, M., Jaramillo-Botero, A., Farley, K., "The Mass Analyzer for Real-time Investigation of Neutrals at Europa (MARINE)," Aerospace Conference, 2015 IEEE, vol., no., pp.1,13, 7-14 March 2015
- Fortunelli*, A., Goddard III, W.A., Sementa, L., Barcaro, G., Negreiros, F.R., Jaramillo-Botero, A., "The atomistic origin of the extraordinary oxygen reduction activity of Pt3Ni7 fuel cell catalysts", Royal Society Chem. Sci., DOI: 10.1039/C5SC00840A, 2015
- Xiao, H., Jaramillo-Botero*, A., Theofanis, P.L., Goddard III, W.A. "Non-adiabatic dynamics modeling framework for materials in extreme conditions", Mechanics of Materials, Elsevier, 10.1016/j.mechmat.2015.02.008, 2015
- An, Q., Jaramillo-Botero*, A., Liu, W.G., Goddard III, W.A. "Reaction Pathways of GaN (0001) Growth from Trimethylgallium and Ammonia versus Triethylgallium and Hydrazine Using First Principle Calculations", J. Phys. Chem. C, DOI: 10.1021/jp5116405, February 4, 2015
- Peng, S., Sheldon, M.T., Liu, W.G., Jaramillo-Botero, A., Goddard III, W.A., Atwater*, H.A., "Ultraviolet Surface Plasmon-Mediated Low Temperature Hydrazine Decomposition", Appl. Phys. Lett. 106, 023102 (2015)
- Cheng, T., Jaramillo-Botero*, A., Goddard, W.A., and Sun, H. "Adaptive Accelerated ReaxFF Reactive Dynamics with Validation from Simulating Hydrogen Combustion", J. Am. Chem. Soc., 2014, 136 (26), pp 9434-9442
- Jaramillo-Botero*, A., Naserifar, S., and Goddard, W.A. "A General Multi-Objective Force Field Optimization Framework, with Application to Reactive Force Fields for Silicon Carbide", J. of Chemical Theory and Computation, 2014, 10(4), pp 1426-1439
- An, Q., Goddard III*, W.A., Zybin, S., Jaramillo-Botero, A., Zhou, T.T, Highly Shocked Polymer Bonded Explosives at a Nonplanar Interface: Hot-Spot Formation Leading to Detonation, J. Phys. Chem. C, 2013, 117 (50), pp 26551-26561
- Jaramillo-Botero*, A., Qi, A., Cheng, M.J., Goddard, W.A. III, Beegle, L., and Hodyss, R., "Hypervelocity impact effect of molecules from Enceladus' Plume and Titan's upper atmosphere on NASA's Cassini Spectrometer from Reactive Dynamics Simulations", Phys. Rev. Letters (PRL), 109, 2012.

Synergistic Activities

- *Significant contributor* to LAMMPS, Sandia's National Laboratory Large-scale Atomic/Molecular Massively Parallel Simulator.
- *Principal developer*, parallel electron force field and extensions introduced in LAMMPS.
- *Principal developer*, GARFField: hybrid evolutionary/gradient based optimization framework for (reactive and non-reactive) force fields.
- *Principal developer*, Robomosp: ROBOTics Modeling and Simulation Platform (sample animations: 7-DOF PA-10 kinematics, dynamics)
- *Principal developer*, CMDF: first-principles based Computational Materials Design Facility.
- *Lecturer and Invited speaker* at multiple academic/industrial institutions and national laboratories in U.S., Europe, and Latin America.
- *Peer project/paper reviewer* for: US Department of Energy – DOE; National Science Foundation – NSF; Institute of Electrical and Electronics Engineers – IEEE; International Federation of Automatic Control (IFAC); Iberoamerican program for science and technology for development (CYTED); Colciencias - NSF equivalent in Colombia; and several indexed journals.

Awards and recognitions:

NSF Fellow (2002, 2004-5), Fulbright scholar (1988-1989), JITA/AIST Fellow (1992-3), multiple public recognitions for outstanding contributions to science and society, including from Colombian Presidents (Álvaro Uribe, 2002-2010, and Andrés Pastrana, 1998-2002).

Professional Societies: American Physical Society (APS) member; American Association for the Advancement of Science member (AAAS); Association for Computing Machinery member (ACM); Institute of Electrical and Electronics Engineers Senior Member (IEEE).

Languages: Fully bilingual in English and Spanish, and partial (spoken) Japanese.

Other relevant information: US Citizen, through Extraordinary Ability Alien US permanent residency awarded for scientific merit (2005)