

# Curriculum Vitae



## **Mohammad M. Karimi**

**Name:** Mohammad

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**Assistant professor**

Pavement engineering (Highway and Transportation)

Department of civil and environmental engineering

Tarbiat Modares University (since Sep. 2018)

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**Date and Place of Birth:** July 18, 1988, Yazd, Iran

## ACADEMIC BACKGROUND

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**B.S.:** Civil Engineering, Iran University of science and Technology, (2006-2010).

**M.S.:** Civil Engineering, Highway and Transportation, Pavement Engineering, Sharif University of Technology, (2010-2012).

**Ph.D.:** Civil Engineering, Highway and Transportation, Pavement Engineering, Sharif University of Technology (2012- January 2018).

**Sabbatical:** Visiting scholar, Constitutive modeling of asphalt concrete, University of Kansas (2016- 2018).

## RESEARCH INTERESTS

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- Constitutive modeling (linear and non-linear, time dependent and time-independent, large and small strain)
- Asphalt concrete and geo-materials constitutive relationships (viscoelastic, viscoplastic and hardening relaxation, visco-continuum damage, mechanical and physical damage, self and induced healing, anisotropic elasticity and viscoelasticity)
- Numerical modeling of constitutive relationships
- Asphalt pavement
- Induced healing of the asphaltic materials
- Full scale monitoring of pavement structure
- Small scale simulation and monitoring of pavement structure
- Pavement construction and performance monitoring
- Intelligent compaction (IC)
- Weigh in Motion (WIM) system
- Fiber optic sensors
- Fiber Bragg Grating (FBG) sensor
- Railway flat wheel and dynamic weighting systems
- Induced heating and healing of materials
- Constitutive modeling of smart materials (e.g., metamaterials)

## PUBLICATIONS

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### Journal Papers:

**Karimi, M.M.**, Darabi, M. K., and Tabatabaee, N. (2019). A Thermodynamic-Based Large Deformation Viscoplastic Constitutive Relationship for Asphalt Concrete Compaction. **International Journal of Solids and Structures**.

**Karimi, M.M.**, Darabi, M.K., Jahanbakhsh, H., Jahangiri, B., Rushing, J. F. (2019). Effect of steel wool fibers on mechanical and induction heating response of conductive asphalt concrete. *International Journal of Pavement Engineering*, 1-14.

**Karimi, M.M.**, Jahanbakhsh, H., Jahangiri, B., Moghadas nejad, F. (2018). Induced Heating-Healing Characterization of Activated Carbon Modified Asphalt Concrete under Microwave Radiation. **Construction and Building Materials**, 178, 254–271.

Jahanbakhsh, H., **Karimi, M.M.**, Jahangiri, B., Moghadas nejad, F. (2018). Induction Heating and Healing of Carbon Black Modified Asphalt Concrete under Microwave Radiation. **Construction and Building Materials**. 174, 656-666.

**Karimi, M.M.**, Tabatabaee, N., Jahangiri, B., and Darabi, M.K. (2017). Constitutive Modeling of Hardening-Relaxation Response of Asphalt Concrete in Cyclic Compressive Loading. **Construction and Building Materials**, 137, 169-184.

**Karimi, M.M.**, Tabatabaee, N., Jahanbakhsh, H., and Jahangiri, B. (2016). Development of a stress-mode sensitive viscoelastic constitutive relationship for asphalt concrete: experimental and numerical modeling. **Mechanics of Time-Dependent Materials**, 1-35.

Jahanbakhsh, H., **Karimi, M.M.**, Nejad, F. M., and Jahangiri, B. (2016). Viscoelastic-based approach to evaluate low temperature performance of asphalt binders. **Construction and Building Materials**, 128, 384-398.

Jahangiri, B., **Karimi, M.M.**, and Tabatabaee, N. (2016). Relaxation of Hardening in Asphalt Concrete under Cyclic Compression Loading. **Journal of Materials in Civil Engineering**, 04016288.

Jahanbakhsh, H., **Karimi, M.M** and N. Tabatabaee. (2016). Experimental and Numerical Investigation of Low Temperature Performance of Modified Asphalt Binders and Mixtures. **Road material and Pavement Design**, 1-22.

Moghadas nejad, F., Sorkhabi, H., and **Karimi, M.M.** (2015). Experimental Investigation of Rest Time Effect on Permanent Deformation of Asphalt Concrete. **Journal of Materials in Civil Engineering**, 28(5).

### **Conference Papers:**

**Karim, M.M.**, Tabatabaee, N., Jahangiri, B and Jahanbakhsh. H. (2016). Effects of Rest and Load Time on Asphalt Mixture Compaction. **International Society for Asphalt Pavements (ISAP)**, Western Research Institute.

Jahangiri, B., **Karimi, M.M** and Tabatabaee, N. (2015). Evaluating Relaxation of Hardening of Asphalt Concrete” Presented at the 94<sup>th</sup> Annual Meeting of the **Transportation Research Board**.

Zahabi, M. H., **Karimi, M.M.**, and Tabatabaee, N. (2016). Microstructure-Based Visco-Elastoplastic Continuum Model of Asphalt Concrete. In 8th **RILEM International Symposium on Testing and Characterization of Sustainable and Innovative Bituminous Materials**, 37-48.

Tajdini, M., Rostami, A., **Karimi, M.M.**, Teherkhani, H., and Mahin Roosta, R. (2012). Evaluation of the Geo-Mechanical Parameters of the Interface between Asphalt Concrete and Sand with Applying Direct Shear Test and Numerical Modelling. **International Conference on Civil Engineering and Materials**.

### **LECTURE**

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Engineering mechanic institute (EMI), 2017. Constitutive Modeling of Intrinsic Cross-Anisotropic Viscoelastic Response of Asphalt Concrete. San Diego, USA.

## RESEARCH EXPERIENCE

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### **M.Sc. Thesis:**

**“Micromechanical Modeling of the Viscoelastic Performance of the Asphalt Concrete Using Finite Element Method”**, Sharif University of Technology, Adviser: Professor Nader Tabatabaee.

In this research, image processing tools were used for discretization of mastic and aggregate phases in asphalt concrete. Nonlinear viscoelastic finite element analysis (FEA) was used for numerical modeling of laboratory loaded specimens. Also, digital image correlation (DIC) techniques were implemented to determine full field displacement and strain. The strain ratios of asphalt binder to mastic, asphalt mastic to asphalt concrete and asphalt binder to concrete were also calculated.

### **Ph.D. Dissertation:**

**“Compaction Modeling of Asphalt Using Thermo-visco-elastoplastic Constitutive Relationships Considering Large Deformations”**, Sharif University of Technology, Adviser: Professor Nader Tabatabaee.

Main goal of this study was presenting a comprehensive constitutive relationship that is capable of modeling the compaction phases of asphalt concrete in laboratory and field. The constitutive relationship was calibrated against experimental tests. Finite element method (FEM) is used to integrate the proposed constitutive relationship. In addition, compaction degree measured in the field was used to validate the proposed constitutive relationship.

## PROFESSIONAL SKILLS

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- Asphalt binder and concrete laboratory assessments.
- Field measurement and investigation of asphalt pavement
- Finite Element Analysis (FEA)- Theory and programming
- Proficient in using ABAQUS (Writing UMAT, VUMAT, UMATHT and UEL subroutines in Fortran to define arbitrary constitutive relationship)
- ABAQUS scripting in the Python language

- Co-simulation in BAQUS software (thermo-electro-magnetic, mechanical-electro-magnetic)
- Digital Image Correlation (DIC)- Theory and programming
- Fiber optic sensors (Faber Bragg Grating (FBG))
- Fortran
- MATLAB

## RESEARCH PROJECTS

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- An Investigation of premature failures of asphalt pavement roads of Kohgiluyeh and Boyer Ahmad Province, Iran. Ministry of road and urban development, Iran. 2015.
- Investigation of various approaches toward road construction without accessibility to the asphalt concrete and Portland cement concrete plants. Iran's National Elites Foundation, Iran. 2012.

## TEACHING EXPERIENCES

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### Teaching

- Advance Pavement Design, M.Sc., Islamic Azad University, 2013.
- Pavement Management System, M.Sc., Islamic Azad University, 2013-2015 (Three semesters).
- Advance Geometry Design of Highway, M.Sc., Islamic Azad University, 2013-2015 (Three semesters).
- Advance Traffic Engineering, M.Sc., Islamic Azad University, 2013-2015 (Three semesters).

### Teaching Assistant

- Advance Pavement Design, Prof. N. Tabatabaee., Sharif University of Technology, 2013-2015 (Three semesters).
- Asphaltic Materials, Prof. N. Tabatabaee., Sharif University of Technology, 2013-2014 (Two semesters).

## **AWARDS AND HONORS**

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- Honored and awarded as the best researcher of the year, School of Civil Engineering, Sharif University of Technology (2017)
- Second place (Silver medal), Civil Engineering National Scientific Olympiad (2010)
- Member of Iran's National Elites Foundation (from 2010)

## **PATENTS**

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- Equipping highway bridges with Fiber Bragg Grating (FBG) optic sensor for Weigh in Motion (WIM) system. 2015, Iran.
- Hydraulic sensor with high speed optical sensor for Weigh in Motion (WIM) system in highways. 2014, Iran.
- Wheel flat detection and dynamic weighting system for railway networks using the Fiber Bragg Grating (FBG) optic sensor. 2014, Iran.

## **COMMITTEE MEMEBER**

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- EMI mechanics of pavement committee, ASCE
- SCIREA Journal of Civil Engineering and Building Construction
- Trends in Civil Engineering and its Architecture
- Academic Exchange Information Center (AEIC)
- International Conference on Mechanical, Control and Computer Engineering (ICMCCE)
- Materials Science: Materials Review

## REVIEWER

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- Construction and Building Materials
- Journal of Materials in Civil Engineering
- International Journal of Mechanical Sciences
- International Journal of Pavement Engineering
- Steel and Composite Structures: an International Journal
- Journal of Soft Computing in Civil Engineering
- International Journal of Mechanical Engineering and Applications
- International Journal of Materials.
- Transportation Research Board
- Materials Science and Applications
- Conference on Materials Science and Engineering
- International Conference on New Energy and Future Energy System
- Global Conference on Polymer and Composite Materials
- International Conference on Material Strength and Applied Mechanics
- International Conference on Biomedical Engineering and Biotechnology
- Global Conference on Materials Science and Engineering
- American Journal of Civil Engineering

## THESIS CONSULTING

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- Induction Heating and Healing of Asphalt Concrete under Electro-magnetic Radiation; Hamid Jahanbakhsh, Ph.D. Thesis, Amirkabir University of Technology, ongoing.
- Study of the Effects of Rest Time and Loading Time on Viscoplastic Strain of Asphalt Concrete; Behnam Jahangiri, M.Sc. Thesis, Sharif University of Technology, 2015.



- Discrete Element Simulation of Creep Behavior in Asphalt Mixtures; Mostafa Estaji, M.Sc. Thesis, Sharif University of Technology, 2015.
- Microstructure-Based Visco-Elastoplastic Continuum Model of Asphalt Concrete; Mohammad Hossein Zahabi Ardekani, M.Sc. Thesis, Sharif University of Technology, 2015.
- Low Temperature Performance Evaluation of Modified Asphalt Binders; Hamid Jahanbakhsh, M.Sc. Thesis, Sharif University of Technology, 2013.
- Modeling of Hot Mix Asphalt Compaction in Field Using Laboratory Data; Reza Maskani, M.Sc. Thesis, Amirkabir university of Technology, 2013.
- Experimental Evaluation of Effect of Rest Time on Healing Mechanism of Asphalt Mixture; Hossain Sorkhabi, M.Sc. Thesis, Amirkabir University of Technology, 2013.
- Modeling of Moisture-Induced Damage in Asphalt Mixtures; Ashkan Bozorgzad, M.Sc. Thesis, Sharif University of Technology, 2012.

## SELECTED COURSES TAKEN

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- Advance Pavement Analysis and Design
- Pavement Management Systems
- Advance Asphaltic Material
- Linear Finite Element Analysis (FEM I)
- Nonlinear Finite Element Analysis (FEM II)
- Numerical Modeling in Geomechanics
- Advance Numerical Modeling in Geomechanics
- Continuum Mechanics
- Mechanics of Viscoelasticity
- Fatigue, Fracture and Creep Mechanics