

KETAN ARORA

CONTACT INFORMATION

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https://scholar.google.com/citations?user=Xqcsi_EAAAAJ&hl=en&oi=ao

CAREER OBJECTIVES

- To make a significant contribution through research in the field of geomechanics by enhancing the safety, efficiency, economics and sustainability of the underground excavation methods & machinery, and support system.
- To enhance the geotechnical engineering-related skills of the undergraduate and graduate students through teaching courses and mentoring in their projects and thesis.

AREAS OF INTERESTS

Tunneling; Design and Analysis of Underground Excavations; Underground Support System; Slope Stabilization; Strata Control; Theoretical and Applied Rock Mechanics; Physical Modelling of Geotechnical Structures; Experimental Geomechanics; Instrumentation and Monitoring of Geotechnical Structures; Numerical and Computational Methods in Geotechnics

EDUCATIONAL QUALIFICATIONS

- **Degree:** Ph.D. in Civil and Environmental Engineering (Geotechnical)
University: Colorado School of Mines, Golden, CO, USA
Start Date: August 2017
End Date: August 2020
Thesis Title: Experimental Study of Tunnels in Squeezing Ground Conditions
CGPA: 3.947 out of 4
- **Degree:** Master of Technology in Rock Engineering and Underground Structures
University: Indian Institute of Technology (IIT) Delhi, New Delhi, India
Start Date: July 2014
End Date: June 2016
Thesis Title: Stress-Strain Behavior of Rocks Under Cyclic Loading
CGPA: 8.905 out of 10
- **Degree:** Bachelor of Technology in Civil Engineering
University: S.V. National Institute of Technology (SVNIT), Surat, India
Start Date: July 2010
End Date: May 2014
Project Title: Finite Element Analysis of Vajont Valley Landslide
CGPA: 8.79 out of 10
- **Education:** Intermediate (2009-10)
School: S.F.D.A.V. Public School, Muzaffarnagar, U.P., India
Board: Central Board for Secondary Education
Score: 89.6%
- **Education:** Matriculation (2007-08)
School: S.F.D.A.V. Public School, Muzaffarnagar, U.P., India
Board: Central Board for Secondary Education
Score: 87.6%

PROFESSIONAL EXPERIENCE

- **Employer:** Indian Institute of Technology (IIT) Kharagpur
Designation: Assistant Professor
Start Date: October 2022
End Date: To Date
Responsibilities: Teaching, Research and Administrative
- **Employer:** Aldea Services Inc., United States
Designation: Tunnel Engineer
Start Date: October 2021
End Date: September 2022
Responsibilities: Design of tunnels; Report preparation; Reporting to client
- **Employer:** Colorado School of Mines, USA
Designation: Adjunct Faculty
Start Date: January 2022
End Date: May 2022
Responsibilities: Teaching
- **Employer:** Colorado School of Mines, USA
Designation: Post-Doctoral Fellow
Start Date: October 2020
End Date: October 2021
Responsibilities: Research
- **Employer:** Indian Institute of Technology (IIT) Delhi
Designation: Project Assistant
Start Date: November 2016
End Date: June 2017
Responsibilities: Research

COURSES TAUGHT

Undergraduate Level

1. Foundation Engineering (at Colorado School of Mines)
2. Engineering Drawing and Computer Graphics (at IIT Kharagpur)
3. Environmental Safety and Hazard Mitigation (at IIT Kharagpur)
4. Surveying Laboratory (at IIT Kharagpur)
5. Mine Hazard and Rescue Laboratory (at IIT Kharagpur)
6. Mine Machinery (at IIT Kharagpur)
7. Rock Mechanics Laboratory (at IIT Delhi)
8. Soil Mechanics Laboratory (at Colorado School of Mines)

Graduate Level

1. Foundation Engineering (at Colorado School of Mines)
2. Ground Control (at IIT Kharagpur)
3. Bulk Material Handling (at IIT Kharagpur)
4. Drilling Technology (at IIT Kharagpur)

INVITED LECTURES

1. Invited to deliver a lecture by **the Institute of Engineers India (IEI) Kharagpur Chapter** on the Topic *Support System for Tunnels in Squeezing Ground* in-person in January 2024.
2. Invited to deliver a lecture on *Tunneling* in the **4th Edition of the Advancement in Geotechnical Engineering from Research to Practice (AGERP) Lecture Series** organized virtually in September 2023.

LIST OF PUBLICATIONS

Journal

1. Arora, K., Chakraborty, T., & Rao, K. S., 2019, Experimental study on stiffness degradation of rock under uniaxial cyclic sinusoidal compression loading, *Rock Mechanics and Rock Engineering*. <https://doi.org/10.1007/s00603-019-01835-3>
2. Arora, K., Gutierrez, M., Hedayat, A., & Xia, C. 2021, Tunnels in Squeezing Clay-Rich Rocks, *Underground Space*. <https://doi.org/10.1016/j.undsp.2020.07.001>
3. Arora, K., Gutierrez, M., & Hedayat, A., 2021, New physical model to study tunnels in squeezing clay-rich rocks, *Geotechnical Testing Journal*. <https://doi.org/10.1520/GTJ20200081>
4. Arora, K., Gutierrez, M., & Hedayat, A., 2020, Time-dependent Behavior of the Tunnels in Squeezing Ground: An Experimental Study. *Rock Mechanics and Rock Engineering*. <https://doi.org/10.1007/s00603-021-02370-w>
5. Gutierrez, M., Xu, G., Arora, K., & Wang, X., 2021, Visco-plastic solution for deep tunnels based on a fractional damage creep constitutive model, *Acta Geotechnica*. <https://doi.org/10.1007/s11440-021-01226-5>
6. Arora, K., & Gutierrez, M., 2021, Viscous-Elastic-Plastic Response of Tunnels in Squeezing Ground Conditions: Analytical Modeling and Experimental Validation, *International Journal of Rock Mechanics and Mining Sciences*, 146, 104888. <https://doi.org/10.1016/j.ijrmms.2021.104888>
7. Arora, K., Gutierrez, M., & Hedayat, A., 2022, Physical model simulation of rock-support interaction for the tunnel in squeezing ground. *Journal of Rock Mechanics and Geotechnical Engineering*, 14(1), 82-92. <https://doi.org/10.1016/j.jrmge.2021.08.016>
8. Ganorkar, K., Arora, K., Gaur, L., Goel, M. D., & Chakraborty, T., 2021, High strain rate characterization of concrete using split Hopkinson pressure bar. *Indian Concrete Journal* 95(11):28-35.
9. Arora, K., & Gutierrez, M., 2023, An Improved Time-Dependent Convergence Confinement Method for Estimation of Tunnel Support Loads in Squeezing Ground Conditions, *Rock Mechanics and Rock Engineering* (Under Review).

Conference Proceedings

1. Arora, K., Chakraborty, T., & Rao, K. S., 2016, Constitutive model equation for various types of rock specimen subjected to uniaxial compression loading, In *Recent Advances in Rock Engineering (RARE 2016)*. Atlantis Press. <https://doi.org/10.2991/rare-16.2016.58>
2. Frash, L. P., Arora, K., Gan, Y., Lu, M., Gutierrez, M., Fu, P., ... & Hampton, J., 2018, Laboratory validation of fracture caging for hydraulic fracture control, In *52nd US Rock Mechanics/Geomechanics Symposium*. American Rock Mechanics Association.
3. Arora, K., Gutierrez, M., & Hedayat, A., 2019, Experimental setup for studying tunnels in squeezing ground conditions. In *Tunnels and Underground Cities. Engineering and Innovation Meet Archaeology, Architecture and Art*, 3515-3524. <https://doi.org/10.4324/9781003031642-2>
4. Arora, K., Gutierrez, M., & Hedayat, A., 2019, Miniature Tunnel Boring Machine for Simulating Tunnel Excavation in Squeezing Ground Conditions, *4th International Conference on Tunnel Boring Machine in Difficult Ground*, 183-192.
5. Arora, K., Gutierrez, M., & Hedayat, A., 2020, Physical Modeling of Lined Tunnel in Squeezing Ground Conditions, In *Geo-Congress 2020: Engineering, Monitoring, and Management of Geotechnical Infrastructure*, 335-344. <https://doi.org/10.1061/9780784482797.033>
6. Arora, K., Gutierrez, M., & Hedayat, A., 2020, Characterization of Synthetic Mudstone for Physical Model Studies, In *54th US Rock Mechanics/Geomechanics Symposium*. American Rock Mechanics Association, Golden, Colorado, USA.

7. Arora, K., & Gutierrez, M., 2021, Visco-Elastic Plastic Solution for Deep Circular Tunnels using Burger's Model and Mohr-Coulomb's Criteria. In 55th US Rock Mechanics/Geomechanics Symposium. American Rock Mechanics Association, Houston, Texas, USA.
8. Ganorkar, K., Arora, K., Gaur, L., Goel, M. D., & Chakraborty, T., 2022, Dynamic Characterization of Concrete using Split Hopkinson Pressure Bar. In ASPS Conference Proceedings, 1(4), 1217-1221.
9. Wibisono, D. Y., Arora, K., & Gutierrez, M., 2022, Laboratory Characterization of a Synthetic Sandstone for Tunnel Rockburst Study. In 56th US Rock Mechanics/Geomechanics Symposium. OnePetro.
10. Wibisono, D. Y., Arora, K., Majumder, D., & Gutierrez, M., 2023, Laboratory-Scale Rockburst Physical Model Testing Using a True-Triaxial Cell. In IOP Conference Series: Earth and Environmental Science, 1124, 1, 012039). IOP Publishing. <http://doi.org/10.1088/1755-1315/1124/1/012039>

RESEARCH PROJECTS

1. Stiffness Degradation of Rocks Under Sinusoidal Cyclic Loading (**Year:** 2014-16; **Role:** as Project at IIT Delhi)
2. High Strain-Rate Characterization of Concrete using Split Hopkinson Pressure Bar (**Year:** 2016-17; **Role:** as Project Assistant at IIT Delhi)
3. Laboratory validation of fracture caging for hydraulic fracture control (**Year:** 2017; **Role:** as graduate student at Colorado School of Mines)
4. Carbon Capture and Sequestration in High North, Oslo, Norway and Svalbard (**Year:** 2018; **Role:** as a Research Associate)
5. Experimental Study of Tunnels in Squeezing Ground Conditions (**Year:** 2017-20; **Role:** as graduate student at Colorado School of Mines)
6. Experimental Investigation on the Progressive Damage Behavior of Tunnels Excavated in Sandstone (**Year:** 2020-21; **Role:** as Post-Doctoral Fellow at Colorado School of Mines)
7. Study of a Multi-Physical Phenomenon Associated with the Stress Induced Damages and Deformation Around the Mechanized Excavated Underground Openings (**Year:** TBD; **Role:** as PI at IIT Kharagpur)
8. Characterization of the Damages and Deformations in Rock around the Underground Excavated Openings (**Year:** TBD; **Role:** as PI at IIT Kharagpur)

INDUSTRIAL PROJECTS

1. San Antonio River Authority (SERA) Microtunnel- Project 29 (**Year:** 2021-22; **Role:** as Tunnel Engineer at Aldea Services Inc.)
2. Northshore Waste Water Tunnel, Vancouver, BC (**Year:** 2021-22; **Role:** as Tunnel Engineer at Aldea Services Inc.)
3. Eagle Mountain-Woodfibre Gas Pipeline Project, Squamish, BC (**Year:** 2021-22; **Role:** as Tunnel Engineer at Aldea Services Inc.)
4. Vetting of the plan of a retaining wall design by MYTHCON (**Year:** 2023; **Role:** as PI at IIT Kharagpur)
5. Ash compliance audit in Tata power project limited for The Tata Power Co Ltd (**Year:** 2023-24; **Role:** as Co-PI at IIT Kharagpur)
6. Investigation for possible sources of water leakage in two identified part at south city residential apartments (**Year:** 2023-24; **Role:** as PI at IIT Kharagpur)

7. Conducting Scientific Study to investigate the impact of mining in Deucha Pachami Coal Block of WBPDCCL The West Bengal Power Development Corporation Limited (**Year:** 2023-24; **Role:** as PI at IIT Kharagpur)

AWARDS AND ACHIEVEMENTS

1. M.Tech fellowship by Ministry of Education formerly Ministry of Human Resource Development, India (**Year:** 2014-16)
2. First Rank Holder in M. Tech Program, Indian Institute of Technology (IIT) Delhi (**Year:** 2016)
3. Melbourne Research Scholarship by University of Melbourne (**Year:** 2017)
4. CEE Graduate Fellowship at Colorado School of Mines (**Year:** 2017-18)
5. Graduate Research Assistantship by University Transportation Centre for Underground Transportation Infrastructure (UTC-UTI) (**Year:** 2018-20)
6. Scholarship worth \$3,800 by Norwegian Centre for International Cooperation in Education (SiU) to attend CCS Course (**Year:** 2018)
7. The RETC attendance award by SME (**Year:** 2019)
8. Best paper award in TBM Digs Conference, Denver, USA (**Year:** 2019)
9. Nominated for Dr. NGW Cook ARMA Ph.D. Dissertation Award (**Year:** 2021)
10. Nominated for ISRM Rocha Medal Award by ISRM India (**Year:** 2022)

SKILLS

Hard Skills

- Numerical and Computational Methods in Geomechanics
- Coding Skills in C++, FORTRAN, MATLAB
- Design of Laboratory Experiments
- Technical Writing for Publications and Grants
- Excellent verbal and written communication skills

Soft Skills

- Critical thinking to develop innovative solution
- Ability to lead and work in a team
- Strong resilience, decisiveness, and determination
- Ability to see opportunity above the obstacles

AFFILIATIONS

- Technology Mining Engineering Society, IIT Kharagpur (2022-present)
- Society for Mining, Metallurgy & Exploration (SME), 2017-present.
- American Rock Mechanics Association (ARMA), Member, 2017-present.
- Underground Construction Association (UCA), 2017-present
- International Society of Rock Mechanics and Rock Engineering (ISRM), 2019-present
- American Society of Civil Engineering (ASCE), 2019-present

VOLUNTEER SERVICES

- Technical Committee of 13th Asian Rock Mechanics Symposium (ARMS 13), 2024
- Faculty Advisor, Mining Engineering Dual Degree Batch 2022-27, IIT Kharagpur
- Assistant Warden, HJB Hall of Residence, IIT Kharagpur
- Co-In-charge, Mining Machinery Lab, IIT Kharagpur
- Organizing team of tunneling short course at Colorado School of Mines
- Active reviewer of several high impact factor journals
- Sustainability Journal, Guest Editor