

Lampros Svolos, PhD

Computational Mechanician

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EDUCATION

- PhD Civil Engineering and Engineering Mechanics**, Columbia University 2020
Computational Mechanics Group – Advisor: Prof. Haim Waisman
Dissertation: *Efficient Computational Methods in Coupled Thermomechanical Problems: Shear Bands and Fracture of Metals*
- MS Applied Mathematics**, National and Kapodistrian University of Athens 2016
Thesis: “Galerkin Finite Element Methods for First Order Hyperbolic Partial Differential Equations” GPA: 9.89/10
- MS Structural Design and Analysis of Structures**, 2016
National Technical University of Athens GPA: 9.33/10
Program: Analysis and Design of Earthquake Resistant Structures
- BS Civil Engineering**, National Technical University of Athens 2014
Department of Civil Engineering – Major: Structural Engineering GPA: 8.18/10
Diploma thesis: “Dynamic behavior of a seismic isolator – Duffing and Van der Pol Equations”

HONORS, AWARDS AND ACHIEVEMENTS

- Teaching Assistant Excellence Award** 2019
In recognition of outstanding performance as TA at Columbia University
- Teaching Assistantship Award** 2016
In recognition of academic achievements (four-year funding as TA)
- Graduated First in the Master’s Program “Applied Mathematics”** 2016
Valedictorian in MS at National and Kapodistrian University of Athens
- Graduated at the top of the School of Civil Engineering** 2014
Top 10% of undergrad students at National Technical University of Athens

RESEARCH EXPERIENCE

Los Alamos National Laboratory (LANL), New Mexico, USA 2020 – Present
Postdoctoral Research Associate, Fluid Dynamics and Solid Mechanics Group (T-3)

- Implemented a continuous/discontinuous Galerkin method for a high-order phase-field model, resulting in 1 peer-reviewed journal publication.
- Derived formulations of high-order virtual element methods and applied them to fracture mechanics problems; work completed in collaboration with scientists from Applied Mathematics and Plasma Physics Group (T-5) at LANL.

Columbia University in the City of New York, New York, USA 2016 – 2020
PhD Student and Teaching Assistant, Computational Mechanics Group

Advisor: Professor Haim Waisman

- Developed efficient numerical methods for coupled thermomechanical problems, which were successfully implemented in Fortran and demonstrated excellent performance on parallel computers.
- Derived thermodynamically consistent models in damage mechanics using analytical techniques.
- Published 3 high-impact peer-reviewed journal articles.

Los Alamos National Laboratory (LANL), New Mexico, USA Summers 2017 – 2019
Graduate Student Intern, Fluid Dynamics and Solid Mechanics Group (T-3)

Mentors: Dr. Curt A. Bronkhorst and Dr. Hashem M. Mourad

- Derived novel thermal-conductivity degradation functions of damage.

RESEARCH FUNDING

Team Member, “Predictive Computational Framework for the Treatment of Dynamic Fracture Problems on Polytopal Meshes,” Laboratory Directed Research & Development Program, LANL, PI: Hashem M. Mourad 2021

- Assisted team members in writing this successful proposal

Research Associate, Joint DoD/DOE Munitions Program, LANL 2020 – Present

Recipient, Travel Award, 14th World Congress in Computational Mechanics, \$1K 2020

GRA, Joint DoD/DOE Munitions Program, LANL Summers 2017 – 2019

RESEARCH INTERESTS

Numerical Methods for Engineering Applications

- Continuous and discontinuous Galerkin finite element methods
- Virtual element methods
- High-order numerical schemes

Engineering Applications

- Shear bands – Temperature-dependent viscoplasticity and intense deformation
- Effects of fire on steel infrastructure components
- Hydraulic fracture during glacier calving

Multiphysics and Multiscale Modeling of Fracture

- Thermodynamically consistent models using analytical techniques
- Phase-field methods for free-discontinuity problems

High-Performance Computing

- Efficient and scalable numerical algorithms for multiphysics problems
- Physics-based preconditioners

TEACHING AND MENTORING

Teaching Assistant, Columbia University, New York, USA Department of Civil Engineering and Engineering Mechanics	2016 – 2020
“Finite Element Analysis I,” (E4332: Engineering Mechanics) <ul style="list-style-type: none">➤ Offered Matlab and Abaqus lectures➤ Developed tutorial materials and homework	2016, 2019
“Experimental Mechanics of Materials,” (E3114: Engineering Mechanics) <ul style="list-style-type: none">➤ Presented a series of weekly experiments at Carleton Laboratory➤ Conducted Charpy impact test and torsion test	2017, 2018
“Structural Design Projects,” (E3127: Civil Engineering) <ul style="list-style-type: none">➤ Initiated brainstorming about project selection➤ Modeled semester projects using SAP2000	2017, 2018
“Buckling of Structures,” (E4213: Civil Engineering)	2017
“Design Projects,” (E3128: Civil Engineering)	2018
“Multi-Hazard Design of Structures,” (E4235: Civil Engineering)	2018
“Design-Prestressed Concrete Structures,” (E4236: Civil Engineering)	2019
“Advanced Design of Steel Structures,” (E4226: Civil Engineering)	2019, 2020

PROFESSIONAL ACTIVITIES AND COMMUNITY SERVICE

Professional Affiliations & Roles:

Member, American Society of Civil Engineers (ASCE)	2021 – Present
Member, Los Alamos Postdoc Association (LAPA)	2020 – Present
Social Chair	11/2020 – 11/2021
➤ Organize and manage social events	
➤ Encourage cultural diversity in events	
Social Media Chair	11/2021 – 11/2022
➤ Update and maintain social media accounts	
➤ Promote LAPA's activities	
Foreign National Liaison	11/2022 – Present
➤ Update foreign national resource guide	
Member, U.S. Association for Computational Mechanics (USACM)	2020 – Present
Member, Engineering Mechanics Institute (EMI)	2018 – Present
Member, Society for Industrial and Applied Mathematics (SIAM)	2017 – 2019

Journals Reviewed:

- *Computer Methods in Applied Mechanics and Engineering*
- *International Journal of Solids and Structures*
- *Communications in Nonlinear Science and Numerical Simulation*
- *Journal of Engineering Mechanics*
- *Engineering Fracture Mechanics*
- *Mathematics and Mechanics of Solids*

Mini-Symposia Organized:

- *Challenges and Advances in Material Damage Modeling, Engineering Mechanics Institute Conference 2023*, June 2023, Georgia Tech, Atlanta, GA, USA
- *Advances in Modeling and Simulation of Material Damage and Failure, 17th U.S. National Congress on Computational Mechanics*, July 2023, Albuquerque, NM, USA

PROFESSIONAL SKILLS AND COMPETENCIES

Languages: Greek (Native), English (Full Professional), French (Elementary)

Programming Languages: Fortran, Matlab, Python, C++

Technical & Parallel Computing Software: Maple, Mathematica, PETSc, MPICH

Operating Systems: Linux, Windows, macOS

Text Processing Software: Microsoft Office, LaTeX

CAE Software: AutoCAD, Abaqus, SAP2000

PUBLICATIONS

Peer-Reviewed Journal Publications

- [4] Svolos, L., Mourad, H. M., Manzini, G., & Garikipati, K. (2022). *A fourth-order phase-field fracture model: Formulation and numerical solution using a continuous/discontinuous Galerkin method*. **Journal of the Mechanics and Physics of Solids**, 165, 104910.
- [3] Svolos, L., Mourad, H. M., Bronkhorst, C. A., & Waisman, H. (2021). *Anisotropic thermal-conductivity degradation in the phase-field method accounting for crack directionality*. **Engineering Fracture Mechanics**, 245, 107554.
- [2] Svolos, L., Berger-Vergiat, L., & Waisman, H. (2020). *Updating strategy of a domain decomposition preconditioner for parallel solution of dynamic fracture problems*. **Journal of Computational Physics**, 422, 109746.
- [1] Svolos, L., Bronkhorst, C. A., & Waisman, H. (2020). *Thermal-conductivity degradation across cracks in coupled thermo-mechanical systems modeled by the phase-field fracture method*. **Journal of the Mechanics and Physics of Solids**, 137, 103861.

Journal Papers in Review or Preparation

- [3] Svolos, L., Plohr, J. N., Manzini, G., & Mourad, H. M. *On the convexity of phase-field fracture formulations: Analytical study and comparison of various degradation functions*, **Under Review**.
- [2] Adak, D., Manzini, G., Mourad, H. M., Plohr, J. N., & Svolos, L. *A C^1 -conforming arbitrary-order two-dimensional virtual element method for the fourth-order phase-field equation*, **Under Review**.
- [1] Svolos, L., & Mourad, H. M. *A phase-field model of ductile fracture based on a variational framework for materials with thermo-viscoplastic behavior*, **In Preparation**.

PROFESSIONAL PRESENTATIONS

Invited

- [1] Svolos, L. (2022) “*High-Order Phase-Field Models of Fracture: Approximating Discontinuities with a Continuous Field*”, Event: **Science in 3'**, Los Alamos National Laboratory, Los Alamos, NM, USA.

Contributed

- [7] Svolos, L., & Mourad (2022) “*A Phase-Field Model of Ductile Fracture based on a Variational Framework for Materials with Thermo-Viscoplastic Behavior*”, **Society of Engineering Science Annual Technical Meeting**, College Station, TX, USA.

- [6] Svolos, L., Mourad, H. M., Manzini, G., & Garikipati, K. (2022) “*A Fourth-Order Phase-Field Fracture Model: Formulation and Numerical Solution Using a Continuous/Discontinuous Galerkin Method*”, **Engineering Mechanics Institute Conference (EMI)**, Johns Hopkins University, Baltimore, MD, USA.
- [5] Svolos, L., Waisman, H., & Mourad, H. M. (2021). “*Modeling the Interplay between Heat Transfer and Crack Propagation in the Phase-Field Method*”, **United States National Congress on Computational Mechanics (USNCCM 16)**, Virtual Event.
- [4] Svolos, L., & Waisman, H. (2021). “*Heat Transfer Across Cracks in Phase-Field Fracture Methods*”, **Engineering Mechanics Institute Conference (EMI)**, Virtual Event.
- [3] Svolos, L. (2021). “*Heat Transfer Across Cracks in Phase-Field Fracture Methods*”, **World Congress in Computational Mechanics (14th WCCM)**, Virtual Event.
- [2] Svolos, L., Bronkhorst, C. A., & Waisman, H. (2019). “*On the Thermal Conductivity Degradation across Cracks in a Model Capturing Brittle and Ductile Fracture Using the Phase-field Method*”, **United States National Congress on Computational Mechanics (USNCCM 15)**, Austin, TX, USA.
- [1] Svolos, L., Berger-Vergiat, L., & Waisman, H. (2018) “*Adaptive updating strategy of a domain decomposition preconditioner for shear bands and crack propagation*”, **Engineering Mechanics Institute Conference (EMI)**, MIT, Cambridge, MA, USA.

REFERENCES

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