Hossein Kabir

Postdoctoral Research Associate
University of Illinois Urbana-Champaign
Urbana, Illinois, 61801, USA

Phone: +1 (952) 221-9279
Email: hkabir2@illinois.edu
Google Scholar (Publications)

Current Employment

- **University of Illinois Urbana-Champaign** *2025 – Present*
  Postdoctoral Research Associate
  Department of Mechanical Science and Engineering, Office: LUMEB 2054
  Supervisor: Prof. William P. King

Education

- **University of Illinois Urbana-Champaign** *2020 – 2025*
  Ph.D. in Civil Engineering GPA: 3.95/4.0
  Supervisor: Prof. Nishant Garg
  Internal Examiner: Prof. John Popovics
  External Examiner: Prof. Jan Olek

- **University of Toronto** *2017 – 2019*
  M.A.Sc. in Civil Engineering GPA: 3.9/4.0
  Advisor: Prof. R. Douglas Hooton

- **Sharif University of Technology** *2012 – 2016*
  B.S. in Civil Engineering GPA: 17.87/20

Honors & Awards

- Runner-up, Giatec Best Paper Award for Sustainability in Construction, Giatec Scientific Inc. (Nov 2025): Link to the News
- Conference Travel Award by American Concrete Institute, ACI Fall Convention, Baltimore, MD, USA. (Nov 2025)
- Scholarship and Teaching for Engineering Postdocs (STEP) Academic-Professional Development Award, Grainger College of Engineering (GCOE), University of Illinois Urbana-Champaign, Urbana, IL, USA. (Sep 2025)
- Trailblazers in Engineering (TBE) Fellowship by Purdue University. (July 2025): Link to the News

- Cozad New Venture Challenge Award, Team RAD (Rapid Analytix Division), Campus-Wide Startup Competition, University of Illinois Urbana-Champaign. Awarded: 5,000 USD (Apr 2025): Link to List of Prize Awards & Link to Presentation
- Conference Travel Award by Grainger College of Engineering (GCOE), University of Illinois Urbana-Champaign, Urbana, IL, USA. (Feb 2025)
- Conference Travel Award by American Concrete Institute, ACI Fall Convention, Philadelphia, PA, USA. (Nov 2024)
- Awarded a Competitive Spot in Blueprint by The Engine™: MIT's Flagship Tough Tech Commercialization Program, Team RAD (Rapid Analytix Division), Boston, MA, USA. (Oct 2024): Link to Completion Certificate
- S.P. Shah Fellowship by American Concrete Institute. Awarded: 10,000 USD (April 2024): Link to the News
- Conference Travel Award by American Concrete Institute, ACI Spring Convention, New Orleans, LA, USA. (March 2024)
- Paper Recognized in the Scientific Reports "Engineering Top 100 of 2023" Collection for High Readership and Research Impact (March 2024): Link to Journal Paper
- Recognized on the UIUC 'Teachers Ranked as Excellent' List with an Outstanding Instructor Rating, University of Illinois Urbana-Champaign (Fall 2023): Link to the Post
- Research Featured as Headline Story in ACI SmartBrief: "Fast, Economical Test Gauges Cement Durability"(July 2023): Link to ACI SmartBrief
- National Science Foundation (NSF) I-Corps Programs (Regional + National). Selected and Participated as Part of a Venture Team; Grant Awarded: 5,000 USD (Regional I-Corps) + 50,000 USD (National I-Corps) (Aug 2023): Link to Completion Certification & Link to the NSF TI 23-31168 I-Corps Award
- iCAP Grant, Illinois Green Fund & Student Sustainability Committee, Urbana, Illinois, USA (Dec 2022). Grants Awarded: 76,000 USD: Link to Awarded Project
- Conference Travel Award by American Concrete Institute, ACI Spring Convention, Orlando, FL, USA. (March 2022)
- RA Fellowship, Department of Civil and Environmental Engineering, University of Illinois, Urbana, Illinois, USA. (Sep 2020 – May 2025)
- RA Fellowship, Department of Civil and Mineral Engineering, University of Toronto, Toronto, ON, Canada. (Sep 2017 – Dec 2019)
- OSAP Non-repayable Grant, Awarded: 12,000 CAD (Jan 2019 – Aug 2019)
- Second Place, Conference Poster Award, ACI Fall Convention, 123 Committee: Research and Current Developments, Cincinnati, OH, USA (Nov 2019): Link to the News

- Granted Direct Admission to Graduate School by the Office of Exceptional Talents for Exceptional Undergraduate Performance (Sep 2016)
- Best Session Paper, ICASCE'15, URCAE Int'l Conference, Antalya, Türkiye (Sep 2015): Link to Certificate
- Ranked 419th among more than 280,000 Candidates (top 0.15%) in the National Pre-University Entrance Exam (July 2012)

Journal Papers

1. Min, Y., **Kabir, H.**, Kothari, C., Iqbal, M. F., & Garg, N. UR2: Ultra-rapid reactivity test for real-time, low-cost quality control of calcined clays. *Cement and Concrete Research*, **191**, 107806, 2025.
2. **Kabir, H.**, Wu, J., Dahal, S., Joo, T., & Garg, N. Automated estimation of cementitious sorptivity via computer vision. *Nature Communications*, **15**(1), 9935, 2024. The AI model and dataset is open-source and can be publicly accessed via GitHub
3. **Kabir, H.**, & Garg, N., Rapid prediction of cementitious initial sorptivity via surface wettability. *npj Materials Degradation*, **7**(1), 52, 2023.
4. **Kabir, H.**, & Garg, N. Machine learning enabled orthogonal camera goniometry for accurate and robust contact angle measurements. *Scientific Reports*, **13**(1), 1497, 2023.
5. **Kabir, H.**, & Aghdam, M. M., A generalized 2D Bézier-based solution for stress analysis of notched epoxy resin plates reinforced with graphene nanoplatelets. *Thin-Walled Structures*, **169**, 108484, 2021.
6. **Kabir, H.**, Hooton, R. D., Popoff, N. J. Evaluation of cement soundness using the ASTM C151 autoclave expansion test. *Cement and Concrete Research*, **136**, 106159, 2020.
7. **Kabir, H.**, & Hooton, R. D. Evaluating soundness of concrete containing shrinkage-compensating MgO admixtures. *Construction and Building Materials*, **253**, 119141, 2020.
8. **Kabir, H.**, & Aghdam, M. M., A robust Bézier based solution for nonlinear vibration and post-buckling of random checkerboard graphene nano-platelets reinforced composite beams. *Composite Structures*, **212**, 184–198, 2019.
9. Kabir, M. Z., Shadan, P., & **Kabir, H.**, A numerical and experimental study on the dynamical behavior of 3D-Panel Wall on Piloti RC Frame. *International Journal of Structural Integrity*, **9**(4), 475-490, 2018.

Conferences

Oral Presentations

1. **Kabir, H.**, Dahal, S., Kumar, A., Garg, N., Computer Vision for Accelerated and Automated Sorptivity Testing, American Concrete Institute (ACI) Fall Convention, Baltimore, MD, USA, 2025.

2. **Kabir, H.**, Dahal, S., Kumar, A., Garg, N., Computer Vision-Driven Sorptivity Tests for Cementitious Materials, C3 Symposium, Chicago, IL, USA, 2025.

3. Min, Y., **Kabir, H.**, Kothari, C., Iqbal, F., Garg, N., UR2: Ultra-Rapid Reactivity Test for Real-Time, Low-Cost Quality Control of SCMs, American Concrete Institute (ACI) Spring Convention, Toronto, ON, Canada, 2025.

4. **Kabir, H.**, Dahal, S., Baten, B., Garg, N., Accelerating and Automating Sorptivity Measurements via Computer Vision, Shaping the Fate of Low-Carbon Cement Science (LCCS 25), Ascona, Switzerland, 2025.

5. **Kabir, H.**, Dahal, S., Kumar, A., Garg, N., Deploying Computer Vision for Rapid Sorptivity Testing, 15th Advances in Cement-Based Materials (ACerS), University of Colorado Boulder, Boulder, CO, USA, 2025.

6. Min, Y., **Kabir, H.**, Kothari, C., Iqbal, F., Garg, N., UR2: An Ultra-Rapid Reactivity Test for Supplementary Cementitious Materials, 15th Advances in Cement-Based Materials (ACerS), University of Colorado Boulder, Boulder, CO, USA, 2025.

7. **Kabir, H.**, Dahal, S., Garg, N., Automating and Accelerating Sorptivity Measurements Using Computer Vision, Oral Presentation, Engineering Mechanics Institute Conference, Anaheim, CA, USA, 2025.

8. **Kabir, H.**, Dahal, S., Garg, N., Estimating cementitious sorptivity via computer vision, 4th RN Raikar Memorial International Conference & Ghosh-Mukherjee International Symposium, Mumbai, India, 2024.

9. **Kabir, H.** & Garg, N., Real-Time Estimation of Cementitious Sorptivity via Computer Vision, American Concrete Institute (ACI) Fall Convention, Philadelphia, PA, USA, 2024: Link to Online Presentation

10. **Kabir, H.**, & Garg, N., Predicting Sorptivity via Surface Wettability: A Computer Vision Approach, American Concrete Institute (ACI) Spring Convention, New Orleans, LA, USA, 2024: Link to Online Presentation

11. **Kabir, H.**, & Garg, N. Predicting Sorptivity via Surface Wettability. 10th International Conference on Concrete under Severe Conditions, Chennai, India, 2024.

12. Min, Y., Kothari, C., Iqbal, F., **Kabir, H.**, Garg, N., An Ultra-Rapid Reactivity (UR2) Test for Real-Time Quality Control of Calcined Clays, 14th Advances in Cement-Based Materials (ACerS), Missouri University of Science and Technology (Missouri S&T), Rolla, Missouri, USA, 2024.

13. **Kabir, H.**, & Garg, N. Sorptivity Prediction in Seconds, Engineering Mechanics Institute Conference and Probabilistic Mechanics & Reliability Conference (EMI/PMC), Chicago, IL, USA, 2024.

14. Min, Y., **Kabir, H.**, Kothari, C., Iqbal, F., Garg, N., An Ultra-Rapid Reactivity (UR2) Test for Real-Time, Low-Cost Quality Control of Calcined Clays, Advanced Materials for Sustainable Infrastructure Development, Gordon Research Conference, Ventura, CA, USA, 2024.

15. **Kabir, H.**, & Garg, N., Low-Cost Automated Orthogonal Camera Goniometry for Accurate Wettability Assessment, Advances in Cement-Based Materials, Columbia University, NYC, NY, USA, 2023.

Poster Presentations

1. **Kabir, H.** Real-Time Imaging and AI for Intelligent, Low-Carbon Infrastructure, Trailblazers in Engineering (TBE), Purdue University, West Lafayette, IN, USA, 2025.

2. **Kabir, H.**, & Garg, N. Initial Sorptivity Prediction in Seconds, Advanced Materials for Sustainable Infrastructure Development, Gordon Research Conference, Ventura, CA, USA, 2024.

3. Dahal, S., **Kabir, H.**, Garg, N., Prediction of Unsaturated Moisture Transport Properties of Cementitious Materials using Physics Informed Neural Networks, American Concrete Institute (ACI) Fall Convention, Philadelphia, PA, USA, 2024.

4. Min, Y., **Kabir, H.**, Kothari, C., Iqbal, F., Garg, N., An Ultra-Rapid Reactivity (UR2) Test for Real-Time, Low-Cost Quality Control of Calcined Clays, Advanced Materials for Sustainable Infrastructure Development, Gordon Research Conference, Ventura, CA, USA, 2024.

5. **Kabir, H.**, & Hooton, R.D. Evaluating the Autoclave Expansion Test as a Performance Measure of Deleterious Levels of Periclase in Cement, ACI Fall Convention, Cincinnati, OH, USA, 2019.

Conference Proceedings

1. **Kabir, H.**, Dahal, S., Kumar, A., Garg, N., Computer Vision-Driven Sorptivity Tests for Cementitious Materials, C3 Symposium, Chicago, IL, USA, 2025.

2. **Kabir, H.**, Dahal, S., Garg, N. Estimating cementitious sorptivity via computer vision, 4th RN Raikar Memorial International Conference & Ghosh-Mukherjee International Symposium, Mumbai, India, 2024.

3. **Kabir, H.**, & Garg, N. Predicting Sorptivity via Surface Wettability. 10th International Conference on Concrete under Severe Conditions, Chennai, India, 2024.

4. **Kabir, H.**, & Garg, N. Sorptivity Prediction in Seconds, Engineering Mechanics Institute Conference and Probabilistic Mechanics & Reliability Conference (EMI/PMC), Chicago, IL, USA, 2024.

5. **Kabir, H.**, & Garg, N. Low-Cost and Reliable Contact Angle Goniometry for Cementitious Materials. 16th International Congress on the Chemistry of Cement (ICCC), Bangkok, Thailand, 2023.

6. **Kabir, H.**, Hooton, R. D., Popoff, N. J., Periclase and the autoclave who cried 'Wolf!'—Determining the influence of ASTM C151 cement autoclave expansion on the volume stability of concrete, 17th Euroseminar on Microscopy Applied to Building Materials, University of Toronto, Toronto, ON, Canada, 2019.

Data Descriptor & Technical Report

1. **Kabir, H.**, Wu, J., Dahal, S., Joo, T., and Garg, N., SorpVision: A Comprehensive Dataset for Cementitious Sorptivity Analysis Powered by Computer Vision. Scientific Data 12, no. 1: 904, 2025.

2. **Kabir, H.**, Samouh, H., and Garg, N., Assessment of Road Conditions on the University of Illinois Campus: Integrating Mobile, Drone, and Satellite Imagery. Student Sustainability Committee, Illinois Climate Action Plan (iCAP), University of Illinois at Urbana-Champaign, Urbana, IL, 2024.

Graduate Thesis

1. **Kabir, H.**, Accelerating and Automating Sorptivity Measurements in Cementitious Systems via Computer Vision. Doctor of Philosophy Thesis, Department of Civil and Environmental Engineering, University of Illinois Urbana-Champaign, Urbana, IL, USA, 2025. Link to Ph.D. Thesis

2. **Kabir, H.**, Evaluation of the Autoclave Expansion Test for Cement. Master of Applied Science Thesis, Department of Civil and Mineral Engineering, University of Toronto, Toronto, ON, Canada, 2019. Link to M.A.Sc. Thesis

Patent

1. Garg, N., Min, Y., Kothari, C., **Kabir, H.**, Iqbal, M. F., Rapid Analytics Device to Predict Performance of Supplementary Cementitious Materials: International PCT Application No. PCT/US2024/046689. (Originally filed as Provisional Application Number 63/538,623 in 2023.)

Invited Presentations

1. **Kabir, H.**, Automated Sorptivity Analysis for Cementitious Materials: A Framework for Enhanced Durability Assessment, Construction Materials Seminar Series, Department of Civil and Environmental Engineering, University of Illinois Urbana–Champaign, Urbana, IL, USA, 2024. Link to Seminar Flyer
2. **Kabir, H.**, Automating Durability Testing in Construction Materials via Computer Vision, King's Research Group, Department of Mechanical Science and Engineering, University of Illinois Urbana–Champaign, Urbana, IL, USA, 2024.
3. **Kabir, H.**, Redesigning Contact Angle Goniometry, SocialFuse, Technology Entrepreneur Center, University of Illinois Urbana–Champaign, Urbana, IL, USA, 2022.

Media Coverage

Research Coverage

- **Ultra-Rapid Quality Testing for Sustainable Cement Materials**:
  We developed a breakthrough five-minute test for assessing the quality of sustainable cementitious materials. This test, published in *Cement and Concrete Research*, utilizes a low-cost colorimetric analysis combined with camera imaging to rapidly determine the reactivity of calcined clays—an emerging class of supplementary cementitious materials (SCMs). By replacing conventional methods that take over a week with an on-site, real-time quality control approach, this innovation accelerates the adoption of low-carbon concrete alternatives. With the potential for automation and expansion to other SCMs, this method is a promising step toward sustainable construction practices. Link to the News
- **Advancing Concrete Durability Testing with Computer Vision**:
  We developed a low-cost, automated test for measuring water absorption in concrete. Using a computer vision model trained on over 6,000 images, the system detects water levels every minute and accurately predicts sorptivity, streamlining a traditionally time-intensive process. With a $60 setup, this innovation, published in *Nature Communications*, makes durability testing faster, more efficient, and accessible to labs worldwide. Link to the News
- **Fast, Automated, Affordable Test for Cement Durability**:
  We developed an innovative, fast, cost-effective method for predicting cement durability. By utilizing computer vision to examine the behavior of water droplets on cement surfaces, we introduced a test that costs under $200 and delivers durability assessments in seconds to minutes—a significant improvement over the current methods, which take hours or days. Our study's findings were published in the *npj Materials Degradation*. Link to the News

Awards Coverage

- **Trailblazers in Engineering Fellow, Purdue College of Engineering**:
  Hossein Kabir was elected as a 2025 Trailblazers in Engineering (TBE) Fellow at Purdue University. This highly competitive program recognizes exceptional early-career researchers preparing for impactful academic careers. UIUC: Link to the News & Purdue: Link to the News

- **S. P. Shah Fellow, American Concrete Institute**:
  Hossein Kabir was awarded the prestigious S. P. Shah Fellowship by the American Concrete Institute (ACI), honoring outstanding contributions to concrete materials research and academic promise. Link to the News

Academic Services

- Reviewer for:
  - *Cement and Concrete Research*, Elsevier
  - *Cement and Concrete Composites*, Elsevier
  - *Composite Structures*, Elsevier
  - *Engineering Fracture Mechanics*, Elsevier
  - *Journal of Engineering, Design and Technology*, Emerald
  - *Construction Innovation: Information, Process, Management Journal*, Emerald
  - *European Journal of Environmental and Civil Engineering*, Taylor & Francis
  - *Computer Science Journal*, PeerJ: Link to Reviewer Page
  - *Environment, Development and Sustainability Journal*, Springer
  - *Nanotechnology Reviews Journal*, De Gruyter
- Conference Service:
  - Poster Judge, ACI Committee 123 (Research and Current Developments) Poster Session, ACI Fall Convention, Baltimore, MD, 2025.
- Contributed to writing grant proposals for Prof. Garg's group:
  - Developing a Durable, Sustainable, and Non-proprietary Ultra-High-Performance Concrete (UHPC). The grant has been awarded and is currently being executed by Mr. Bayezid Baten.
  - Temporal and Spatial Evolution of Microstructure of Sustainable Concrete in Virtual Reality. Research completed by Mr. Dhanush Bejjarapu.
  - Automated Traffic Monitoring at Railroad Crossings (proposal submitted).

Leadership

- Lead and mentor a research subgroup of three Ph.D. students in Mechanical Science and Engineering focused on 3D vision, computational photogrammetry, and AI-driven reconstruction workflows. Oversee project direction, algorithm development, experiment design, and dissemination of findings through presentations and manuscript preparation.
- Lead a Senior Design Project applying photogrammetry for advanced manufacturing inspection and 3D reconstruction. Coordinated a team of four students to capture and process image datasets, develop digital twins of manufactured parts, and present validated workflows to faculty and industry mentors.
- Moderated a session at the Spring 2024 American Concrete Institute (ACI) Convention in New Orleans, focused on "Challenges in Artificial Intelligence and Machine Learning for the Concrete Industry." This opportunity allowed me to facilitate insightful discussions among industry experts and academics, enhancing our collective understanding of AI/ML applications in concrete technologies.
- As a contributing author and voting member of ACI Committee 135, I was actively involved in drafting the opening and closing chapters (Chapters 1 and 5) of the ACI 135 Emerging Technology Report, also known as the STAR Chapter. My role focused on shaping the narrative around AI integration and its future impact on the concrete industry, ensuring a thorough and forward-looking perspective.
- Served as a Graduate Mentor for the UIUC ACI Student Chapter, guiding two undergraduate students in preparation for the ACI Spring Concrete Competition. Supported formulation design, mix optimization, and testing workflows while fostering technical growth and hands-on laboratory competency. Link to UIUC ACI Student Team Submission
- Completed the Imprint i-Program (Illinois Leadership Center, University of Illinois Urbana-Champaign), a series of leadership seminars focused on professional transition, mentoring, and building intentional networks with alumni leaders. Link to Linked-In Post

Teaching Experience

- **Graduate Academy Microteaching Volunteer** (August 2025)
  - Volunteered with the Center for Innovation in Teaching and Learning to help train new graduate teaching assistants (TAs) at the University of Illinois. Guided microteaching sessions by observing short mock lessons, providing structured feedback, and facilitating small group discussions to prepare TAs for their first semester of teaching. Link to Service Acknowledgment

- **Programming & Computing** (Spring & Fall 2024, Spring 2025)
  - Collaborated with Prof. Popovics on developing the curriculum for a new programming and computing course tailored for students in the CEE department. As this was the inaugural offering of this class, I had the unique privilege of contributing to the creation of the course syllabus.
- **Behavior of Materials** (Fall 2023 & Spring 2024)
  - As a Teaching Assistant for the Behavior of Materials course under Prof. Nishant Garg, I taught students the relationship between macroscopic properties and micro- and nanoscale phenomena in engineering materials like metals, ceramics, and polymers. My responsibilities also included leading lab sessions and grading weekly assignments. In this semester, the University of Illinois Urbana-Champaign recognized me as an outstanding teacher in the List of Teachers Ranked as Excellent by Their Students.
- **Introduction to Numerical Algorithms for Computational Mathematics** (Spring & Fall 2018)
  - Teaching Assistant under Prof. Richard Pancer at the Department of Computer Science, University of Toronto Scarborough. Responsibilities included offering tutorial lectures, assisting students with course material, and grading assignments.
- **Introduction to Nonlinear Dynamics and Chaos** (Fall 2018)
  - Teaching Assistant under Dr. Kasun Fernando at the Department of Mathematics, University of Toronto. Supported students through tutorials, problem-solving sessions, and grading of coursework.
- **Solid Mechanics I** (2015–2016)
  - Teaching Assistant under Prof. Hossein M. Shodja at the Department of Civil Engineering, Sharif University of Technology. Assisted in course delivery, supported students in tutorials, and graded assignments and exams.

Analytical Skills

- Expertise in 3D reconstruction, computer vision, and optical metrology, including multi-view stereo (SfM), monocular prior-guided 3D reconstruction, Gaussian splatting, Image Sensing, 3D optical measurement techniques, camera calibration, depth-map fusion, and quantitative geometric fidelity benchmarking.
- Expertise in machine learning algorithms, including supervised learning (e.g., linear regression, logistic regression, GLM models, decision trees, random forest, GBM, and XGBoost) and unsupervised learning (e.g., clustering analysis, PCA).

- Expertise in statistical analysis, including exploratory data analysis (EDA), A/B testing, causal inference, anomaly detection, data imputation, and techniques for reducing collinearity/variance.
- Expertise in neural networks and deep learning, including convolutional neural networks (CNN), transformers, and fine-tuning large language models (LLMs) for further training on custom data.

Lab Skills

- Laser Profilometry
- X-ray Diffraction & Raman Spectroscopy
- Scanning Electron Microscopy
- Rheometer and Rheology Testing
- Wavelength-dispersive X-ray Spectroscopy
- Non-destructive Testing
- Fourier Transform Infrared Spectroscopy
- Atomic Force Microscope
- X-ray Computed Tomography
- X-ray Radiography

Professional Memberships

- American Concrete Institute (ACI)
- ACI Student Chapter at UIUC
- American Ceramic Society (ACerS)
- Ontario Society of Professional Engineers (OSPE)

Industrial Experience

- **Consulting Engineer at Braun Intertec Co.** *Jan 2020 – Aug 2020*
  - Modeling of heat evolution in mass concrete.
  - Troubleshooting issues encountered in construction projects.
  - Providing technical support to customers.