










M. Naqib Rahimi, Ph.D. Candidate

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Summary:

I am a Ph.D. candidate in Civil Engineering specializing in fluid-structure interaction, failure modeling, and finite element analysis. I have extensive experience developing advanced algorithms for failure simulations in multi-physics environments, with a focus on Smoothed Particle Hydrodynamics, Peridynamics, Finite Elements, Isogeometric Analysis, and Phase Field method. I also have hands-on expertise in grant writing and high-performance computing, including CUDA parallelization.




EDUCATION

- 2021 – Now  **Ph.D. in Civil engineering., Stony Brook University**
Thesis title: Computational mechanics of extreme events: Advanced multi-physics simulations with Smoothed Particle Hydrodynamics, Isogeometric Analysis, Micro Plane Model, and Phase Field.
- 2019 – 2021  **M.Sc. in Material Science and Nanoengineering, Sabanci University**
Thesis title: Peridynamic Modeling of Internal Features and Interfaces for Material Toughening.
- 2015 – 2021  **B.Sc. in Mechanical Engineering, Inonu University**
Thesis title: Energy Assessment of Bio-wastes in Afghanistan's Kunar city.
- 2014 – 2018  **B.Sc. in Civil Engineering, Inonu University.** Honors degree
Thesis title: Excel-based Programming in Civil Engineering.



SKILLS

- | | |
|---------------------|---|
| Coding |  C++, Python, Fortran, MATLAB, CUDA, and FEniCS. |
| Methods |  SPH, Phase Field, Finite Element, Isogeometric Analysis, Peridynamics. |
| Softwares |  ANSYS, LSDYNA, SolidWorks, AutoCAD. |
| Post/Pre-processing |  ANSA, LS-PrePost, ParaView, GiD, and Corel Draw. |
| Languages |  English, Persian, Turkish, Hindi, and Pashto. |



FUNDED PROPOSALS

- 2024 – Now  **CAREER: Open-Source GPU-Accelerated Computational Infrastructure for Coastal Fluid-Structure Interaction in Extreme Hydrodynamic Conditions**
Research Assistant (NSF AWARD #: 2338313)
PI: Georgios Moutsanidis
- Developed a fully SPH-based solver for failure analysis of structures in extreme FSI scenarios.
 - Generated preliminary results that led to the award.
- 2020 – 2022  **Development and Experimental Validation of Parallelized Hybrid SPH-PD Particle Method for Fluid-Solid Interaction Solutions of Hydro-elasticity Problems**
Research Assistant (TUBITAK Project ID: 121M425)
- Developed a GPU solver for failure analysis of linear elastic brittle structures in turbulent channels.
 - Designed experimental setup for validation purposes.
- 2020 – 2021  **Parallelized Hybrid Particle Methods Supported by Innovative Non-local Models: Applications to Fluid-Structure-Interaction Analysis**
Primary Investigator (Project ID: B.A.KM-21-02377)
- Developed a new SPH-Peridynamics numerical method for failure analysis of structures in multi-physics scenarios.

JOB EXPERIENCE

- May 2024 – Aug 2024  **R&D Simulation Engineer Intern, ANSYS-LSDYNA.**
- Continued working on similar topics from the previous year.
 - Took on the integration of CUDA parallelization into parts of the ANSYS-LSDYNA code.
 - Led the first steps in transforming a significant portion of the ANSYS-LSDYNA base code to CUDA parallel architecture.
- May 2023 – Aug 2023  **R&D Simulation Engineer Intern, ANSYS-LSDYNA.**
- Developed parallel algorithms for ANSYS-LSDYNA software to simulate airbag behavior during car crashes.
 - Conducted FEM analyses and meshing for complex geometries.
 - Performed mesh cleaning and re-meshing of airbags using ANSA and LS-PrePost.





JOB EXPERIENCE (continued)

- Jun 2017 – Aug 2017  **Engineer Intern**, Inonu University Department of Constructions.
- Led a team of 9 interns in construction activities at Inonu University's campus.
 - Participated in the construction of various new buildings, including a bridge, amphitheater, and student activity center.
- Jun 2016 – Aug 2016  **Engineer Intern**, Guven Constructions.
- Reported workflow and material usage for ongoing construction sites.
 - Engaged in regular standardization and quality control activities.







AWARDS

- 2024  **IACS Junior Researcher Award**
Presented by the Institute for Advanced Computational Science (IACS) to PhD students for their outstanding research achievements.
-  **SBU Civil Engineering Research Merit Award**
Recognizes exceptional research contributions from a graduate student in the Department of Civil Engineering at Stony Brook University.
- 2023  **Best Student Paper**
Was recognized for the best student paper by the Fluid Dynamics Committee of the American Society of Civil Engineers at the Engineering Mechanics Institute (EMI) conference.
- 2019  **Summa Cum Laude Award**
Ranked 1st out of 940 students in the Faculty of Engineering, Inonu University.
- 2018  **First Place in National Undergraduate Thesis Competition**
Awarded by the Scientific and Technological Research Council of Turkey (TUBITAK) for outstanding undergraduate thesis work.
- 2017  **Young Merit Award**
Presented by the MISA Organization for exceptional academic and personal achievements.
- 2011  **Silver Medalist in Mathematics**
Achieved silver at the International Science Olympiad (ISO) in Abuja, Nigeria.
- 2010  **Gold Medalist in Mathematics**
Awarded the gold medal at the National Mathematics Olympiad in Afghanistan.

SCHOLARSHIPS

- 2019  **Master's Scholarship**
- 2015  **Undergraduate Scholarship (Mechanical Engineering)**
- 2013  **Presidential Scholarship (Civil Engineering)**
- 2008  **High School Scholarship**









TEACHING EXPERIENCE

- Jan 2024 – May 2024  **Steel and Reinforced Concrete Design I (CIV312)**
- Jan 2021 – Jul 2021  **Calculus (Math102)**
- Sep 2020 – Jan 2021  **Manufacturing Processes (IE309)**
- Jan 2020 – June 2020  **Int. to Material Science (ENS205)**
- Jan 2019 – Jan 2020  **Calculus (MATH102)**
- Jan 2019 – Apr 2019  **Dynamics (DNK201)**

PUBLICATIONS

Journal Articles

- [11] **M. N. Rahimi** and G. Moutsanidis, "Modeling concrete failure with smoothed particle hydrodynamics using the microplane (m7) constitutive model," *In Press*, Jan. 2025.
- [10] **M. N. Rahimi**, G. Moutsanidis, and L. Svolos, "Phase field modeling of dynamic brittle fracture in functionally graded materials under thermal shock," *In Press*, Mar. 2025.

- [9] **M. N. Rahimi** and G. Moutsanidis, "Iga-sph: Coupling isogeometric analysis with smoothed particle hydrodynamics for air-blast-structure interaction," *Engineering with Computers*, pp. 1–22, May 2024.  DOI: <https://doi.org/10.1007/s00366-024-01978-0>.
- [8] **M. N. Rahimi** and G. Moutsanidis, "An sph-based fsi framework for phase-field modeling of brittle fracture under extreme hydrodynamic events," *Engineering with Computers*, Aug. 2023.  DOI: <https://doi.org/10.1007/s00366-023-01857-0>.
- [7] **M. N. Rahimi**, D. C. Kolukisa, M. Yildiz, M. Ozbulut, and A. Kefal, "A Generalized Hybrid Smoothed Particle Hydrodynamics-Peridynamics Algorithm with a Novel Lagrangian Mapping for Solution and Failure Analysis of Fluid-Structure Interaction Problems," *Computer Methods in Applied Mechanics and Engineering*, Feb. 2022, (Highly cited).  DOI: 10.1016/j.cma.2021.114370.
- [6] **M. N. Rahimi** and G. Moutsanidis, "A smoothed particle hydrodynamics approach for phase field modeling of brittle fracture," *Computer Methods in Applied Mechanics and Engineering*, Aug. 2022.  DOI: <https://doi.org/10.1016/j.cma.2022.115191>.
- [5] **M. N. Rahimi** and G. Moutsanidis, "Modeling dynamic brittle fracture in functionally graded materials using hyperbolic phase field and smoothed particle hydrodynamics," *Computer Methods in Applied Mechanics and Engineering*, Nov. 2022.  DOI: <https://doi.org/10.1016/j.cma.2022.115642>.
- [4] **M. N. Rahimi**, A. Kefal, and M. Yildiz, "An improved ordinary-state based peridynamic formulation for modeling FGs with sharp interface transitions," *International Journal of Mechanical Sciences*, May 2021.  DOI: 10.1016/j.ijmecsci.2021.106322.
- [3] B. AlKhateab, I. E. Tabrizi, J. S. M. Zanjani, *et al.*, "Damage mechanisms in CFRP/HNT laminates under flexural and in-plane shear loadings using experimental and numerical methods," *Composites Part A: Applied Science and Manufacturing*, Oct. 2020.  DOI: 10.1016/j.compositesa.2020.105962.
- [2] **M. N. Rahimi**, A. Kefal, M. Yildiz, and E. Oterkus, "An ordinary state-based peridynamic model for toughness enhancement of brittle materials through drilling stop-holes," *International Journal of Mechanical Sciences*, Sep. 2020.  DOI: 10.1016/j.ijmecsci.2020.105773.
- [1] **M. N. Rahimi** and O. H. Bettemir, "Development of an Unmanned Ground Vehicle for Shelter and Cave Reconnaissance and annihilation," *Savtek 2018 9. Defence Technologies*, vol. 1, no. -, pp. 761–771, Apr. 2018.

Conference Proceedings

- [8] **M. N. Rahimi**, G. Moutsanidis, and L. Svolos, "Dynamic crack propagation in functionally graded materials under thermal shock: A novel phase field approach," in *Engineering Mechanics Institute Conference and Probabilistic Mechanics and Reliability Conference (EMI/PMC 2024) in Chicago, Illinois, May 28-31, 2024*, May 2024.
- [7] **M. N. Rahimi** and G. Moutsanidis, "High Fidelity Modeling of Fracture Under Extreme Hydrodynamic Events: A Coupled SPH-Phase-Field FSI Approach," in *Engineering Mechanics Institute Conference 2023 (EMI 2023) in Atlanta, Georgia, June 6-9, 2023*, Jun. 2023.
- [6] D. C. Kolukisa, R. Saghatchi, **M. N. Rahimi**, G. Moutsanidis, and M. Yildiz, "SPH-PD Modeling of the Periodic Elastic Response of a Beam Behind a Cylinder in Laminar Incompressible Flow," in *The 12th TSME International Conference on Mechanical Engineering in Phuket, Thailand*, Dec. 2022.
- [5] G. Moutsanidis and **M. N. Rahimi**, "SPH framework for Modeling Fracture in Fluid-Structure Interaction: a comparative study between phase field and peridynamics," in *Meshfree and Novel Finite Element Methods with Applications in Berkeley, California*, Jun. 2022.
- [4] **M. N. Rahimi** and G. Moutsanidis, "A coupled total Lagrangian SPH-phase field framework for brittle fracture," in *16th SPHERIC in Catania, Italy*, Jun. 2022.
- [3] **M. N. Rahimi** and G. Moutsanidis, "SPH framework for Hyperbolic phase field modeling of brittle fracture," in *Meshfree and Novel Finite Element Methods with Applications in Berkeley, California*, Jun. 2022.
- [2] **M. N. Rahimi**, A. Kefal, and M. Yildiz, "Numerical Investigation on Effective Toughening Mechanisms of Graded Composites," in *JOINT EVENT: ICCS23 - 23rd International Conference on Composite Structures & MECHCOMP6 - 6th International Conference on Mechanics of Composites*, Elsevier, Mar. 2020, p. 151.

- [1] **M. N. Rahimi**, O. F. Bulak, and O. H. Bettemir, “Excel Based Program Modeling and Project Management Application Development,” in *Tubitak Project Competition Proceedings*, The Scientific and Technological Research Council of Turkey (TUBİTAK), 2018, p. 87.

References


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