Giacomo Po, PhD

CONTACT INFORMATION

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EDUCATION

University of California Los Angeles (UCLA), Los Angeles CA

Ph.D., Mechanical Engineering, May 2011

- Major Field: Structural and Solid Mechanics
- Dissertation: "A Computational Model for Discrete-to-Continuum Dislocation-Based Crystal Plasticity"
- Advisor: Professor Nasr M. Ghoniem

M.S., Mechanical Engineering, Dec 2007

- GPA: 4.0/4.0

University of Bologna, Bologna Italy

B.S., Mechanical Engineering, April 2004

- 100/100 *Summa cum Laude*

Licenza, Collegio Superiore of the University of Bologna March 2004

ACADEMIC APPOINTMENTS

Postdoctoral Researcher May 2011 to present
Department of Mechanical and Aerospace Engineering, UCLA

- Research interests: computational mechanics of materials and their defects. Modeling of materials microstructures in relationship to macroscopic properties. Discrete and continuum dislocation-based plasticity of metals and ceramics. High temperature structural materials, high strain rate loading, materials in extreme environments.

Lecturer Sep. 2012 to present
Department of Mechanical and Aerospace Engineering, UCLA

- Instructor of the course "Introduction to Computer Aided Design and Drafting": topics include, theory of engineering drawing, CAD, rapid prototyping.
- Instructor of the course "Statics and Strength of Materials": topics include, statics of solids, stress, strain, axially loaded bars, torsion of bars, bending of beams.
- Instructor of the course "Advanced Strength of Materials": topics include, linear elasticity, stress, strain, yielding theories, fracture mechanics, fatigue, beam bending, torsion, axisymmetric problems, buckling.
- Instructor of the course "Introduction to Machines and Mechanisms": topics include position, velocity, and acceleration analysis of mechanisms, analysis of cam-follower systems, gears (spur, helical,bevel, worms,...), dynamics of mechanisms.

Teaching Assistant 2007-2011
Department of Mechanical and Aerospace Engineering, UCLA.

- Mechanical Product Design
- Damage and Failure of Materials in Mechanical Design
- Strength of Materials

Research Grants

Discrete Dislocation Dynamics-based modeling and simulation of elastic-plastic response to tension-torsion loading 11/2014-8/2015

- Source of support: Sandia National Laboratories
- Total award amount: $70,000.00
- Role: Co-PI

Revealing ductility in transition-metal carbides through small-scale experiments and modeling 04/2016-4/2019

- Source of support: National Science Foundation (CMMI)
- Total award amount: $360,001.00
- Role: Co-PI

Resilient Self-Healing Materials for the Extreme Environment of Space Electric Propulsion & Power 09/2016-8/2019

- Source of support: Air Force Office of Scientific Research (AFOSR)
- Total award amount: $1,200,000.00
- Role: Co-PI

Awards

Academic Awards

- June 2011: UCLA Mechanical Engineering Outstanding Ph.D. Award.
- Jan 2007: UCLA Mechanical Engineering Department Fellowship.
- 1998-2003: University of Bologna, Collegio Superiore full scholarship. The Collegio offers advanced and interdisciplinary education selecting particularly motivated students of any program of the University of Bologna.

Professional Service

Referee Service

- International Journal of Plasticity
- Journal of Nuclear Materials
- Journal of the Mechanics and Physics of Solids
- Advances in Condensed Matter Physics

Conference Service

- Local organizing committee member of "Dislocations 2016" conference, 19-23 September 2016, Purdue University in West Lafayette, Indiana.
- session chair for "Mechanical Behavior Related to Interface Physics II: Twinnig effects.", TMS S. Diego, CA, February 16-20 2014.
- co-organizer for symposium: "Dislocation Plasticity", 2013 MRS Fall Meeting & Exhibit, Boston, Massachusetts, December 1–6, 2013.
- session chair for "Modeling and Experimental Validation of Multiscale Mechanical Behavior from Atomic Scale to Macro Scale: Dislocation Dynamics Session", TMS S. Antonio Texas, March 3-7 2013.
- co-organizer for symposium: "Dislocation-based Plasticity: Experiments, Theory and Modeling", 19th International Symposium on Plasticity, Nassau, Bahamas, January 3–8, 2013.

Professional Experience

Mechanical Engineer

Ferrari S.p.A., Modena, Italy 2004-2006

- Performed combustion data acquisition experiments at the engine test-bench, using various types of transducers.

- Developed MATLAB-based combustion data processing tools for automatic generation of optimal engine controls maps. Applications include air/fuel control, torque-management, misfiring, and variable camshaft control subsystems.
- Development of a new method for optimum spark advance control based on ion current sensors. Patent deposited: Method of controlling the spark lead of an internal combustion engine.

Scientific Programming

Excellent knowledge of C++ and MATLAB, demonstrated through the development of open-source libraries:

MODEL, the Mechanics of Defects Evolution Library

- abstract graph and network classes and related algorithms;
- splines, spline implicitization algorithms, 3d collision detection;
- general FEM library for user-friendly solution of PDEs in weak form
- object-oriented discrete dislocation dynamics with arbitrary template parameters (dimensionality, shape functions, crystal lattice type, ...)
- high-quality visualization tools (openGL based) for Dislocation Dynamics and Molecular Dynamics
- https://bitbucket.org/model/model/wiki/Home

Publications

Journal Articles

[1] Giacomo Po, Markus Lazar, Nikhil Chandra Admal, Nasr Ghoniem. An anisotropic non-singular theory of dislocations with atomic resolution. *(in preparation).*

[2] Nikhil Chandra Admal, Jaime Marian, Giacomo Po. The atomistic representation of Mindlin's first strain-gradient elasticity tensors. *(in preparation).*

[3] Giacomo Po, Yinan Cui, David Rivera, David Cereceda, Jaime Marian, and Nasr Ghoniem. A phenomenological mobility law for dislocations in bcc metals. *(in preparation).*

[4] Yinan Cui, Giacomo Po, Nasr Ghoniem. Influence of loading conditions on strain bursts and dislocation avalanches statistics at the microscale. *(in preparation).*

[5] Can Erel, Giacomo Po, Tamer Crosby, and Nasr Ghoniem. Dipolar dislocation loop formation and interaction mechanisms in fcc metals. *(in preparation).*

[6] Reese Jones, Jonathan Zimmerman, Giacomo Po, Kranthi K Mandadapu. Comparison of dislocation density tensor fields derived from discrete dislocation dynamics and crystal plasticity simulations of torsion. *(submitted to IJP).*

[7] Yinan Cui, Giacomo Po, Nasr Ghoniem. Temperature insensitivity of the flow stress in body-centered cubic micropillar crystals. Acta Materialia 108, 128-137 (2016).
http://dx.doi.org/10.1016/j.actamat.2016.02.008

[8] Stefan Sanfeld, Giacomo Po. *Microstructural comparison of the kinematics of discrete and continuum dislocations models.* Modelling Simulation Mater. Sci. Eng. 23 (8), 085003 (2015).
http://dx.doi.org/10.1088/0965-0393/23/8/085003

[9] Dariush Seif, Giacomo Po, Matous Mrovec, Markus Lazar, Christian Elsässer, Peter Gumbsch. *An atomistically-enabled non-singular anisotropic elastic representation of near-core dislocation stress fields in α-iron.* Physical Review B 91 (18) 184102 (2015).
http://dx.doi.org/10.1103/PhysRevB.91.184102

[10] Markus Lazar and Giacomo Po, *The non-singular Green tensor of Mindlin's anisotropic gradient elasticity with separable weak non-locality.* Physics Letters A 379 (2015), 1538-1543.
http://www.sciencedirect.com/science/article/pii/S0375960115002790

[11] Tamer Crosby, Giacomo Po, Can Erel, Nasr Ghoniem. *The Origin of Strain Avalanches in Submicron Plasticity of FCC Metals.* Acta Materialia 89 (2015), 123-132.
http://dx.doi.org/10.1016/j.actamat.2015.02.003

[12] Nathaniel Burbery, Raj Das, Giacomo Po, Nasr Ghoniem. *Understanding the Threshold Conditions for Dislocation Transmission from Tilt Grain Boundaries in FCC Metals under Uniaxial Loading.* Applied Mechanics and Materials, 553 28-34 (2014).
http://dx.doi.org/10.4028/www.scientific.net/AMM.553.28

[13] Giacomo Po, Mamdouh Mohamed, Tamer Crosby, Can Erel, Anter El-Azab, Nasr Ghoniem. *Recent progress in Discrete Dislocation Dynamics and its applications to micro plasticity.* The Journal of The Minerals, Metals & Materials Society (TMS), 66 (10) 2108-2120 (2014).
http://dx.doi.org/10.1007/s11837-014-1153-2

[14] Markus Lazar and Giacomo Po, The non-singular Green tensor of gradient anisotropic elasticity of Helmholtz type. *European Journal of Mechanics A* 50 (2015), 152162.
http://dx.doi.org/10.1016/j.euromechsol.2014.10.006

[15] Giacomo Po, Markus Lazar, Dariush Seif, and Nasr Ghoniem, Singularity-free dislocation dynamics with strain gradient elasticity. *Journal of The Mechanics and Physics of Solids*, 68 (2014) 161-178.
http://dx.doi.org/10.1016/j.jmps.2014.03.005

[16] Tamer Crosby, Giacomo Po, Nasr M. Ghoniem, Modeling Concurrent Radiation Damage And Plastic Deformation. *Journal of Nuclear Materials*, 455 (2014) 126-129.
http://dx.doi.org/10.1016/j.jnucmat.2014.05.045

[17] Giacomo Po and Nasr Ghoniem, A variational formulation of constrained dislocation dynamics coupled with heat and vacancy diffusion. *Journal of The Mechanics and Physics of Solids*, 66, 103-116 (2014).
http://dx.doi.org/10.1016/j.jmps.2014.01.012

[18] Dariush Seif, Giacomo Po, Ryan Crum, Vijay Gupta, and N.M. Ghoniem, Shock-Induced Plasticity and the Hugoniot Elastic Limit in Copper Nano Films and Rods. *Journal of Applied Physics*, 115, 054301 (2014).
http://dx.doi.org/10.1063/1.4863720

[19] Markus Lazar and Giacomo Po, The solid angle and the Burgers formula in the theory of gradient elasticity: line integral representation. *Physics Letters A*, 378, 597-601 (2014).
http://dx.doi.org/10.1016/j.physleta.2013.12.018

[20] G. Youssef, R. Crum, S. V. Prikhodko, D. Seif, G. Po, N. Ghoniem, S. Kodambaka, and V. Gupta. The Influence of Laser-Induced Nanosecond Rise-Time Stress Waves on the Microstructure and Surface Chemical Activity of Single Crystal Cu Nanopillars. *Journal of Applied Physics*, 113, 084309 (2013).
http://dx.doi.org/10.1063/1.4793646

[21] Giacomo Po and Nasr M. Ghoniem. Continuum Modeling of Plastic Flow Localization in Irradiated fcc Metals. *Journal of Nuclear Materials* 442, S607-S611 (2013).
http://dx.doi.org/10.1016/j.jnucmat.2012.10.039

[22] Nasr M. Ghoniem, Giacomo Po and Shahram Sharafat, Deformation Mechanisms in Ferritic/Martensitic Steels and The Impact on Mechanical Design. *Journal of Nuclear Materials*, 441, 704-712, 2013.
http://dx.doi.org/10.1016/j.jnucmat.2013.03.045

[23] Ramirez, B., Ghoniem, N. M., & Po, G. Ab-initio continuum model for the influence of local stress on cross-slip of screw dislocations in fcc metals. *Physical Review B*, 86(9), p. 094115, (2012).
http://dx.doi.org/10.1103/PhysRevB.86.094115

[24] Giacomo Po and Nasr Ghoniem, Coupled Oscillations of double-walled carbon nanotubes. *Journal of Applied Physics*, 107 (9) 2010.
http://dx.doi.org/10.1063/1.3359654

Conference Proceedings

[25] Giacomo Po and Nasr Ghoniem. Modeling of Dislocation Microstructure Evolution In Microindentation Experiments. *Proc. of the International Symposium on Plasticity and Its Current Applications*, Jan 3-8 2012, San Juan, Puerto Rico.

[26] Giacomo Po and Nasr Ghoniem. Modeling and Finite Element Simulation of Dislocation Density Evolution in Microindentation Experiments. *Proc. of the 11th US National Congress on Computational Mechanics*, July 25-28 2011, Minneapolis.

[27] Giacomo Po and Nasr Ghoniem. Atomically-Constrained Dislocation Dynamics. *Proceedings of the 5th international conference on Multiscale Materials Modeling*, October 4-8 2010, Freiburg, Germany.

[28] Giacomo Po and Nasr Ghoniem. Continuum Theory of Dislocations: Finite Element Simulations of Microstructure Evolution during Micro-Indentation. *Proc. of the 5th international conference on Multiscale Materials Modeling*, October 4-8 2010, Freiburg, Germany.

[29] N. Cavina, G. Po, L. Poggio, D. Zecchetti, Individual cylinder knock detection based on ion current sensing: correlation analysis. *Proc. of ASME Internal Combustion Engine Division 2006 Spring Technical Conference*, May 8-10 2006, Aachen, Germany.

[30] N. Cavina, G. Po, L. Poggio, Ion Current based Spark Advance Management for Maximum Torque Production and Knock Control. *Proc. of 8th biennial ASME Conference on Engineering Systems Design and Analysis*, July 4-7 2006, Turin, Italy.

Invited Presentations

[31] Giacomo Po. Recent Progress in DD and its applications to micro-plasticity, International Workshop on Dislocation Dynamics Simulations, Trends and Challenges in DD. Dec 10-12 2014, Saclay, France.
http://www.numodis.fr/WORKSHOP2014/schedule.html

[32] Giacomo Po. Dislocation plasticity of indented crystals. Symposium on dislocation plasticity, Feb 24-28 2014, Kloster Schontal, Germany.

[33] Giacomo Po. Mechanisms of Dipolar Loop Formation and Interactions in FCC metals. Symposium: Mechanical Behavior Related to Interface Physics II: Twinning effects, TMS S. Diego, CA, February 16-20 2014.

[34] Giacomo Po. Singularity-free dislocation dynamics with strain gradient elasticity. Symposium on New Developments in Defect Mechanics, Jan 18-19 2014, San Diego, California.
http://maeresearch.ucsd.edu/markenscoff/nsf/

[35] Giacomo Po. Constrained Network Parametric Dislocation Dynamics (CNPDD) in Finite Volumes. Symposium: Modeling and Experimental Validation of Multiscale Mechanical Behavior from Atomic Scale to Macro Scale. TMS S. Antonio, Tx, March 2013.

[36] Giacomo Po. Discrete Dislocation Plasticity in Micro and Nano Crystals. Seminar in Mechanics & Materials Engineering (UCSD), November 2012.

[37] Giacomo Po. Discrete Dislocation Dynamics in Micro and Nano Crystals. Institute for Pure & Applied Mathematics (IPAM), November 2012.
http://www.ipam.ucla.edu/programs/workshops/workshop-iii-mesoscale-and-continuum

Books

[38] Nasr Ghoniem and Giacomo Po, *Computational Multiscale Metal Plasticity*. Wiley, (in preparation).

References

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