Exneyder Andres Montoya Araque

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Geological engineer with a solid background and hands-on experience in applied geology, geomorphology, and geotechnical engineering. Specialized in the study and modeling of hydrogeological phenomena and hazard scenarios, integrating quantitative and qualitative approaches through deterministic and probabilistic methods. Experienced in regional and local scale analysis using empirical, statistical, and physically based modeling. Skilled in developing computational solutions and advanced GIS tools for geospatial analysis, with a strong drive to solve complex technical challenges.

Education

2022 – 2025 **Doctorate in Engineering,**, *Universidad EAFIT (Colombia) & Université Paris-Saclay (France)*, Double degree via international cotutella
Thesis: *Performance-based seismic landslide hazard assessment: Numerical frameworks for regional and local-scale applications*
Supervisors: Silvana Montoya-Noguera, *PhD.* & Fernando Lopez-Caballero, *PhD., HDR.*

2017 – 2019 **Master in Engineering – Geotechnics**, *Universidad Nacional de Colombia*, Medellín.
Thesis: *Slope Stability Assessment for Block-in-Matrix Composite-Materials by the Tortuous Surface Method.*
Supervisor: Lúdger O. Suárez Burgoa, *PhD.*

2010 – 2016 **Geological Engineering**, *Universidad Nacional de Colombia*, Medellín.
Final career project: Circular Slope Stability pyProgram (`pyCSS`): Programa de código abierto en Python para el análisis de estabilidad de taludes en 2D, métodos de Fellenius y de Bishop.
Supervisor: Lúdger O. Suárez Burgoa, *PhD.*

Academic experience

Teaching

2022 – Present **Adjunct Professor**, *Universidad EAFIT*, Medellín, Ant. Colombia
Laboratory of Applied Soil Mechanics (2022-2), Fundamentals of Soil Mechanics (2025-1), Slope stability (2022-2 to 2025-2)

2021 – Present **Adjunct Professor**, *Universidad EIA*, Envigado, Ant. Colombia
Structural Geology (2021-1, 2022-2, 2024-1, 2025-1), Geomorphology (2021-2, 2025-2), General Geology (2022-1, 2022-2).

2025 **Adjunct Professor**, *Universidad Mayor, Real y Pontificia de San Francisco Xavier de Chuquisaca*, Sucre, Bolivia
Soil and Rock mechanics (2025-2).

Research

2023 – 2025 **Investigador Estudiante de Doctorado**, *Programa ECOS NORD para el intercambio de investigadores entre Colombia (EAFIT) y Francia (CentraleSupélec - UPSaclay)*
Tema: Evaluación de la amenaza de deslizamientos detonados por lluvia y sismos - Medellín, Colombia.

2017 – 2018 **Joven Investigador**, *COLCIENCIAS – UNAL*, Medellín, Ant. Colombia
Tema: Análisis de estabilidad de taludes en BIMs mediante el método de equilibrio límite con el algoritmo A*.

Experience in consultancy

2024 – Present
Consultant, *Universidad EAFIT*, Medellín.
Activities: Providing specialized professional services in geotechnical engineering, as well as data analysis and processing for disaster risk projects: Hydrogeotechnical instrumental monitoring; early warning systems for geohazards; and hazard assessment for landslides and flash floods.

2016 – 2022
Engineering Assistant to Junior Specialist Engineer, *Ingeniería, Tecnología e Instrumentación S.A. - INTEINSA*, Medellín.
Activities: Geological, geomorphological, and morphodynamic studies for engineering projects; laboratory characterization of soil and rock samples; geological-geomorphological field mapping; supervision of field drilling rigs; and generation of cartographic products using GIS and CAD tools.

2016
Project Assistant, *Corporación Ambiental Visión Verde*, Medellín.
Activities: Field and office support for the Geological Risk group, focusing on torrential flood hazard assessments for the POMCA (Watershed Management and Protection Plans) within CORNARE's jurisdiction.

Languages

Spanish	English	French
Native	B2	A2

IT Skills

Programming	Python, R, MatLab/Octave
Markup languages	LaTeX and Markdown
OS	Microsoft Windows and Linux: Ubuntu
GIS	ArcGis, QGis, Global Mapper, Google Earth
Drawing	CAD: AutoCAD and Civil3D, Vector: Inkscape/CorelDraw, Raster: Gimp

Honors

May 2019	Master's thesis with Laureate Distinction.	*UNAL, Facultad de Minas*
Aug. 2016	Honor roll: Geological Engineer	*UNAL, Facultad de Minas*

Publicaciones recientes

Montoya-Araque, Exneyder A. et al.: *Numerical earthquake-induced landslide hazard assessment at regional scale in the Colombian Andes*. en. In: *Soil Dynamics and Earthquake Engineering* 195 (Aug. 2025), p. 109370. ISSN: 02677261. DOI: 10.1016/j.soildyn.2025.109370.

Montoya-Araque, Exneyder A, Fernando Lopez-Caballero, and Silvana Montoya-Noguera: "Using fragility curves in the probabilistic spatial assessment of permanent displacements of slopes". In: *Proceedings of the 18th World Conference on Earthquake Engineering*. Milan, Italy, July 2024.

Montoya-Araque, Exneyder A., Fernando Lopez-Caballero, and Silvana Montoya-Noguera: "Evaluación de deslizamientos sísmicos mediante el cálculo de desplazamientos permanentes considerando los efectos topográficos en la propagación de ondas". Español. In: *III Conferencia Interamericana sobre Reducción del Riesgo de Desastres y Adaptación al Cambio Climático*. Manizales, May 2024.

Montoya-Araque, Exneyder A., Silvana Montoya-Noguera, and Fernando Lopez-Caballero: *An open-source application software for spatial prediction of permanent displacements in earthquake-induced landslides by the Newmark sliding block method: pyNewmarkDisp*. In: *Environmental Modelling & Software* 173 (Jan. 2024), p. 105942. ISSN: 13648152. DOI: 10.1016/j.envsoft.2024.105942.

Montoya-Araque, Exneyder A. and Silvana Montoya-Noguera: *Sensitivity Analysis of a Physically Based Model to Assess Rainfall-Triggered Shallow Landslides*. In: *Geotechnical and Geological Engineering* 41.5 (July 2023), pp. 2797–2814. ISSN: 0960-3182. DOI: 10.1007/s10706-023-02427-3.

Montoya-Araque, Exneyder A. et al.: *An open-source application software to determine the preconsolidation pressure of soils in incremental loading oedometer testing: pySigmaP*. In: *SoftwareX* 17 (Jan. 2022), p. 100990. ISSN: 23527110. DOI: 10.1016/j.softx.2022.100990.

Ariza-Triana, Andrés, Exneyder A. Montoya-Araque, and Ludger O. Suarez-Burgoa: *Modeling of Bimrock/Bimsoil Structures by Means of Circular Particles Packed in R2*. In: *Lecture Notes in Civil Engineering*. Ed. by Marco Barla, Alice Di Donna, and Donatella Sterpi. Vol. 126. Cham, 2021, pp. 737–743. ISBN: 978-3-030-64517-5. DOI: 10.1007/978-3-030-64518-2_87.

Montoya-Araque, Exneyder A, Ludger O Suarez-Burgoa, and Edmund W Medley: *Application of the tortuous surface method to stochastic analysis of bimslope stability*. In: *Bulletin of Engineering Geology and the Environment* 79.10 (Dec. 2020), pp. 5329–5340. ISSN: 1435-9529. DOI: 10.1007/s10064-020-01909-5.

Montoya-Araque, Exneyder A and Ludger O Suarez-Burgoa: *Automatic generation of tortuous failure surfaces in block-in-matrix materials for 2D slope stability assessments*. In: *Computers and Geotechnics* 112 (Aug. 2019), pp. 17–22. ISSN: 0266352X. DOI: 10.1016/j.compgeo.2019.04.002.

Montoya-Araque, Exneyder A and Ludger O Suarez-Burgoa: "Evaluación de estabilidad de taludes compuestos por bimsoils/bimrocks mediante modelación computacional de superficies de falla tortuosas con el algoritmo A*". In: *XVI Congreso Panamericano de Mecánica de Suelos e Ingeniería Geotécnica – Geotechnical Engineering in the XXI Century: Lessons learned and future challenges*. Cancún, México, 2019, pp. 628–636. DOI: 10.3233/STAL190093.

Suarez-Burgoa, Ludger O, Andres Ariza-Triana, and Exneyder Montoya-Araque: *Modelamiento de estructuras de bimsoils mediante el empaquetado de partículas circulares en R2*. In: *Revista de la Facultad de Ciencias* 8.2 (July 2019), pp. 115–137. ISSN: 2357-5549. DOI: 10.15446/rev.fac.cienc.v8n2.72343.

Montoya-Araque, Exneyder A and Ludger O Suarez-Burgoa: *Software de aplicación en Python 3 para el cálculo de la estadística de tensores de segundo orden de Jelinek en datos de anisotropía de susceptibilidad magnética*. In: *Boletín de Ciencias de la Tierra* 44 (2018), pp. 49–58. ISSN: 0120-3630. DOI: 10.15446/rbct.n44.70973.

Montoya-Araque, Exneyder A. and Ludger O. Suarez-Burgoa: *pyBIMstab: Application software for 2D slope stability analysis of block-in-matrix and homogeneous materials*. In: *SoftwareX* 7 (Jan. 2018), pp. 383–387. ISSN: 23527110. DOI: 10.1016/j.softx.2018.11.003.

Suarez-Burgoa, Ludger O. and Exneyder Andrés Montoya-Araque: *Programa en código abierto para el análisis bidimensional de estabilidad de taludes por el método de equilibrio límite*. In: *Revista de la Facultad de Ciencias* 5.2 (July 2016), pp. 88–104. ISSN: 2357-5549. DOI: 10.15446/rev.fac.cienc.v5n2.59914.

Software development

pyNewmarkDisp Application software for spatial calculation of permanent displacements due to ground motion based on Newmark's sliding block method. ©2022, Exneyder A. Montoya-Araque, Silvana Montoya-Noguera, Fernando López-Caballero & Universidad EAFIT.

pySigmaP Application software for calculating the preconsolidation pressure of soils in incremental loading (IL) oedometer testing by several methods. ©2020, Exneyder A. Montoya-Araque, Alan J. Aparicio-Ortube, David G. Zapata-Medina, Luis G. Arboleda-Monsalve & UNAL.

pyBIMstab Application software to evaluate the factor of safety against sliding of slopes made of Blocks-In-Matrix (BIM) materials along tortuous surfaces. ©2018, Exneyder A. Montoya-Araque, Ludger Suárez-Burgoa & UNAL.

jelinekstat Application software in Python 3 to apply the Jelínek's (1978) statistical model for a sample of n 2^{nd}-order tensors. ©2018, Exneyder A. Montoya-Araque, Ludger Suárez-Burgoa & UNAL.

pyCSS Circular Slope Stability pyProgram: 2D slope stability analysis by the limit equilibrium method using the Fellenius and Bishop methods. ©2016, Ludger Suárez-Burgoa, Exneyder A. Montoya Araque & UNAL.