

Vahid Morovati

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Areas of Interest

Computational Mechanics, Multi-Scale Multi-Physics Modeling, Mechanical Behavior of Materials, Material Characterization, Damage Accumulation

Current Position

Assistant Professor

Aug. 2022 - ~

Department of Civil and Environmental Engineering & Institute of Materials Science-Polymer Program

University of Connecticut

Postdoctoral Positions

Postdoctoral Fellow

Feb. 2021 - Aug. 2022

Department of Aerospace Engineering & Engineering Mechanics, The University of Texas at Austin

Research Associate

Feb. 2020 - Jan. 2021

Department of Civil & Environmental Engineering, Michigan State University

Education

PhD, Dual Major - Civil Engineering & Mechanical Engineering

Aug. 2017 - Jan 2020

Michigan State University, East Lansing, Michigan, GPA: 4/4, Advisor: Prof. Dargazany

Dissertation Title: A Micromechanical Platform to Study Nonlinear Behavior of Elastomeric Materials

PhD, Civil Engineering

Sep. 2010 - Jul 2016

Sharif University of Technology, Tehran, Iran, GPA: 18/20, Advisor: Prof. Kazemi

Dissertation Title: Detection of Abrupt Changes in Structural Properties Through Vibration Signal Processing

MS, Civil Engineering, Structural Engineering

Sep. 2007 - Dec. 2009

Sharif University of Technology, Tehran, Iran, GPA: 18/20, Advisor: Prof. Ghannad

Thesis Title: Studying Site Effects Through Seismic Signal Processing

BS, Civil Engineering

Sep. 2003 - Sep. 2007

Sharif University of Technology, Tehran, Iran, GPA: 16/20

Honors and Awards

NSF fellowship

2021

To attend Mechanistic Machine Learning and Digital Twins for Computational Science & Engineering Conference

Beckman Institute Post-doctoral Fellowship, \$187K, Three-year support (declined)

2021

Beckman Institute, University of Illinois at Urbana-Champaign

Project Title: "A Multi-Scale Approach to Model Micro-Structural Changes in Ligaments".

Winner of **the Fitch H. Beach Award** for Outstanding Graduate Research

2020

College of Engineering, Michigan State University

Most Outstanding Researcher

2020

Department of Civil and Environmental Engineering, Michigan State University

Haythornthwaite Foundation Student Travel Award

2018

2018 International Mechanical Engineering Congress and Exposition (IMECE) of the ASME

National Elites Foundation Fellowship for PhD Students, Iran

2012-2013

National Elites Foundation Fellowship for Master Students, Iran

2007-2009

Exceptionally Talented students Fellowship, Sharif University of Technology, Iran

2007-2009

Publications

Peer Reviewed Journal Articles.....

1. **Morovati, V.**, Z. Xue, K. Liechti, and R. Huang. "Interlayer Coupling and Strain Localization in Small-Twist-Angle Graphene Flakes." *Extreme Mechanics Letters* 55 (2022): 101829,.
2. Ghaderi, A., **V. Morovati**, Y. Chen, and R. Dargazany. "A physics-informed multi-agents model to predict thermo-oxidative/hydrolytic aging of elastomers." *International Journal of Mechanical Sciences* 223 (2022): 107236.
3. Akbari, R., **V. Morovati**, R. Dargazany. "Reverse physically motivated frameworks for investigation of strain energy function in rubber-like elasticity." *International Journal of Mechanical Sciences* (2022): 107110.
4. Bahrololoumi, A., **V. Morovati**, M. Shaafaey, R. Dargazany. "A multi-physics approach on modeling of hygrothermal aging and its effects on constitutive behavior of cross-linked polymers." *Journal of the Mechanics and Physics of Solids* 156 (2021): 104614
5. **Morovati, V.**, A. Bahrololoumi, R. Dargazany. "Fatigue-Induced Stress-Softening in Cross-Linked Multi-network elastomers: Effect of Damage Accumulation." *International Journal of Plasticity* 142 (2021): 102993.
6. Ghaderi, A., **V. Morovati**, R. Dargazany. "A Bayesian Surrogate Constitutive Model to Estimate Failure Probability of Elastomers." *Mechanics of Materials* 162 (2021): 104044
7. Mohammadi, H., **V. Morovati**, AE. Korayem, E. Poshtan, R. Dargazany. "Constitutive Modeling of elastomers during photo- and thermo-oxidative aging.", *Polymer Degradation and Stability* 191 (2021): 109663.
8. Bahrololoumi, A., H. Mohammadi, **V. Morovati**, R. Dargazany. "A Physically-Based Model for Thermo-Oxidative and Hydrolytic Aging of Elastomers." *International Journal of Mechanical Sciences* 194 (2021): 106193.
9. **Morovati, V.**, M.A. Saadat, R. Dargazany. "Necking of Double Network gels: Constitutive modeling with micro-structural insight." *Physical Review E*, 102, no. 6 (2020): 062501.
10. Ghaderi, A., **V. Morovati**, R. Dargazany. "A Physics-informed Assembly of Feed-Forward Neural Network Engines to Predict Inelasticity in Cross-Linked Polymers." *Polymers* (2020), 12, 2628.
11. Bahrololoumi, A., **V. Morovati**, E. Poshtan, R. Dargazany. "A Multi-physics Constitutive Model to Predict Quasi-static Behaviour: Hydrolytic Aging in Thin Cross-linked Polymers." *International Journal of Plasticity* 130 (2020): 102676.
12. Mohammadi, H., **V. Morovati**, E. Poshtan, R. Dargazany. "Understanding Decay Functions and their contribution in Modeling of Thermal-induced Aging of Cross-linked Polymers." *Polymer Degradation and Stability* 175 (2020): 109108.
13. **Morovati, V.**, R. Dargazany. "Improved approximations of non-Gaussian probability, force, and energy of a single polymer chain." *Physical Review E* 99, no. 5 (2019): 052502.
14. **Morovati, V.**, R. Dargazany. "Micro-mechanical modeling of the stress softening in double-network hydrogels." *International Journal of Solids and Structures* 164 (2019): 1-11.
15. **Morovati, V.**, R. Dargazany. "NET v1. 0: A framework to simulate permanent damage in elastomers under quasi-static deformations." *SoftwareX* 10 (2019): 100229.
16. **Morovati, V.**, H. Mohammadi, R. Dargazany. "A generalized approach to generate optimized approximations of the inverse Langevin function." *Mathematics and Mechanics of Solids* 24, no. 7 (2019): 2047-2059.
17. Lin J, H Zhang, **Morovati, V.**, R Dargazany. "PEGylation on mixed monolayer gold nanoparticles: Effect of grafting density, chain length, and surface curvature." *Journal of colloid and interface science* 504 (2017): 325-333
18. **Morovati, V.**, M.T. Kazemi, "Detection of sudden structural damage using blind source separation and time-frequency approaches", *Smart Materials and Structures* 25, no. 5 (2016): 055008.

Books.....

1. **Morovati, V.**, A. Tehrani, M. Babazadeh, Problems in Structural Engineering, a tutorial for nationwide PhD entrance exam, Civil House Publications, (2013).
2. **Morovati, V.**, M. Tajodini, H. Pesaran, Problems in Earthquake Engineering, a tutorial for nationwide PhD entrance exam, Civil House Publications, (2013).

Book Chapters.....

1. **Morovati, V.**, M. A. Saadat, S. Alazhary, R. Dargazany. "A physically motivated model for inelastic response of double network hydrogels." In Constitutive Models for Rubber XI, CRC Press, (2019).
2. Khalili, L., **V. Morovati**, R. Dargazany, J. Lin. "Micro-mechanical modeling of visco-elastic behavior of elastomers with respect to time-dependent response of single polymer chains." In Constitutive Models for Rubber X, pp. 523-528. CRC Press, (2017).

Conference Proceedings.....

1. **Morovati, V.**, A. Ghaderi, R. Dargazany. "Data-Driven Constitutive Modeling of the Progressive Softening in Elastomeric Gels With Interpenetrating Networks." ASME 2020 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2020).
2. Ghaderi, A., **V. Morovati**, A. Bahrololoumi, R. Dargazany. "A Physics-Informed Neural Network Constitutive Model for Cross-Linked Polymers." ASME 2020 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2020).
3. Bahrololoumi, A., H. Mohammadi, **V. Morovati**, R. Dargazany. "A Modified Network Alteration Model to Predict Quasi-Static Behavior of the Cross-Linked Polymers During Hydrolytic Aging." ASME 2020 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2020).
4. Ghaderi, A., **V. Morovati**, P. Nasiri, R. Dargazany. "Uncertainty Quantification in Predicting Behaviour of Rubber-Like Materials in Uni-Axial Loading." ASME 2020 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2020).
5. Chen, Y., **V. Morovati**, R. Dargazany. "A Directional Damage Constitutive Model for Stress-Softening in Solid Propellant." ASME 2020 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2020).
6. **Morovati, V.**, R. Dargazany. "Modelling Damage Accumulation During Cyclic Loading in Elastomeric Gels With Interpenetrating Networks." ASME 2019 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2019).
7. **Morovati, V.**, M. A. Saadat, R. Dargazany. "Modelling Stress Softening and Necking Phenomena in Double Network Hydrogels." ASME 2019 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2019).
8. **Morovati, V.**, R. Dargazany. "Understanding Role of Filler Particles in Stress Softening of Filler-Reinforced Elastomers." International Elastomer Conference, Rubber Division ACS, (2019).
9. **Morovati, V.**, R. Dargazany. "An Improved Non-Gaussian Statistical Theory of Rubber Elasticity for Short Chains." ASME 2018 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2018).
10. **Morovati, V.**, R. Dargazany. "Micro-Mechanical Modeling of the Stress Softening in Double-Network Hydrogels." ASME 2018 International Mechanical Engineering Congress and Exposition, pp. V009T12A031-V009T12A031. American Society of Mechanical Engineers, (2018).
11. **Morovati, V.**, H. Mohammadi, R. Dargazany. "A Generalized Approach to Improve Approximation of Inverse Langevin Function." ASME 2018 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2018).
12. Dargazany, R, J. Lin, H. Mohammadi, and **V. Morovati**. "Modeling Tensile-Torsion Response of Double Twisted Helical Yarns." ASME 2018 International Mechanical Engineering Congress and Exposition. American Society of Mechanical Engineers Digital Collection, (2018).

13. **Morovati, V.**, M.T. Kazemi, "Structural System Identification through Vibration Signal Processing" 9th National Congress on Civil Engineering, Babol University, Babol, Iran, (2014) (in Farsi).
14. **Morovati, V.**, S.F. Ghahari, M.A. Ghannad, "Studying Site Effects through Seismic Signal Processing" 5th National Congress on Civil Engineering, Ferdowsi University, Mashhad, Iran, (2010) (in Farsi).

Presentations

Lectern.....

1. Size Dependency And Structural Stability Of Twisted Bilayer Graphene, In 19th U.S. National Congress on Theoretical and Applied Mechanics, June 2022.
2. Micromechanical Platform to Study Nonlinear Behavior of Elastomeric Materials, In Solids Seminars, November 2021, Department of Aerospace Engineering & Engineering Mechanics, University of Texas at Austin.
3. Data-Driven Constitutive Modeling of the Progressive Softening in Elastomeric Gels With Interpenetrating Networks, In ASME 2020 International Mechanical Engineering Congress and Exposition.
4. Modelling Damage Accumulation During Cyclic Loading in Elastomeric Gels With Interpenetrating Networks, In ASME 2019 International Mechanical Engineering Congress and Exposition.
5. Modelling Stress Softening and Necking Phenomena in Double Network Hydrogels, In ASME 2019 International Mechanical Engineering Congress and Exposition.
6. Understanding Role of Filler Particles in Stress Softening of Filler-Reinforced Elastomers, In 2019 International Elastomer Conference, Rubber Division ACS.
7. An Improved Non-Gaussian Statistical Theory of Rubber Elasticity for Short Chains, In ASME 2018 International Mechanical Engineering Congress and Exposition.
8. Micro-Mechanical Modeling of the Stress Softening in Double-Network Hydrogels, In ASME 2018 International Mechanical Engineering Congress and Exposition.
9. A Generalized Approach to Improve Approximation of Inverse Langevin Function, In ASME 2018 International Mechanical Engineering Congress and Exposition.

Poster.....

10. A Physically Motivated Model for Accumulated Damage of Double-Network Hydrogels, In 2019 Engineering Graduate Research Symposium, Michigan State University.
11. A Micro-Mechanical Model for Inelastic Response of Double-Network Hydrogels, In 2018 Engineering Graduate Research Symposium, Michigan State University.

Working and Research Experience

Postdoctoral Fellow, The University of Texas at Austin *Feb. 2021- Aug. 2022*
Department of Aerospace Engineering & Engineering Mechanics,

Projects:

- Soft4Sense – Smart Surfaces for Reliable Tooling Integration
Funding Sources: Incentive PT2020, Incentive FCT, and UT Austin Portugal Program
- 2D Moiré Structures in Bilayer Graphene and TMDs

Research Associate, Michigan State University *Feb. 2020-Jan. 2021*
Head of the Modeling Group, High Performance Material Group (HPM)

Projects:

- A Hybrid Physics-based Data-Driven Approach to Model Damage Accumulation in Corrosion of Polymeric Adhesives
- A data driven framework to predict mechanical behaviour of soft materials

Graduate Research Assistant, Michigan State University *Jul. 2017-Jan. 2020*

Projects:

- A Hybrid Physics-based Data-Driven Approach to Model Damage Accumulation in Corrosion of Polymeric Adhesives
Funding Source: USDOE Office of Energy Efficiency and Renewable Energy (EERE)
- Constitutive behavior of Adhesive fillers in Extreme Conditions
Funding Source: BOSCH Co.
- Parallel Damage in Elastomer Joints: Damage Accumulation toward Failure
Funding Source: American Chemical Society
- Constitutive Modeling and Finite Element Simulation of Necking and Cyclic Stress Softening Phenomena in Tough Hydrogels
- Finite Element Simulation of Fatigue and Failure in Composite Elastomers

Graduate Researcher , Sharif University of Technology	<i>Sep. 2010-Jul. 2016</i>
Structural Design Engineer and Manager , Tehran, Iran <i>Residential Buildings, PE, Tehran Construction Engineering Organization</i>	<i>Jun.2009-Jun. 2016</i>
- Design of industrial and residential structures, more than 100,000 m^2	
Internship , Behin Taraddod Pars Consulting Engineers, Tehran, Iran	<i>Jun.-Aug. 2007</i>
Internship , Structural Design Office, Tehran, Iran	<i>Jun.-Aug. 2006</i>
Internship , Environment and Social Development Organization, Tehran Municipality, Iran	<i>Jul.-Nov. 2005</i>

Teaching Experience

Guest Lecturer , Michigan State University <i>CE 804: Mechanics for Infrastructure (Graduate Level)</i>	<i>Fall 2017, Fall 2018</i>
Teaching Assistant , Sharif University of Technology <i>Structural Analysis II (Undergraduate Level)</i> <i>Design of Concrete Structure I (Undergraduate Level)</i> <i>Continuum Mechanics (Graduate Level)</i> <i>Theory of Elasticity (Graduate Level)</i> <i>Random Vibration (Graduate Level)</i>	<i>Sep. 2009-Dec. 2012</i>
Instructor , Sanjesh Takmili Institute and Oxin Institute of Higher Education <i>Strength of Materials (Undergraduate Level)</i> <i>Structural Analysis (Undergraduate Level)</i> <i>Concrete Structure Design (Undergraduate Level)</i> <i>Steel Structure Design (Undergraduate Level)</i>	<i>Sep. 2010-Mar. 2012</i>

Referee Services

International Journal of Mechanical Sciences
 International Journal of Solids and Structures
 Engineering Structures
 Mechanics of Materials
 Surface Science
 Macromolecular Theory and Simulations
 Polymers
 Mathematical and Computational Applications, etc.

Professional Memberships

American Society of Civil Engineers
 American Society of Mechanical Engineers