

## Ketan Arora, Ph.D.

Geotechnical Engineer

Website: <http://www.aroraketan.com>

Phone: +91-9873483442

E-mail: [ketanarora24@gmail.com](mailto:ketanarora24@gmail.com)

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### EDUCATION

- 2017-2020     Ph.D. in Civil and Environmental Engineering  
Colorado School of Mines, Golden, CO, USA  
Dissertation Title: Experimental Study of Tunnels Constructed in Squeezing Clay-Rich Rocks  
Dissertation Advisors: Prof. Marte Gutierrez and Dr. Ahmadreza Hedayat  
GPA: 3.947/4
- 2014-2016     M.Tech. in Civil Engineering  
Indian Institute of Technology (IIT) Delhi, New Delhi, India  
Dissertation Title: Experimental study on stiffness degradation of rock under uniaxial cyclic sinusoidal compression loading  
Dissertation Advisors: Dr. Tanusree Chakraborty and Prof. K. S. Rao  
GPA: 8.905/10
- 2010- 2014     B.Tech. in Civil Engineering  
National Institute of Technology (NIT), Surat, India  
GPA: 8.79/10

### RESEARCH INTERESTS

Design and Analysis of Underground Structures; Rock Mechanics and Rock Engineering; Foundation Engineering; Geomechanics for Energy and Mineral Resources

### PROFESSIONAL EXPERIENCE

Duration	Role and Organization
October 2022 to Till Date	<b>Assistant Professor</b> in Department of Mining Engineering Indian Institute of Technology (IIT) Kharagpur, India
October 2021 to September 2021	<b>Tunnel Engineer</b> Aldea Services Inc., Denver CO USA
January 2022 to May 2022	<b>Adjunct Faculty</b> in Civil & Environmental Engineering Colorado School of Mines, USA
October 2020 to October 2021	<b>Post-Doctoral Fellow</b> in Civil & Environmental Engineering Colorado School of Mines, USA
August 2017 to August 2020	<b>Research Assistant</b> in Civil & Environmental Engineering Colorado School of Mines, USA
November 2016 to June 2017	<b>Project Assistant</b> in Civil Engineering Indian Institute of Technology (IIT) Delhi, India
July 2014 to June 2016	<b>Teaching &amp; Research Assistant</b> in Civil Engineering Indian Institute of Technology (IIT) Delhi, India

## AWARDS AND ACHIEVEMENTS

Name of Award	Awarding Agency	Year
M.Tech fellowship	Ministry of Education formerly Ministry of Human Resource Development	2014-16
First Rank Holder in M. Tech Program	Indian Institute of Technology (IIT) Delhi	2016
Melbourne Research Scholarship	University of Melbourne	2017
CEE Graduate Fellowship	Colorado School of Mines	2017-18
Graduate Research Assistantship	University Transportation Centre for Underground Transportation Infrastructure (UTC-UTI)	2017-20
Scholarship worth \$3,800	Norwegian Centre for International Cooperation in Education (SiU) to attend CCS Course	2018
The RETC Attendance Award	Society for Mining, Metallurgy & Exploration	2019
Best paper award	TBM Digs, Denver, Colorado	2019
Dr. NGW Cook ARMA Ph.D. Dissertation Award	American Rock Mechanics Association (ARMA)	2021 (Declined)
Rocha Medal Award	International Society for Rock Mechanics (ISRM)	2023 (Declined)

## PUBLICATIONS

### Refereed Journal Articles (published and submitted; Total: 9)

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> (Impact Factor: 5.252)
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> (Impact Factor: 1.83)
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> (Impact Factor: 1.492).
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> (Impact Factor: 5.252).
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> (Impact Factor: 5.856)

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> (Impact Factor: 7.135)
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> (Impact Factor: 5.915)
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. (Impact Factor: 0.324)
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 (Total: 10)**

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 54<sup>th</sup> 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 55<sup>th</sup> 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>

## **COURSES TAUGHT**

- Foundation Engineering
- Engineering Drawing and Computer Graphics
- Environmental Safety and Hazard Mitigation
- Ground Control
- Mine Hazard and Rescue Laboratory
- Surveying Laboratory

## **SERVICES**

- 2017-2019 Underground Grouting and Ground Improvement short course at Colorado School of Mines, Course-Instructor
- 2017-2019 Tunneling short course at Colorado School of Mines, Course-Instructor
- Engineering Fracture Mechanics, Reviewer, 2018-present
- Rock Mechanics and Rock Engineering, Reviewer, 2020-present
- ASTM Geotechnical Testing Journal, Reviewer, 2020-present
- ASTM Journal of Testing and Evaluation, Reviewer, 2021-present
- Sustainability Journal, Guest Editor, 2021-present
- Tunneling and Underground Space Technology, 2021- present
- Sustainability, Guest Editor, 2021-22
- 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

## **PROFESSIONAL SKILLS**

Programming Languages:	C, C++, MATLAB, FORTRAN
Software Proficiency:	ABAQUS, Roc-Science, Lab-VIEW
Experimental Techniques:	Geomaterial testing, physical model testing, Instrumentation and monitoring

## **PROFESSIONAL AFFILIATIONS**

- 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.