Dr Alexandros N. Nordas

PhD (DIC), MSc (DIC), Dipllng

Senior Scientific Associate | Lecturer | Expert Technical Consultant, ETH Zurich

Senior Specialist – Rock Mechanics and Underground Construction, Nagra

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Personal Webpage | LinkedIn | Google Scholar | Research Gate

EDUCATION

Feb. 2015-July 2019

PhD in Computational Structural Mechanics

Department of Civil and Environmental Engineering

Imperial College London

- PhD thesis: "High-Fidelity Nonlinear Analysis of Composite Structural Systems"
  Supervisors: Professor Bassam A. Izzuddin, Dr Lorenzo Macorini
  Grade: 1/8 - Pass with no corrections
- Research disciplines: nonlinear mechanics, nonlinear Finite Element modelling, extreme static and dynamic (blast) loading, High-Performance Computing, computational contact mechanics, offshore structural engineering
- Departmental postgraduate student representative (2016-2017)
- Structural engineering cluster postgraduate student representative (2017-2018)

Sept. 2013-Sept. 2014

Master of Science (MSc) in Earthquake Engineering (90 ECTS) – 90/100 (Distinction)

Advanced Structural Engineering Cluster, Department of Civil and Environmental Engineering

Imperial College London

- MSc thesis: ''Advanced Numerical Modelling of Structural Sandwich Panels subjected to Intense Blast Loading'' - fully funded by Equinor ASA (formerly Statoil ASA)
  Supervisor: Professor Bassam A. Izzuddin
  Grade: 90/100
- Graduated 1st in the Department of Civil and Environmental Engineering
- Graduated 1st in the Advanced Structural Engineering Cluster
- Graduated 1st in the Earthquake Engineering MSc Program
- Earthquake Engineering MSc Program Course Representative (2013-2014)

2008-2013

Diploma in Civil Engineering (300 ECTS): 9.40/10.00 (Excellent)

School of Civil Engineering

National Technical University of Athens (NTUA)

- Diploma thesis: "Advanced Computational Techniques of Model Complexity Reduction for Large-Scale Structural Dynamics Applications"
  Supervisor: Professor M. Papadrakakis
  Grade: 10.0/10.0
- Graduated 2nd in NTUA School of Civil Engineering

2002-2008

High School Diploma: 19.7/20.0

The American College of Greece PIERCE

- Class of 2008 Salutatorian | Ranked 1st in panhellenic examinations

ACADEMIC AND PROFESSIONAL EXPERIENCE

Sep. 2024-Present

Senior Specialist - Rock Mechanics and Underground Construction

Nagra

- Planning and realisation of deep geological repository for radioactive waste: engineering design and construction of repository drifts for high-level waste, caverns for low-/intermediate-level waste and access shafts.
- Deep geological repository optimisation: Feasibility assessment of alternative tunnel design and construction concepts for high-level waste drifts.

Jan. 2020-Present

Expert Technical Consultant

Chair of Underground Construction, Institute for Geotechnical Engineering

ETH Zurich

- Client: NAGRA

  Industrial project: Construction of a deep geological repository for radioactive nuclear waste in Switzerland embedded in Opalinus Clay, encompassing drifts for high-level waste (HAA) and caverns for low-/intermediate-level waste (SMA)

  Work Packages (WP):

  - WP1 - Implementation and validation of the anisotropic linear elastic-perfectly plastic (ALEPP) constitutive model for Opalinus Clay (Jan. 2020 - Dec. 2020)
  - WP2 - Evaluation of triaxial test results for Opalinus Clay specimens from Bülach and Mont Terri and calibration of the ALEPP constitutive model (Jun. 2020 – September 2022)
  - WP3 - Development of high-fidelity, coupled hydraulic-mechanical Finite Element models for life cycle hazard assessment of the HAA and SMA tunnels (Jan. 2020 - Jun. 2021)
  - WP4 - Sensitivity analysis of numerical model predictions for the range of Opalinus Clay parameters determined from the ALEPP model calibration (Apr. 2021 – Jul. 2020)
  - WP5 - Derivation of analytical solutions for the ground response curve of brittle softening rocks exhibiting desaturation, as an aid for preliminary calculations (May 2021 - Jun. 2021)
  - WP6 – Detailed design computations for the HAA repository tunnels (Sep. 2021 – Mar. 2022)
  - WP7 – Detailed design computations for the SMA repository tunnels (Jan. 2022 – Dec. 2022)
  - WP9 – Evaluation of additional triaxial test results for Opalinus Clay specimens from Bülach and re-calibration of the ALEPP constitutive model (Mar. 2022 – September 2022)
  - WP10 – Sensitivity analysis of HAA repository tunnel computations for the new Opalinus Clay parameters determined from the ALEPP model re-calibration (Sep. 2022 – Dec. 2022)

Jan. 2020-Present

Senior Scientific Associate (Oberassistent I) | Lecturer (Jan. 2023 - Present)

Postdoctoral Researcher (Jan. 2020 – Dec. 2022)

Chair of Underground Construction, Institute for Geotechnical Engineering

ETH Zurich

- Research disciplines: life-cycle computational simulation and hazard assessment of underground systems, time-dependent ground processes, large deformation problems and instability phenomena in rocks, constitutive modelling, development of novel design aids.
- Ph.D. Thesis supervision:
  - Thomas Leone "Effects of Creep on the Interaction between TBM, Lining and Rock" (Submitted - Doctoral Examination: 05.12.2023)
- M.Sc. Final Thesis supervision:
  - Hoong Hao Yap (Imperial College London exchange student) "Evaluation of Monitoring Data from Underground Galleries in Opalinius Clay at Mont Terri: Class A Predictions and Back-Analysis", July 2023

- Kopp Seraina "The Influence of Anisotropy in Tunnelling through Low-Permeability Squeezing Ground", July 2022
- Sattler Nicola "Comparative 2D and 3D Rock-Support Interaction Analyses for Low-Permeability Rock", July 2021
- Wenger Simon "Design of Tunnel Support in Low-Permeability Anisotropic Rock", July 2021

• M.Sc. Project Thesis supervision:

- Kopp Seraina "Applicability of the large-strain correction equation to anisotropic or coupled problems", December 2021
- Hertz Liz "Shield Jamming in Narrow Fault Zones", December 2021
- Rüegger Petra "Gibralter Flysch: Rock mass parameters and shield jamming hazard", December 2021

• Teaching:

- "Underground Construction I (Untertagbau I)", M.Sc. programme
- "Fels- und Untertagbau", B.Sc. programme

Jan. 2015 – Jul. 2023

Research Associate
Computational Structural Mechanics group
Imperial College London

• Industrial project: INFLOAT (INnovative FLoor systems for Offshore plAtform Topsides) Sponsors: AMEC Foster-Wheeler, POSCO, Worley Parsons | Funding: £ 150000

- Conceptualisation and design of prototype laser-welded steel sandwich panels for use in topside decks of offshore oil and gas platforms - Patent application: Case No. 8378 "Novel Two-Way Sandwich Structures"
- Experimental program coordinator for 35 tests of the prototypes in the POSCO R&D facilities in Seoul, South Korea
- Development of novel design methodology for sandwich deck systems in offshore platforms, resulting in 30% reduction in cost and 50% reduction in construction time
- Ongoing design methodology enhancement based on genetic optimisation algorithms

Sep. 2011 – Sep. 2013 & Aug. 2021- Mar. 2022

Research Associate
Institute of Structural Analysis and Seismic Research
National Technical University of Athens

• Development of structural design optimisation tools based on Neural Networks and Machine Learning and reduced-order model algorithms for structural health monitoring

Jan. 2015 - Jan. 2019

Graduate Teaching Assistant
Department of Civil and Environmental Engineering
Imperial College London

• Lecturer/project coordinator: Nonlinear Structural Analysis, Finite Element Analysis, Computational Engineering Analysis, Structural Mechanics, Structural Dynamics, Reinforced Concrete, Earthquake Engineering, Mathematics, Creative Design.

Jun. 2009 - Aug. 2009 & Jun 2010.- Aug. 2010

Structural engineer - intern
Zervas & Charitonidis SA General Construction Company

• Assistance in the structural design of residential and commercial buildings.
• Detailing and CAD technical drawings of reinforced concrete structural elements.
• Administrative support and organisational assistance (project portfolios, expenses).

FUNDING AND AWARDS

2019 **ICE Telford Premium Prize** - Award for the journal paper "High-fidelity non-linear analysis of metal sandwich panels" by Nordas *et al.*, in recognition of its exceptional quality and benefit to the civil engineering, construction and materials science community. *Institution of Civil Engineers (ICE)*

2018 & 2017 & 2016 **Departmental Graduate Teaching Assistant (GTA) of the Year 2016 (1st place) | 2017 (1st place) | 2018 (2nd place) Awards** - Awarded annually to the PhD student of the Department of Civil and Environmental Engineering voted as best GTA by the undergraduate and taught postgraduate-MSc student bodies. *Department of Civil and Environmental Engineering, Imperial College London*

2017 & 2016 **Faculty of Engineering Highly Commended Graduate Teaching Assistant (GTA) of the Year 2016 | 2017 Awards** - Awarded annually to the three best Departmental GTAs in the Faculty of Engineering of Imperial College London. *Faculty of Engineering, Imperial College London*

2017 **CivSoc Best Graduate Teaching Assistant (GTA) of the Year 2017 Award** - Awarded annually to the PhD student of the Department of Civil and Environmental Engineering voted as best GTA by the CivSoc student committee and the Imperial College London student union. *Department of Civil and Environmental Engineering, Imperial College London*

2016 **Imperial College London - Massachusetts Institute of Technology (MIT) Global Fellow** - Selected as one of *the* 20 Imperial College London – 20 MIT Global Research Fellows and acted as ambassador of Imperial College London in the 2016 Global Fellows Programme. *Imperial College London, Massachusetts Institute of Technology (MIT)*

2015 **Letitia Chitty Centenary Memorial Prize** - Awarded annually to the MSc student whose performance is judged to be top in the Department of Civil and Environmental Engineering. *Department of Civil and Environmental Engineering, Imperial College London*

2015 **Patrick J Dowling Prize in Advanced Structural Engineering** - Awarded annually to the postgraduate student in the Department of Civil and Environmental Engineering at the top of the final class list in the Advanced Structural Engineering MSc Cluster. *Department of Civil and Environmental Engineering, Imperial College London*

2015 **ABS Consulting Prize in Earthquake Engineering** - Annual Award for outstanding performance in the Earthquake Engineering MSc Program. *Department of Civil and Environmental Engineering, Imperial College London*

2013 **Statoil Scholarship (£12500)** *Equinor ASA (formerly Statoil ASA), Imperial College London*

2013 **2 Departmental MSc Scholarships (£9000)** *Department of Civil and Environmental Engineering, Imperial College London*

2013 **Limmat Foundation Award of Excellence (€8000)** - Award of excellence for the 3 top students in the NTUA School of Civil Engineering class of 2013 (Graduated 2nd). *Limmat Foundation*

2009 & 2010 **Christos Papakyriakopoulos Prize** - Annual award to the undergraduate students of the NTUA Engineering Schools achieving the highest overall performance in Mathematics. *NTUA*

2008 **NTUA 1st Year Prize** - Ranked within the top 10% of admitted undergraduate students in NTUA. *National Technical University of Athens*

2008 **Municipality of Athens fellowship** - 1st place in the panhellenic examinations amongst PIERCE class of 2008. *Greek Ministry of Education and Religious Affairs, The American College of Greece*

2008 **Eurobank EFG fellowship** – 1st place in the panhellenic examinations amongst PIERCE class of 2008. *Eurobank EFG, The American College of Greece*

Accepted Journal Articles

- Nordas, A. N., Cantieni, L., Natale, M., Anagnostou, G. (2025). Effect of squeezing on construction and structural safety of the Swiss high-level radioactive waste repository drifts. *Journal of Rock Mechanics and Geotechnical Engineering* (in Press)
- Nordas, A.N., Cantieni, L., Anagnostou, G. (2024). An analytical solution for the undrained ground response to tunnelling considering the excavation-induced desaturation. *Journal of Rock Mechanics and Geotechnical Engineering* (in Press). doi: 10.1016/j.jrmge.2024.04.020
- Nordas, A. N., Leone, T., Anagnostou, G. (2024). Creep versus consolidation in tunnelling through squeezing ground—part B: transferability of experience. *Rock Mechanics and Rock Engineering*, *57*(8), 5537-5555. doi: 10.1007/s00603-024-03968-6
- Leone, T., Nordas, A. N., Anagnostou, G. (2024). Creep Versus Consolidation in Tunnelling Through Squeezing Ground—Part A: Basic Time Effects. *Rock Mechanics and Rock Engineering*, 1-18. doi: 10.1007/s00603-023-03720-6
- Leone, T., Nordas, A. N., Anagnostou, G. (2024). An estimation equation for the TBM thrust force in creeping rock. *Computers and Geotechnics*, 165, 105802. doi: 10.1016/j.compgeo.2023.105802
- Nordas, A. N., Natale, M., Leone, T., Anagnostou, G. (2023). Thrust force requirements in fault zones with squeezing ground. Computers and Geotechnics, 160, 105479. doi: 10.1016/j.compgeo.2023.105479
- Nordas, A. N., Brauchart, A., Anthi, M., Anagnostou, G. (2023). Calibration Method and Material Constants of an Anisotropic, Linearly Elastic and Perfectly Plastic Mohr–Coulomb Constitutive Model for Opalinus Clay. *Rock Mechanics and Rock Engineering*, 1-23. doi: 10.1007/s00603-023-03509-7
- Leone, T., Nordas, A., Anagnostou, G. (2023). Effects of creep on shield tunnelling through squeezing ground. *Rock Mechanics and Rock Engineering*. doi: 10.1007/s00603-023-03505-x (accepted for publication)
- Natale, M., Nordas, A. N., Kopp, S., Anagnostou, G. (2023). Large strain correction for tunnel analyses considering hydromechanical coupling and ground anisotropy. *Scientific Reports,* 13(1), 16080. doi: 10.1038/s41598-023-42158-2
- Nordas, A.N., Izzuddin, B.A. (2022). Translational surface coupling along a line with non-conforming meshes. *Computers & Structures. 260*, p.106703. doi: 10.1016/j.compstruc.2021.106703
- Lagaros, N. D., Kournoutos, M., Kallioras, N. A., Nordas, A. N. (2023). Constraint handling techniques for metaheuristics: a state-of-the-art review and new variants. *Optimization and Engineering*, 1-48. doi: 10.1007/s11081-022-09782-9
- Kallioras, N.A., Nordas, A.N., Lagaros, N.D. (2021). Deep Learning-Based Accuracy Upgrade of Reduced Order Models in Topology Optimization. *Applied Sciences*, *11*(24), 12005. Doi: 10.3390/app112412005
- Nordas, A.N., Santos, L., Izzuddin, B.A., Macorini, L. (2018) High-fidelity non-linear analysis of metal sandwich panels. *Proceedings of the Institution of Civil Engineers - Engineering and Computational Mechanics*. 171(2), 79-96. – *Awarded the Telford Premium Prize*
- Santos, L., Nordas, A.N., Izzuddin, B.A., Macorini, L. (2018) Mechanical models for local buckling of metal sandwich panels. *Proceedings of the Institution of Civil Engineers - Engineering and Computational Mechanics*. 171(2), 65-78.

Journal Articles under Review

- Nordas, A.N., Izzuddin, B.A. (2024). Full shell surface coupling along a line with non-conforming meshes. *Computational Mechanics.* (under review)

Accepted Peer-Reviewed Conference Papers

- Nordas, A.N, Leone, T., Anagnostou, G. (2024). Is a large TBM diameter unfavourable under squeezing conditions? In Yan J., Celestino T., Thewes M., Eberhardt E. (Eds): *Tunnelling for a Better Life* –

Proceedings of the ITA-AITES World Tunnel Congress 2024 (WTC 2024), 19-25 April 2024, Shenzen, China. CRC Press. pp. 2020-2027

- Nordas, A. N., Leone, T., Anagnostou, G.: Tunnel Interaction in Low-Permeability, Squeez-ing Ground. In: Proceedings of the 58th U.S. Rock Mechanics/Geomechanics Symposium. American Rock Mechanics Association (ARMA), Golden, Colorado, USA (2024b). doi: 10.56952/ARMA-2024-0590
- Nordas, A. N., Natale, M., Anagnostou, G., Cantieni, L. (2023b). Study into the TBM jamming hazard in Opalinus clay. In Anagnostou, G., Benardos, A., & Marinos, V. P. (Eds.) *Expanding Underground-Knowledge and Passion to Make a Positive Impact on the World: Proceedings of the ITA-AITES World Tunnel Congress 2023 (WTC 2023), 12-18 May 2023, Athens, Greece*. CRC Press. pp. 2146-2153.
- Cantieni, L., Nordas, A.N., Morosoli, D., Anagnostou, G. (2023). On the short-term response of Opalinus Clay to tunnelling. In: *Proceedings of the ISRM 15th International Congress on Rock Mechanics and Rock Engineering & 72nd Geomechanics Colloquium – Challenges in Rock Mechanics and Rock Engineering*, Schubert, W. & Kluckner, A. (eds), Salzburg, Austria, October 9-14, 2023. Austrian Society for Geomechanics: Salzburg. pp. 373-378.
- Nordas A.N., Izzuddin B. A., Macorini L. (2018) Surface coupling along a line with non-matched meshes. In: *Proceedings of the Elsevier 13th International Conference on Computational Structures Technology C.S.T. 13, 4-6 September 2018, Sitges, Barcelona, Spain*. Amsterdam, Elsevier. pp. 319-322.
- Nordas A.N., Santos L., Izzuddin B. A., Macorini L. (2018) 1D coupling element for effective modelling of sandwich panels. In: Keller, T., Yanes Armas, S., Carlsson, L. A. and Frostig, Y. (eds.) *12th International Conference on Sandwich Structures ICSS-12: Proceedings, 19-22 August 2018, EPFL, Lausanne, Switzerland*. Lausanne, EPFL-CCLab Composite Construction Laboratory. pp. 44-46.
- Santos L., Nordas A.N., Izzuddin B. A., Macorini L. (2018) Structural design optimisation of rectangular honeycomb core sandwich panels under out-of-plane loading. In: Keller, T., Yanes Armas, S., Carlsson, L. A. and Frostig, Y. (eds.) *12th International Conference on Sandwich Structures ICSS-12: Proceedings, 19-22 August 2018, EPFL,* Lausanne, Switzerland. Lausanne, EPFL-CCLab Composite Construction Laboratory. pp. 165-167.
- Nordas A.N., Santos L., Izzuddin B. A., Macorini L. (2017) Effective high-fidelity nonlinear analysis of metal sandwich panels using partitioned modelling. In: A. Faramarzi and S. Dirar (eds.) *Proceedings of the 25th U.K. Association of Computational Mechanics (U.K.A.C.M.) Conference on Computational Mechanics*, 11-13 *April 2017, Birmingham, UK*. Birmingham, University of Birmingham. pp. 284-287.
- Santos L., Nordas A.N., Izzuddin B. A., Macorini L. (2017) Design-oriented mechanical models for local buckling assessment of sandwich panels with metal cores. In: A. Faramarzi and S. Dirar (eds.) *Proceedings of the 25th U.K. Association of Computational Mechanics (U.K.A.C.M.) Conference on Computational Mechanics*, 11-13 *April 2017, Birmingham, UK*. Birmingham, University of Birmingham. pp. 288-291.

Peer-Reviewed Conference Papers under Review

- Nordas, A.N, Leone, T., Anagnostou, G. (2025). Effectiveness of driving a pilot tunnel coaxially to the main tunnel in low-permeability ground. *Proceedings of the ITA-AITES World Tunnel Congress 2025 (WTC 2025), 9-15 May 2025, Stockholm, Sweden*. CRC Press (under review).
- Nordas, A.N, Arnold, A., Lombardi, M., Anagnostou, G. (2025). Assessment of TBM entrapment risk in fault zones during construction of the Swiss radioactive waste repository. *Proceedings of the ITA-AITES World Tunnel Congress 2025 (WTC 2025), 9-15 May 2025, Stockholm, Sweden*. CRC Press (under review).

NAGRA Expert Consulting Reports

- Nordas, A., Arnold, A., Lombardi, M., Anagnostou, G. (2024). Additional 3D HAA tunnel computations with ALEPP considering fault zones. ETH Zurich (in preparation).
- Natale, M., Nordas, A., Anagnostou, G. (2022). Additional 3D HAA tunnel computations with ALEPP (Rev A). ETH Zurich, 08.12.22.
- Natale, M., Nordas, A., Anagnostou, G. (2022). Additional 3D HAA tunnel computations with ALEPP (Rev A). ETH Zurich, 08.12.22.

- Anthi, M., Nordas, A., Anagnostou, G. (2022). Calibration of the anisotropic, linearly elastic, perfectly plastic model (ALEPP) based upon triaxial tests on Bülach Opalinus clay specimens from boreholes BUL1-1, TRU1-1, BOZ1-1 and BOZ2-1, rev B. ETH Zurich, 30.09.22
- Morosoli, D., Nordas, A., Anagnostou, G. (2022). Structural analysis and design considerations for the SMA caverns (Rev. A). ETH Zurich, 20.12.22
- Natale, M., Nordas, A., Anagnostou, G. (2022). 3D HAA tunnel computations with ALEPP, Rev. B. ETH Zurich, 24.03.22.
- Nordas, A., Anagnostou, G. (2021). Analytical short-term ground response curves for a linearly elastic, brittle-plastic constitutive model, Rev. A. ETH Zurich, 20.06.21.
- Nordas, A., Brauchart, A., Natale, M., Anagnostou, G. (2021). Ground response curves after ALEPP for Bülach and Mont Terri material constants, Rev. A. ETH Zurich, 16.07.21.
- Brauchart, A., Natale, M., Nordas, A., Vonwiller, P., Anagnostou, G. (2021). Numerical models for tunnel calculations, Rev. A. ETH Zurich, 20.06.21
- Brauchart, A., Nordas, A., Anthi, M., Anagnostou, G. (2022). Calibration of the Anisotropic Linearly Elastic, Perfectly Plastic Model (ALEPP) based upon Bülach and Mont Terri Triaxial Test Results (rev. C). ETH Zurich, Zurich, 30.09.22.
- Leone, T., Nordas, A., Anagnostou, G. (2020). Implementation and Validation of the Manica and of the Anisotropic, Linearly Elastic, Perfectly Plastic Constitutive Models into ABAQUS (rev. C). ETH Zurich, Zurich, 14.12.20.

COMMERCIALISATION OF RESEARCH – PATENTS

2019 **Case No. 8378: Novel Two-Way Sandwich Structures** - Application to European Patent Office for certification of novel steel, laser-welded, two-way spanning sandwich composites for employment in offshore platform topside deck systems (decision pending).

PROGRAMMING SKILLS

Technical programming languages: Matlab, Python, Fortran, Maple.

Finite Element analysis software: ABAQUS, ANSYS, ADAPTIC, SAP 2000, SOFISTIK

CAD software: AutoCad 2D (Autodesk Certificate of completion - 95/100)

LANGUAGES

Greek: Native Language

English: Full Professional Proficiency (University of Cambridge CPE, University of Michigan CPE, TOEFL: 105/120)

German: Basic (A2/B1)

French: Basic (A2)

REFERENCES

Prof. Dr. G. Anagnostou, ETH Zurich (georg.anagnostou@igt.baug.ethz.ch)

Prof. B. A. Izzuddin, Imperial College London (b.izzuddin@imperial.ac.uk)

Dean Prof. N. Lagaros, National Technical University of Athens (nlagaros@central.ntua.gr)