Curriculum Vitae

Personal information

Name	Shantanu Patel
Address	B-209, IIT Kharagpur, India
Mobile	+91-8447986033
E-mail	shantanu@ualberta.ca, shantanu.iitd7@gmail.com
Nationality	Indian
Gender	Male

Research interests

Experimental Rock Mechanics
Numerical modelling in geomechanics
Underground construction
Geological disposal of waste
Carbon sequestration/ Geothermal Energy
Slope stability

Teaching interests

Rock Mechanics
Underground Metal Mining
Mine Economics
Design of Underground Structures
Numerical Methods in Geotechnical Engineering

Education and training

Dates	September 2012- June 2018
Title of qualification awarded	**PhD, "Geotechnical Engineering". Received the prestigious 2019 Dr. N.G.W. Cook Ph.D. Dissertation Award at ARMA, New York. This award is presented to an outstanding doctoral dissertation in rock mechanics or rock engineering.**
Principal subjects	Advanced Soil Mechanics, Foundation Engineering, Seepage and Drainage, Soil Structures and Terrain Analysis, Soil Mechanics Lab
Name of the organisation	Department of Civil and Environmental Engineering, **University of Alberta, Canada**
Dates	July 2006 - May 2008
Title of qualification awarded	**Masters in "Rock Engineering & Underground Structures"** (consistently **topped** the graduate class in all semesters).
Principal subjects	Structural Geology, Finite Element Methods in Geotechnical Engineering, Slopes and Foundations, Analysis and Design of Underground Structures, Underground Space Technology, Rock Mechanics Lab.
Name of the organisations	**Indian Institute of Technology Delhi**, India and as an exchange student to **EPFL, Lausanne,** Switzerland
Dates	July 2002 – May 2006
Title of qualification awarded	Bachelor of Technology in "Mining Engineering" with first-class honours. My Graduate Aptitude Test in Engineering score of 99 percentile (All India Rank-7) was the best among more than 400 students in my institute.
Principal subjects	Engineering Mechanics, Mechanics of Solids, Advance Computing, Basic Surveying, Thermal Engineering, Fluid Mechanics, Basic Electrical Engineering, Basic Electronics, Operation Research, Numerical Methods in Engineering, Underground Coal Mining, Geo-mechanics, Underground Metal Mining, Opencast Mining, Geo-mechanics Lab
Name of the organisation	**National Institute of Technology Rourkela**

Publications:

Journal Publications

1. **Patel, S**., & Martin, C. D. (2017). Evaluation of Tensile Young's Modulus and Poisson's Ratio of a Bi-modular Rock from the Displacement Measurements in a Brazilian Test. **Rock Mechanics and Rock Engineering**, 1–13. https://doi.org/10.1007/s00603-017-1345-5
2. **Patel, S**., & Martin, C. D. (2018a). Application of digital image correlation technique for measurement of tensile elastic constants in Brazilian tests on a bi-modular crystalline rock. **Geotechnical Testing Journal**, 41(4), 664–674. https://doi.org/10.1520/GTJ20170208
3. **Patel, S.**, & Martin, C. D. (2018b). Application of Flattened Brazilian Test to Investigate Rocks Under Confined Extension. **Rock Mechanics and Rock Engineering**, 51(12), 3719–3736. https://doi.org/10.1007/s00603-018-1559-1
4. **Patel, S.**, & Martin, C. D. (2020). Impact of the initial crack volume on the intact behavior of a bonded particle model. **Computers and Geotechnics**, 127(July), 103764. https://doi.org/10.1016/j.compgeo.2020.103764
5. **Patel, S**., & Martin, C. D. (2020). Effect of stress path on the failure envelope of intact crystalline rock at low confining stress. **Minerals**, 10(12), 1–22. https://doi.org/10.3390/min10121119

International Conference Publications

6. **Patel S**. and C. D. Martin (2015). A new approach to apply confining stress to bonded particle models. The **13th International ISRM Congress 2015**, Montreal, Canada.
7. **Patel, S**. & Martin, C. D. Simulating bi-Modularity in Crystalline Rock Using Discrete Element Modelling. ***52nd US Rock Mech. Symp.*** *17-20 June 2018* (2018).
8. **Patel, S**. & K.G. Sharma (2008). Three-Dimensional Transient Thermo-Hydro-Mechanical Analysis of Underground Nuclear Repository, **5th Asian rock mechanics symposium (ARMS 2008)**, the 2008 ISRM sponsored international symposium Nov. 2008, Tehran, Iran.
9. **Patel, S.** & K.G. Sharma (2009). Three-Dimensional Elasto-Plastic Thermo-Mechanical Analysis of Underground Nuclear Repository, **International symposium on computational geo-mechanics** May 2009, Juan-Les-Pins, France.
10. **Patel, S**. & K.G. Sharma (2010). Transient Three-Dimensional Heat Transfer Study of a KBS3 Type Nuclear Repository, Sixth **International Congress on Environmental Geotechnics**, November 8 - 12, 2010, New Delhi, India
11. **Patel, S**. (2019). Investigation of Stress State of the Surface of A Brazilian Disk Using Digital Image Correlation Technique. INDOROCK 2019: 8th Indian Rock Conference 4-5 November 2019, November, 129–135.
12. **Kumar B., Patel S. (2021).** Comparison of H-B and M-C Failure Criterion at Low Confinement and their Impact on the Prediction of Failure Zone Around an Underground Metal Mine 11th Asian Rock Mechanics Symposium (ARMS 11), Beijing, China

Teaching experience

Teaching assistant *during PhD for:*

1. Third-year civil engineering course "**Geotechnical Engineering**" (Class of 101 students, Fall 2015)
2. Third-year civil engineering course "**Geotechnical Engineering**" (Class of 96 students, Fall 2016)
3. Fourth-year civil engineering course "**Geotechnical Engineering Design**" (Class of 57 students, Winter 2016)
4. Fourth-year civil engineering course "**Geotechnical Engineering Design**" (Class of 31 students, Winter 2017)
5. Fourth-year civil engineering course "**Geotechnical Engineering Design**" (Class of 45 students, Winter 2018)

Assistant Professor, IIT Kharagpur:

1. 1st-year graduate course "**Fundamental and applied geomechanics**"
2. 5th-year dual degree course "**Numerical modelling lab-1**"
3. 1st-year Graduate course **"Design of Underground Structures"**
4. 3rd year Undergraduate course "**Underground Metal Mining" (coming semester)**
5. 3rd year Undergraduate course "**Economics of Mining Enterprises"**
6. 4th-year Undergraduate course "**Tunnelling and Underground structures**"
7. 1st-year undergraduate course "**Engineering Drawing**"

Research experience

Research Project

1. **Impact of Confined Extension on the Failure Envelope of Intact Low Porosity Rock**. *Funded by:* Swedish Nuclear Fuel and Waste Management Co. (SKB) Sweden, the Canadian Nuclear Waste Management Organization (NWMO), and the Natural Sciences and Engineering Research Council of Canada.
2. **Thermo-Hydro-Mechanical analysis of underground nuclear repository.** Bhabha Atomic Research Center (BARC), India (Through IIT Delhi)
3. **Investigation and implications of bi-modularity in rock mechanics applications.** *Funded by:* Institute Scheme for Innovative Research and Development (ISIRD), IIT Delhi (Ongoing)
4. **Investigation of rock fracturing under both compression and tension using digital image correlation technique.** *Funded by:* Start-up Research Grant, DST (Under review)

PhD Guidance

2 ongoing (**one student under PMRF scheme**)

MTech Guidance

4 Completed, 1 ongoing

Work experience

Academic Experience

Dates	August 2019- Present
Occupation or position held	**Assistant Professor**
Main activities and responsibilities	Teaching and Research (Guiding 2 PhD student, Teaching UG and Graduate courses)
Name and address of employer	**Indian Institute of Technology (IIT) Kharagpur**, India, 721302
Type of business or sector	Research and Teaching (Educational Institute)
Dates	July 2018- March 2019
Occupation or position held	**Post-doctoral Research Assistant**
Main activities and responsibilities	Conducting research related to rock mechanics (both experimental and discrete element modelling)
Name and address of employer	**University of Alberta, Edmonton, Alberta, Canada, T6G 2R3** www.ualberta.ca
Type of business or sector	Research and Teaching (Educational Institute)
Dates	September 2012- June 2018
Occupation or position held	**Graduate Research Assistant and Teaching Assistant**
Main activities and responsibilities	Conducted research related to nuclear waste disposal. Project funded by- Swedish Nuclear Fuel and Waste Management Co. (**SKB**) Sweden, the Canadian Nuclear Waste Management Organization (**NWMO**) and the Natural Sciences and Engineering Research Council of Canada (**NSERC**)

	Teaching assistant for undergraduate geotechnical engineering courses.
Name and address of employer	University of Alberta, Edmonton, Alberta, Canada, T6G 2R3 www.ualberta.ca
Type of business or sector	Research and Teaching (Educational Institute)
Industrial Experience	
Dates	April 2011- July 2012
Occupation or position held	**Geotechnical Engineer**
Main activities and responsibilities	***Pir Panjal Road Tunnel*** 1. Structural analysis and design of inner concrete lining of road tunnels (of about 10m diameter each at maximum cover of about 1100m) using FLAC 2D and Staad.Pro. 2. Design of north portal cut slope (about 30m high) in clayey silt using FLAC2D and FLAC Slope. 3. Structure analysis and design of reinforced concrete at junction areas (niches, cross-passages and emergency stations) ***Padur Underground Storage Cavern*** 4. Was responsible for overall safety and stability of underground oil storage cavern its access tunnels and shafts. The cavern was 20m wide 30m high and 1500m long at a depth of about 50m
Name and address of employer	**GEOCONSULT INDIA Private Limited** Plot No. 473, Industrial Estate, Udyog Vihar, Phase V Gurgaon - 122 016, India Tel.: +91 124 4569 700 Fax: +91 124 4569 710 http://www.geoconsult.at/
Type of business or sector	Engineering and Development Consultancy.
Dates	July 2008 – March 2011
Occupation or position held	**Assistant Tunnel Engineer/ Tunnel Engineer**
Main activities and responsibilities	***Pala Maneri Hydro-electric Project (480MW):*** Analysis, design, preparation of design report and construction drawings for the following project components:- 5. Desilting chambers (Three parallel chambers of 12.6m (W) x 19.62m (H) x 320m (L) at 50m spacing) in gneiss with high a insitu stress, (using: empirical methods (RMR and Q-system), wedge analysis using SWEDGE and stress analysis using numerical methods: FLAC 2D and PHASE 2). 6. Dam cut slope of about 150m high in jointed gneiss (global stability analysis using Slope/W and FLAC Slope, Wedge analysis using Swedge and plane failure analysis) 7. 5.7m diameter feeder tunnel and 3.0m diameter silt flushing tunnel in gneiss (using: empirical methods (RMR and Q-system) and further assessed by stress analysis using numerical methods: FLAC 2D and PHASE 2). ***Shrinagar Hydro-Electric Project (330MW):*** Analysis, design, preparation of design report and construction drawings for the following project components:- 8. Power channel embankment (global stability analysis using slope/W and FLAC Slope), maximum height 24m. 9. PCC lining for 9.8m diameter headrace tunnel in quartzite and metabasic rock using FLAC 2D and PHASE 2. 10. Tunnel Junctions, in jointed quartzite rock (using: empirical methods (Q-system), wedge analysis using SWEDGE and stress analysis using numerical methods: FLAC 2D and PHASE 2). 11. Reinforced concrete lining for 12m high power channel using FLAC2D. 12. Primary support for diversion tunnel, 9.8m diameter in quartzite (using: empirical methods (RMR and Q-system), wedge analysis using SWEDGE and stress analysis using numerical methods: FLAC 2D and PHASE 2).

Kameng Hydro-Electric Project (600MW):
Analysis, design, preparation of design report and construction drawings for the following project components:-

13. Pressure tunnel and pressure shaft primary support in carbonaceous shale and sandstone (using: empirical methods (RMR and Q-system), wedge analysis using SWEDGE and stress analysis using numerical methods: FLAC 2D and PHASE 2).
14. The reinforced concrete lining of 25m dia. 60m high surge shaft in shale and sandstone (using: empirical methods (RMR and Q-system), wedge analysis using SWEDGE and stress analysis using numerical methods: FLAC 2D and PHASE 2).
15. Construction adit plugs.

Jorethang Hydro-electric Project (96MW):
Analysis, design, preparation of design report and construction drawings for the following project components:-

16. Powerhouse cut slope of about 70m high in phyllitic-quartzite rock (global stability analysis using Slope/W and FLAC Slope, wedge analysis using Swedge and plane failure analysis)
17. Head race tunnel and adit portals cut slope (global stability analysis using Slope/W and FLAC Slope, wedge analysis using Swedge and plane failure analysis)
18. Head race tunnel 7m diameter in phyllitic-quartzite, shale with sandstone band and dolomite rock with maximum cover of 750m (design of primary support, PCC lining, using: empirical methods (RMR and Q-system), wedge analysis using SWEDGE and stress analysis using numerical methods: FLAC 2D and PHASE 2).
19. Primary support for 6m diameter construction adit (using: empirical methods (RMR and Q-system), wedge analysis using SWEDGE and stress analysis using numerical methods: FLAC 2D and PHASE 2).

Nyabarongo Hydro-Power Project (28MW):

20. Design of primary support for 6.7m diameter diversion tunnel in quartzite (using: empirical methods (RMR and Q-system), wedge analysis using SWEDGE and stress analysis using numerical methods: FLAC 2D and PHASE 2). Preparation of design report and construction drawings.

Nafra Hydroelectric Project (96MW):

21. Consolidation analysis and design of embankment slopes for 40m high rockfill dam above 50m thick clay layer.
22. Quantity estimation for underground structures.

Rohtang Road Tunnel:

23. Preparation of construction drawings for south portal slope protection.

Name and address of employer	**SMEC (Snowy Mountains Engineering Corporation) India Pvt Ltd**. 5th Floor, DLF Building 8, Tower C, DLF Cyber City, Phase–II, Gurgaon– 122002, Haryana, New Delhi (INDIA) http://www.smec.com
Type of business or sector	Engineering and Development Consultancy.

Personal skills and competences

Mother tongue	Oriya
Other language(s)	English, Hindi
Social skills and competences	Good ability to adapt to multicultural environments gained through my work and international academic experience.
Technical skills and competences	**High-level knowledge in the field of "Geotechnical Engineering and Underground Structure Design".** **Capable of setting up and maintaining laboratory test equipment related to rock and soil mechanics.** **Capable of doing numerical simulations of complex geotechnical problems**.

Computer skills and competences

Proficient with distinct element codes: **PFC2D** and **PFC3D**
Proficient with finite difference codes: **FLAC 2D** and **FLAC 3D**.
Proficient with different geotechnical softwares like: **GEOSLOPE, SLIDE, SWEGDE** and **UNWEDGE**.
Proficient level in finite element analysis packages: **PLAXIS** and **Phase2**.
Beginner level user in structural analysis and design software: **Staad.Pro**.
Intermediate user in **AutoCAD.**
Advanced level in **Microsoft Office** (Word, Excel, PowerPoint).
Beginner level in distinct element codes: **UDEC** and **3DEC**

Additional information

Membership of Professional Association:

1. International Society of Rock Mechanics (ISRM)
2. American rock mechanics association (ARMA)
3. Canadian rock mechanics association (CARMA)
4. Indian Society for Rock Mechanics & Tunnelling Technology (ISRMTT)
5. Tunnelling Association of Canada (TAC)
6. Geotechnical Society of Edmonton (GSE)
7. Geotechnical Society of Canada (GSC)

Honours and Awards:

1. Ph.D. Research and Teaching Assistantship- University of Alberta, Edmonton, Canada, 2012-June 2018
2. Received assistantship to complete the masters research project at the EPFL Switzerland within the Indo-Swiss Joint Research Program
3. Received Graduate Research Assistant Scholarship- Indian Institute of Technology for two years (July 2006- May 2008).
4. Received a research grant through IIT Dehli from the Bhabha Atomic Research Center (BARC) in India to investigate transient coupled processes associated with underground storage of high-level nuclear waste.
5. Received a research grant through IIT Dehli for the stability analysis and design of cut slopes of National Highway-22, India during masters.
6. Received National Rural Talent Scholarship in Secondary School for three years
7. Received Dr. N.G.W. Cook Ph.D. Dissertation Award at ARMA 2019, New York.