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Mohammad Sarraf Joshaghani

Education

August 2019 **Ph.D., Civil Engineering**, *University of Houston*, Houston, TX, United States.
With concurrent degree program in **High Performance Computing.**
Thesis title: *Multi-scale and interface mechanics for porous media: mathematical models and computational frameworks.* (click here to view)
Supervisor: Dr. K. B. Nakshatrala

2014 **M.Sc., Civil Engineering**, *University of Houston*, Houston, TX, United States.
Thesis title: *Full-scale testing and numerical modeling of subsea pipe soil interaction.*
Supervisors: Dr. C. Vipulanandan

2012 **B.Sc., Civil Engineering**, *Azad University of Mashhad*, Mashhad, Iran.

Professional Experience

September 2019 –present **Postdoctoral Research Associate**, Rice University, Houston, TX.
Department of Computational and Applied Mathematics
Computational Modeling of Porous Media (COMP-M) group
- *Developed numerical methods and scalable high-performance computational frameworks for (in)compressible two-phase flow systems in heterogeneous porous media. Two distinct features that make the proposed methods appealing to application scientists are: (i) maximum principle is satisfied, and (ii) mass balance is locally conserved.*
- *Developed a multiphysics reservoir simulator based on discontinuous Galerkin finite element method, in collaboration with TOTAL's R&D division.*

August 2015 –August 2019 **Graduate Research Assistant**, University of Houston, Houston, TX.
Department of Civil and Environmental Engineering
Computational and Applied Mechanics Laboratory (CAML) group
- *Developed a theoretical/computational framework for modeling flow in porous media with coupled double pore-networks.*
- *Proposed a composable block solvers and performance spectrum analysis for double porosity/permeability model.*
- *Developed a theoretical/mechanistic framework for obtaining the interface condition for porous-fluid domains, employing dissipation theorem and calculus of variations.*
- Developed an optimized-based nonnegative framework for coupling plasticity with species diffusion.
- *Mathematical modeling of the hemodynamic forces and vascular morphology of the cerebral aneurysm.*

November 2014 –July 2015 **Civil Engineer**, Odebrecht Group, Houston, TX.
- *Reviewed designs and drafts of structural components of* 1.1 *miles of Grand parkway-SH99 bridges, and performed structural analysis for pre-stressed concrete beams.*
- *Provided an interface with design group and resolve non-conformity-reports for superstructures.*

September 2014 –November 2014 **Intern**, EDI Building Consultants Co., Houston, TX.
- *Analysis and design of steel connections for Williams Tower penthouse roof.*
- *Structural and damage assessments for Houston Club implosion on Esperson building.*

August 2012 –August 2014 **Research Assistant**, University of Houston, Houston, TX.
- *Developed a numerical model based on ALE formulation to predict subsea pipe-soil interaction.*
- *Performed full scale laboratory modeling of HPHT subsea pipelines, susceptible to thermal buckling; and proposed mitigation solutions.*
- *Developed a model for characterizing rheological and mechanical behavior of ultra-soft clayey soil*

Publications

PREPRINTS

1 **M. S. Joshaghani**, B. Riviere, and M. Sekachev Maximum-principle-satisfying discontinuous Galerkin methods for incompressible two-phase immiscible flow *submitted to Computer Methods in Applied Mechanics and Engineering Journal*, 2021. [Available on arXiv]

2 **M. S. Joshaghani**, V. Girault, and B. Riviere A vertex scheme for two-phase flow in heterogeneous media *submitted to Journal of Computational Physics*, 2021. [Available on arXiv]

3 **M. S. Joshaghani** and K. B. Nakshatrala A modeling framework for coupling plasticity with species diffusion *submitted to International Journal for Numerical Methods in Engineering*, 2020. [Available on arXiv]

PEER-REVIEWED

1 **M. S. Joshaghani**, J. Chang, K. B. Nakshatrala, and M. G. Knepley On composable block solvers and performance spectrum analysis for double porosity/permeability model *Journal of Computational Physics* 386: 428-466, 2019. [Journal link]

2 K. B. Nakshatrala and **M. S. Joshaghani** On interface conditions for flows in coupled free-porous media *Transport in Porous Media* 130: 577-609, 2019. [Journal link]

3 **M. S. Joshaghani**, S. H. Joodat, and K. B. Nakshatrala A stabilized mixed discontinuous Galerkin formulation for double porosity/permeability model *Computer Methods in Applied Mechanics and Engineering Journal* 352: 508-560, 2019. [Journal link]

4 A. M. Raheem, C. Vipulanandan, and **M. S. Joshaghani** Non-destructive experimental testing and modeling of electrical impedance behavior of untreated and treated ultra-soft clayey soils *Journal of Rock Mechanics and Geotechnical Engineering* 9(3): 543-550, 2017. [Journal link]

5 M. M. R. Mousavi, M. D. Champiri, **M. S. Joshaghani**, and S. Sajjadi A kinematic measurement for ductile and brittle failure of materials using digital image correlation *AIMS Materials Science* 3(4): 1759-1772, 2016. [Journal link]

6 A. M. Raheem, and **M. S. Joshaghani** Modeling of shears strength-water content relationship of ultra-soft clayey soil. *International Journal of Advanced Research* 4(4): 537-545, 2016. [Journal link]

7 **M. S. Joshaghani**, A. M. Raheem, and M. M. R. Mousavi Analytical modeling of large-scale testing of axial pipe-soil interaction in ultra-soft soil *American Journal of Civil Engineering and Architecture* 4(3): 98-105, 2016. [Journal link]

8 C. Vipulanandan, J. A. Yahouide, and **M. S. Joshaghani** Deepwater axial and lateral sliding pipe-soil interaction model study *Pipelines 2013: Pipelines and Trenchless Construction and Renewals–A Global Perspective*: 1583–1592, 2013. [Journal link]

IN-PREPARATION

1 **M. S. Joshaghani**, B. Riviere, and M. Sekachev A bound-preserving discontinuous Galerkin method for compressible two-phase flow.

2 **M. S. Joshaghani**, B. Riviere Maximum-principle preserving discontinuous Galerkin schemes for convection-dominated PDEs: a brief survey.

3 K. B. Nakshatrala, **M. S. Joshaghani**, and M. Shabouei A posteriori criterion based on Noether's theorem to assess accuracy of numerical solutions for diffusion equations.

Conference Presentations and Talks

1 **M. S. Joshaghani**. Maximum-Principle-Satisfying Discontinuous Galerkin Methods for Compressible Two-Phase Immiscible Flow *SIAM Conference on Mathematical and Computational Issues in the Geosciences (GS21), Online*, June 2021. [oral presentation]

2 **M. S. Joshaghani**. A maximum principle preserving finite element method with mass conservation property for solving two-phase flow in heterogeneous porous media *13th Annual Meeting of the International Society for Porous Media (InterPore), Online Conference*, June 2021. [oral presentation]

3 **M. S. Joshaghani**. Mechanics at the interface of flow and highly heterogeneous domain with complex porous structures *Department of Computational & Applied Mathematics (CAAM) Colloquium*, Rice University, October 2020. [invited talk]

4 **M. S. Joshaghani**. Maximum-principle-preserving vertex-based method for two phase flows in porous media *3rd Annual Meeting of the Society of Industrial and Applied Mathematics (SIAM) Texas-Louisiana Section*, Texas A & M University, October 2020. [invited talk]

5 **M. S. Joshaghani**. A modeling framework for coupled plasticity and species diffusion with applications to degradation *Engineering Mechanics Institute (EMI) Conference*, Pasadena, CA, June 2019. [poster presentation]

6 **M. S. Joshaghani**, and K. B. Nakshatrala. A scalable parallel implementation of double porosity/permeability model *Society of Industrial and Applied Mathematics (SIAM) Conference on Mathematical and Computational Issues in the Geosciences*, Houston, TX, March 2019. [oral presentation]

7 **M. S. Joshaghani**. On composable block solvers and performance spectrum model for the four-field double porosity/permeability model *Society of Industrial and Applied Mathematics (SIAM) Conference on Computer Science and Engineering*, Spokane, WA, Febreuary 2019. [poster presentation]

8 **M. S. Joshaghani**. Stabilized discontinuous Galerkin formulation for modeling flow in highly heterogeneous media with complex porous structures *Center for Thermo-Fluid Mechanics (CTFM) Seminar*, Houston, TX, October 2018. [invited talk]

9 **M. S. Joshaghani**. A stabilized mixed DG formulation for flow in porous media with double pore-networks *Engineering Mechanics Institute (EMI) Conference*, Boston, MA, May 2018. [oral and poster presentation]

10 **M. S. Joshaghani**. Finite element simulation of deep-water pipe walking phenomenon on ultra soft soil *American Geophysical Union (AGU) Fall Meeting*, San Francisco, CA, December 2014. [poster presentation]

11 **M. S. Joshaghani**. Testing and modeling of fixed and rolling buoyancy sections *Center for Innovative Grouting Material and Technology (CIGMAT) Conference*, Houston, TX, March 2014. [poster presentation]

Teaching Experience

Workshop Instructor at University of Houston

- *"Solving PDEs in Python: A FEniCS tutorial"*, UH Center for Advanced Computing and Data Science (CACDS), Houston, TX, June 2018.
- *"CFD Code Development Frameworks"*, UH Center for Thermo-Fluid Mechanics (CTFM), Houston, TX, September 2018.

Teaching Assistant at University of Houston

Statics (Spring 2017-2019), solid mechanics (Fall 2016), matrix analysis (Fall 2017)

Awards & Honors

2019 **Runner-up Best Dissertation Award.**
Department of Civil and Environmental Engineering, University of Houston

2019 **SIAM CSE19 Travel Award.**
Society for Industrial and Applied Mathematics (SIAM)

2018 **Winner of computational mechanics student competition.**
Engineering Mechanics Institute (EMI), Massachusetts Institute of Technology [UH eNews Coverage]

2017-2018 **Future Faculty Program Fellowship.**
Cullen College of Engineering, University of Houston

2018-2019 **Center for Advanced Computing and Data Science Fellow.**
University of Houston

2015-2019 **UH Doctoral Student Tuition Fellowship.**
University of Houston

2012-2013 **Houston Endowment and Presidential Fellowship.**
2015-2017 Cullen College of Engineering

2003 **Awarded best K-12 student paper.**
Iranian national competion for K-12 students, Organization for Development of Exceptional Talents

Computer skills

Programming Languages	C/C++, FORTRAN, LaTeX, Mathematica, MATLAB, Python, R, Shell scripting, version control
Scientific libraries	CUDA, Deal II, FEniCS/Firedrakes, FreeFEM++, MPI, NumPy, OpenFOAM, OpenMP, PETSc, PFLOTRAN, SciPy
Commercial softwares	ABAQUS, COMSOL, PLAXIS, SAP
Visualization Packages	AutoCAD, gnuplot, Grace, GMSH, ParaView, VisIt

References

- Prof. Beatrice Riviere
  Dept. of Computational & Applied Mathematics
  Duncan Hall 3019
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- Prof. Matthew G. Knepley
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  211A Capen Hall
  University at Buffalo, Buffalo,
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- Prof. Kalyana B. Nakshatrala
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(Additional references available upon request.)

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