Hossein Kabir

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Work Experience

- **University of Illinois Urbana-Champaign** **May 2025 – Present**
  Postdoctoral Research Associate
  Department of Mechanical Science and Engineering
  Supervisor: Prof. William P. King
- **University of Illinois Urbana-Champaign** **Sep 2020 – May 2025**
  Graduate Research Assistant
  Department of Civil and Environmental Engineering
- **Braun Intertec Corporation** **Jan 2020 – Aug 2020**
  Staff Engineer, Consulting Group
- **University of Toronto** **Sep 2017 – Dec 2019**
  Graduate Research Assistant
  Department of Civil and Mineral Engineering

Education

- **University of Illinois Urbana-Champaign** **2020 – 2025**
  Ph.D. in Civil Engineering GPA: 3.95/4.0
  Supervisor: Prof. Nishant Garg
  Thesis Title: *Accelerating and Automating Sorptivity Measurements in Cementitious Systems via Computer Vision*, Defense Slides
- **University of Toronto** **2017 – 2019**
  M.A.Sc. in Civil Engineering GPA: 3.9/4.0
  Advisor: Prof. R. Douglas Hooton
  Thesis Title: *Evaluation of the Autoclave Expansion Test for Cement*, Defense Slides
- **Sharif University of Technology** **2012 – 2016**
  B.S. in Civil Engineering GPA: 17.87/20

Research Areas

- Sustainable Construction Materials
- Automation-Enabled Materials QA/QC
- Vision-Based Infrastructure Sensing
- 3D Optical Metrology & Uncertainty
- Computer Vision Methods
- Mechanics-Informed Modeling & Simulation

Research Experience

- **University of Illinois Urbana-Champaign** **May 2025 – Present**
  Postdoctoral Research, Intelligent Manufacturing and Thermal Systems Laboratory (MechSE)
  Develop metrology-grade computer-vision pipelines for advanced manufacturing inspection, with emphasis on single-view and sparse-view photogrammetry (camera calibration, view planning/optimization, and uncertainty-aware benchmarking) and real-time 3D reconstruction/measurement from limited imagery.

  Collaborative: Built computer vision workflows for heat-transfer analysis (segmenting visible images to define modeling domains and boundary-condition regions).

- **University of Illinois Urbana-Champaign** **Sep 2020 – May 2025**
  Ph.D. Research, Department of Civil and Environmental Engineering (UIUC)
  Developed low-cost imaging and machine-learning frameworks to accelerate and automate durability characterization of cementitious materials (sorptivity and wettability), including robust image processing/segmentation, dataset development, and model validation against laboratory reference measurements.
  Integrated complementary high-resolution characterization to connect surface/microstructure to transport behavior (via laser profilometry for surface roughness mapping and Raman imaging for surface heterogeneity/phase mapping).

  Collaborative: Co-developed an ultra-rapid reactivity/quality-control test for supplementary cementitious materials using low-cost, field-deployable analysis (funded by ARPA-E, U.S. Department of Energy, Award No. DE-AR0001401).

- **University of Toronto** **2017 – 2019**
  M.A.Sc. Research, Department of Civil & Mineral Engineering (UofT)
  Evaluated the ASTM C151 autoclave expansion test as a performance measure for cement soundness, with emphasis on periclase-related expansion and volume stability; this work provided a main technical input to the rationale for removing autoclave expansion measurement requirements from ASTM C150 and C595 cement specifications (supported by St. Marys Cement Company, Votorantim Cimentos).

  Conducted phase and microstructural characterization to interpret expansion mechanisms (via SEM/EDS, XRD/QXRD, and TG/DTA) and connected measured phases to expansion response.

Teaching Experience

- **Graduate Academy Microteaching** **Aug 2025**
  University of Illinois Urbana-Champaign
  Role: Graduate Academy Microteaching Volunteer
  Supported training for more than 700 graduate TAs by observing microteaching sessions, providing structured feedback on lesson delivery and classroom communication, and facilitating small-group debrief discussions. Acknowledgment

- **Programming & Computing** **Spring & Fall 2024; Spring 2025; Spring 2026**
  University of Illinois Urbana-Champaign
  Role: Course Assistant
  Instructor: Prof. John S. Popovics
  Supported the inaugural course offering through syllabus development, assignment development, help sessions/office hours, and grading.

- **CEE 300: Behavior of Materials** **Fall 2023; Spring 2024**
  University of Illinois Urbana-Champaign
  Role: Teaching Assistant & Lab Instructor
  Instructors: Prof. John Popovics and Prof. Nishant Garg
  Led discussion/problem-solving sessions on structure–property relationships in engineering materials; instructed laboratory sessions/recitations; and graded weekly assignments and exams. Recognized as Teachers Ranked as Excellent (Fall 2023). List

- **CIV209H1: Civil Engineering Materials** **Spring 2018 & 2019**
  University of Toronto
  Role: Teaching Assistant
  Instructors: Prof. R. Douglas Hooton and Prof. Michelle Nokken
  Supported laboratory demonstrations illustrating fundamental principles for the selection and use of civil engineering materials, emphasizing the underlying property relationships across common materials.

- **C37H3: Numerical Algorithms for Computational Mathematics** **Spring & Fall 2018**
  University of Toronto Scarborough
  Role: Teaching Assistant
  Instructor: Prof. Richard Pancer
  Delivered tutorial sessions, supported students with computational assignments, and graded homework and exams.
- **MAT 332H5S: Introduction to Nonlinear Dynamics and Chaos** **Fall 2018**
  University of Toronto
  Role: Teaching Assistant
  Instructor: Dr. Kasun Fernando
  Facilitated tutorials and problem-solving sessions, and supported grading of coursework and exams.
- **CME261H1: Engineering Mathematics I** **Fall 2017**
  University of Toronto
  Role: Teaching Assistant
  Instructor: Prof. Marianne Hatzopoulou
  Led tutorial sessions and graded assignments and exams.
- **CE 20-111: Mechanics of Materials I** **2015 – 2016**
  Sharif University of Technology
  Role: Teaching Assistant
  Instructor: Prof. Hossein Shodja
  Assisted course delivery through tutorials and office hours and graded assignments and exams.

Honors & Awards

- **S. P. Shah Fellowship (American Concrete Institute)** **Apr 2024**
  Award: 10,000 USD. Link
- **Teachers Ranked as Excellent (Outstanding Instructor Rating)** **Fall 2023**
  University of Illinois Urbana–Champaign. List
- **Cozad New Venture Challenge Award** **Apr 2025**
  Team Rapid Analytix Division (RAD)
  Technology Entrepreneur Center, University of Illinois Urbana–Champaign.
  Award: 5,000 USD. Link & Presentation
- **Trailblazers in Engineering (TBE) Fellowship** **Jul 2025**
  Purdue University. Link
- **STEP Academic-Professional Development Award** **Sep 2025**
  The Grainger College of Engineering, University of Illinois Urbana–Champaign.
- **Blueprint Tough Tech Commercialization Program** **Oct 2024**
  Team Rapid Analytix Division (RAD)
  Participated in The Engine (MIT's program; competitive selection). Certificate
- **Conference Poster Award (Second Place)** **Nov 2019**
  ACI Fall Convention (Committee 123), Cincinnati, OH, USA. Link
- **Giatec Best Paper Award for Sustainability in Construction** **Nov 2025**
  (Runner-up)
  Giatec Scientific Inc. Link
- **Conference Travel Awards** **2022–2025**
  American Concrete Institute (Spring/Fall Conventions)
  Locations: Orlando (2022), New Orleans (2024), Philadelphia (2024), Baltimore (2025).
- **National Pre-University Entrance Exam Ranking** **Jul 2012**
  Ranked 419th among >280,000 candidates (top 0.15%).

Proposal Writing

- **iCAP Grant** **Dec 2025**
  Automated Waste Sorting via Computer Vision & Robotics: A Feasibility Study
  Illinois Green Fund & Student Sustainability Committee. Award: 181,000 USD.
  Role: Assisted Prof. Nishant Garg's group with proposal writing and development.

- **iCAP Grant** **Dec 2022**
  Low-Cost Inspection and Sustainable Repair for Campus Pavements
  Illinois Green Fund & Student Sustainability Committee. Award: 76,000 USD. Link
  Role: Assisted Prof. Nishant Garg's group with proposal writing and development.

- **NSF I-Corps (Regional + National) — Participant (venture team)** **Aug 2023**
  Awards: 5,000 USD + 50,000 USD (deposited to Prof. Nishant Garg's group).
  NSF Award & Certificate
  Role: Participated in the NSF I-Corps program as a venture team member; contributed to proposal preparation and customer discovery activities.

Leadership

- **Research Subgroup Lead & Mentor (MechSE, UIUC)** **Oct 2025 – Present**
  Lead and mentor a subgroup of three Ph.D. students in 3D vision, computational photogrammetry, and AI-driven reconstruction; guide project scoping, algorithm development, experimental design, validation, and dissemination (talks/manuscripts).
  - **Ethan Cho** — Sparse multi-view reconstruction and view optimization on a rotary imaging rig (uncertainty-aware view selection; benchmarking).
  - **Devashish Kulkarni** — Focus-stacking-based 3D reconstruction for small parts (< 1 inch); end-to-end pipeline design and evaluation.
  - **Luyun (Bruce) Li** — Online/offline 3D reconstruction from short smartphone videos; robustness, real-time constraints, and validation protocols.
- **Research Subgroup Lead & Mentor (CEE, UIUC)** **Jan 2024 – Present**
  Lead and mentor two M.S. students on measuring absorption in concrete, masonry, and precast samples; oversee algorithm development, experimental design, validation, and dissemination (talks/manuscripts).
  - **Sunav Dahal** — Characterizing sorptivity using X-ray CT imaging and validating results with physics-informed neural networks (PINNs).
  - **Achyuth Kumar** — Assisting with applying Vision Transformers for segmentation of wetting fronts to quantify absorption in infrastructure materials.
- **Senior Design Project Lead (MechSE, UIUC)** **Fall 2025**
  Led a senior design team (ME 470) applying photogrammetry for manufacturing inspection and 3D reconstruction; coordinated data collection, digital-twin generation, validation, and midterm/final presentations.
  Supervisor: Prof. William P. King.
- **Imprint i-Program (Illinois Leadership Center, UIUC)** **Fall 2024**
  Completed a leadership seminar series on professional transition, mentoring, and intentional network-building with alumni leaders. Link
- **Software Lead, RAD (Venture Team)** **Summer 2022 – Present**
  Led Rapid Analytix Division (RAD) venture-team software architecture and analysis pipelines enabling five-minute, on-site testing and real-time, AI-based quality control of cementitious materials.

Service

- **Conference Service, T.H.E. (Urbana, 2026)** **Feb 2026**
  Supported organization of the 2026 Transportation & Highway Engineering (T.H.E.) Conference, hosted by UIUC CEE; the conference convenes over 1,500 transportation engineers from across Illinois.
- **Journal Reviewer** **2024 – Present**
  Cement and Concrete Research; *Cement and Concrete Composites*; *Composite Structures*; *Engineering Fracture Mechanics*; *Construction Innovation*; *European Journal of Environmental and Civil Engineering*; *Environment, Development and Sustainability*; *PeerJ Computer Science*.
- **Poster Judge, ACI Committee 123 Poster Session** **Nov 2025**
  Baltimore, MD, USA.
- **Conference Service, EMI/PMC (Chicago, 2024)** **Jul 2024**
  Supported conference organization for the Engineering Mechanics Institute Conference and the Probabilistic Mechanics & Reliability Conference hosted by UIUC CEE.
- **Session Moderator, ACI Spring Convention** **Mar 2024**
  Moderated Challenges in AI/ML for the Concrete Industry, facilitating discussion among academic and industry speakers.
- **ACI Committee 135 (Voting Member)** **Apr 2023 – Present**
  Lead contributing author for the ACI 135 Emerging Technology Report (STAR Chapter); coordinated drafting and editing with emphasis on AI/ML integration and implications for practice.
- **Graduate Mentor, UIUC ACI Student Chapter** **Spring 2022**
  Mentored two undergraduate students for the ACI Spring Concrete Competition; supported formulation design, mix optimization, and testing workflows.
  Team Submission

Journal Articles (Published)

1. **Kabir, H.**, Wu, J., Dahal, S., Joo, T., & Garg, N. SorpVision: A Comprehensive Dataset for Cementitious Sorptivity Analysis Powered by Computer Vision. *Scientific Data*, **12**, 904, 2025. DOI
2. 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. DOI
3. **Kabir, H.**, Wu, J., Dahal, S., Joo, T., & Garg, N. Automated estimation of cementitious sorptivity via computer vision. *Nature Communications*, **15**(1), 9935, 2024. DOI. GitHub
4. **Kabir, H.**, & Garg, N. Rapid prediction of cementitious initial sorptivity via surface wettability. *npj Materials Degradation*, **7**(1), 52, 2023. DOI
5. **Kabir, H.**, & Garg, N. Machine learning enabled orthogonal camera goniometry for accurate and robust contact angle measurements. *Scientific Reports*, **13**(1), 1497, 2023. DOI. Recognized in Engineering Top 100 of 2023 (Mar 2024)
6. **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. DOI
7. **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. DOI
8. **Kabir, H.**, & Hooton, R. D. Evaluating soundness of concrete containing shrinkage-compensating MgO admixtures. *Construction and Building Materials*, **253**, 119141, 2020. DOI
9. **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. DOI

10. 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. DOI

Journal Articles (In Review)

1. **Kabir, H.**, Whealton, C. T., & King, W. P. Comprehensive Workflow for Three-Dimensional Reconstruction of Additively Manufactured Parts: Practical Steps for Inspection and Measurement. *In review*, 2026.
2. Kulkarni, D. R., **Kabir, H.**, & King, W. P. Smart Sampling for Data-Efficient Three-Dimensional Reconstruction of Additively Manufactured Parts. *In review*, 2026.
3. Kothari, C., Iqbal, M. F., **Kabir, H.**, & Min, Y. ER2 - Easy Rapid Rheology Test for Predicting Workability of Cement-Calcined Clay Blends within 5 minutes: Role of Water Uptake as the 3rd paper. *In review*, 2026.

Journal Articles (In Preparation)

1. **Kabir, H.**, Whealton, C. T., Conway, C. H., Kulkarni, D. R., & King, W. P. Single-view three-dimensional reconstruction for manufacturing inspection and metrology. *Manuscript in preparation.*
2. **Kabir, H.**, Dahal, S., Kumar, A., & Garg, N. Linking sorptivity and durability in concrete via computer vision. *Manuscript in preparation.*
3. Dahal, S., **Kabir, H.**, Tartakovsky, A. M., & Garg, N. Discovering moisture transport laws in porous cementitious media using sparse measurements and physics-informed neural networks (PINNs). *Manuscript in preparation.*

Conference Publications

1. **Kabir, H.**, Dahal, S., Garg, N. Computer Vision-Driven Sorptivity Tests for Cementitious Materials. C3 Symposium, Chicago, IL, USA, 2025. Proceedings
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. Proceedings
3. **Kabir, H.**, & Garg, N. Predicting Sorptivity via Surface Wettability. 10th International Conference on Concrete under Severe Conditions (CONSEC24), Chennai, India, 2024. Proceedings
4. **Kabir, H.**, & Garg, N. Low-Cost and Reliable Contact Angle Goniometry for Cementitious Materials. 16th International Congress on the Chemistry of Cement (ICCC 2023), Bangkok, Thailand, 2023. Proceedings
5. **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 (EMABM), Toronto, ON, Canada, 2019. Proceedings

Talks & Posters

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

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 *(Oral presentation)*.
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 *(Oral presentation)*.
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 *(Oral presentation)*.
7. **Kabir, H.**, Dahal, S., Garg, N. Automating and Accelerating Sorptivity Measurements Using Computer Vision. Engineering Mechanics Institute (EMI) Conference, Anaheim, CA, USA, 2025 *(Oral presentation)*.
8. **Kabir, H.** Real-Time Imaging and AI for Intelligent, Low-Carbon Infrastructure. Trailblazers in Engineering (TBE), Purdue University, West Lafayette, IN, USA, 2025 *(Poster)*.
9. **Kabir, H.**, Dahal, S., Garg, N. Estimating Cementitious Sorptivity via Computer Vision. 4th R. N. Raikar Memorial International Conference & Ghosh–Mukherjee International Symposium, Mumbai, India, 2024 *(Oral presentation)*.
10. **Kabir, H.**, & Garg, N. Real-Time Estimation of Cementitious Sorptivity via Computer Vision. American Concrete Institute (ACI) Fall Convention, Philadelphia, PA, USA, 2024 *(Oral presentation)*. Video
11. **Kabir, H.**, & Garg, N. Predicting Sorptivity via Surface Wettability: A Computer Vision Approach. American Concrete Institute (ACI) Spring Convention, New Orleans, LA, USA, 2024 *(Oral presentation)*. Video
12. **Kabir, H.**, & Garg, N. Predicting Sorptivity via Surface Wettability. 10th International Conference on Concrete under Severe Conditions, Chennai, India, 2024 *(Oral presentation)*.
13. 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, MO, USA, 2024 *(Oral presentation)*.
14. **Kabir, H.**, & Garg, N. Sorptivity Prediction in Seconds. Engineering Mechanics Institute Conference and Probabilistic Mechanics & Reliability Conference (EMI/PMC), Chicago, IL, USA, 2024 *(Oral presentation)*.
15. **Kabir, H.**, & Garg, N. Initial Sorptivity Prediction in Seconds. Gordon Research Conference: Advanced Materials for Sustainable Infrastructure Development, Ventura, CA, USA, 2024 *(Poster)*.
16. 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 *(Poster)*.
17. 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. Gordon Research Conference: Advanced Materials for Sustainable Infrastructure Development, Ventura, CA, USA, 2024 *(Poster)*.
18. **Kabir, H.**, & Garg, N. Low-Cost Automated Orthogonal Camera Goniometry for Accurate Wettability Assessment. Advances in Cement-Based Materials, Columbia University, New York City, NY, USA, 2023 *(Oral presentation)*.
19. **Kabir, H.**, & Hooton, R. D. Evaluating the Autoclave Expansion Test as a Performance Measure of Deleterious Levels of Periclase in Cement. American Concrete Institute (ACI) Fall Convention, Cincinnati, OH, USA, 2019 *(Poster)*.

Technical Report

1. **Kabir, H.**, Samouh, H., & 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. Report

Invited Talks

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. Flyer
2. **Kabir, H.** Automating Durability Testing in Construction Materials via Computer Vision. Department of Mechanical Science and Engineering (MechSE), 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.

Patents

- 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 (filed 2024; provisional filed 2023).
- **Kabir, H.**, Kumar, A., & Garg, N. Surface-wettability-based system and methods for rapid durability assessment of cementitious and concrete materials. *Invention disclosure submitted to the University of Illinois Office of Technology Management (OTM).*

Media Coverage

- **Trailblazers in Engineering Fellow** **Jul 2025**
  Purdue College of Engineering. Link
  The Grainger College of Engineering. Link
  Elected as a 2025 TBE Fellow, recognizing exceptional early-career researchers preparing for impactful academic careers.
- **Five-minute QC test for sustainable cement materials** **Feb 2025**
  AZoBuild. Link
  Illinois News Bureau. Link
  Introduced a five-minute, low-cost imaging/colorimetric test for rapid, on-site QC of sustainable cementitious materials (e.g., calcined clays), replacing conventional week-long methods.
- **Automated sorptivity test for concrete** **Dec 2024**
  The Grainger College of Engineering. Link
  Developed a low-cost, computer-vision-based setup that tracks water levels and predicts sorptivity, streamlining durability testing with minute-by-minute automated measurements.
- **S. P. Shah Fellow (ACI)** **Apr 2024**
  The Grainger College of Engineering. Link
  Awarded the S. P. Shah Fellowship by ACI, recognizing contributions to concrete materials research and academic promise.
- **Fast, low-cost test for cement durability** **Jul 2023**
  The American Ceramic Society. Link
  Engineers Ireland. Link
  EurekAlert. Link

Illinois News Bureau. Link

Reported a droplet-based computer-vision method for rapid cement durability assessment, delivering results in seconds to minutes with an affordable experimental setup.

- **Headline feature: ACI SmartBrief** **Jul 2023**

  Fast, Economical Test Gauges Cement Durability. Link

  Highlighted as a headline story emphasizing the speed and cost-effectiveness of the computer-vision-based cement durability test.

Technical Skills

- **Computational / Analytical:** 3D reconstruction (SfM/MVS; sparse multi-view); camera calibration and photogrammetry; depth/normal estimation and fusion; Gaussian splatting; optical metrology and geometric error benchmarking; numerical modeling and finite element analysis (FEA); machine learning (RF, GBM, XGBoost); deep learning (CNNs, transformers); statistical analysis and experimental design.
- **Experimental / Imaging:** Laser profilometry; XRD; Raman imaging/spectroscopy; SEM; rheometry; X-ray radiography/CT; FTIR; AFM; UPV (ultrasonic pulse velocity); MIRA (ultrasonic tomography).
- **Software & Tools:** Python (NumPy, pandas, SciPy, scikit-learn, Matplotlib); MATLAB; R (tidyverse); PyTorch; BoTorch; OpenCV; Git/GitHub; Linux; LaTeX; Abaqus; SolidWorks; Autodesk Fusion 360; Blender; nTopology (nTop); GrabCAD; CloudCompare; PolyWorks.

Professional Memberships

- American Concrete Institute (ACI)
- ACI Committee 135 (voting member): Machine Learning-Informed Construction and Design
- American Society of Mechanical Engineers (ASME)
- American Ceramic Society (ACerS)

References

- **William P. King**
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- **Nishant Garg**
  - Associate Professor, Department of Civil and Environmental Engineering, University of Illinois Urbana–Champaign
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- **R. Douglas Hooton**
  - Professor Emeritus, Department of Civil & Mineral Engineering, University of Toronto
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