

Francisco Mendoza Torres

Curriculum Vitae

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EDUCATION

Ph.D. in Earth Sciences (Mathematical Modeling)

2013-2017

National Autonomous University of Mexico (UNAM), Geophysics Institute

Author of *Nonparametric copula modeling for joint stochastic simulation of Discrete Fracture Networks (DFN) in naturally fractured porous media* (used as Ph.D. thesis) which produced methodology, numerical algorithms and computational codes for the analysis, modeling and simulation of Discrete Fracture Networks with focus on the probabilistic dependence among the variables involved.

Courses: Mathematical Analysis, Abstract Algebra (Group Theory), General topology, Mathematical Statistics, Structural Geology.

Workshops taken: Distributed Data for Dynamics and Manifolds. Banff International Research Station (BIRS) for Mathematical Innovation and Discovery.

M.Sc. in Earth Science (Reservoir Characterization)

2008-2011

National Autonomous University of Mexico (UNAM), Geophysics Institute

Produced the thesis *Geophysical Analysis and Modeling of the structure of the Chicxulub crater*. Compared different geophysical models and built my own structural model by interpreting 2D seismic data in Petrel software. Grade 9 (Scale 1-10, 10 Highest Mark).

Courses: Numerical Methods, Geostatistics, Inverse theory in Geophysics, Geophysical data processing, Elastodynamics, Seismic Data Processing, Exploration Seismology, Petrophysics (Rock physics and well log interpretation), Static Reservoir Characterization, Geology, Sequence Stratigraphy, Plate Tectonics.

B.Sc. Physics

1999-2005

Jarez Autonomous University of Tabasco (UJAT)

Realized the importance of mathematical physics and gained the skills to, mathematically, model physical phenomena.

WORK EXPERIENCE

Adjunct Professor - Geostatistics

2014-2017

Geophysics Institute, UNAM

Taught project-centered courses to students in the *Earth Sciences* and *Exploration and Production of Natural Resources* graduate programs. No previous knowledge of statistics was assumed for this course, however the course did teach up to multivariate linear models for spatial estimation and simulation, mainly using gstat and geoR packages from the R software. Datasets for this class were selected to show different real case scenarios.

Researcher - Spatial statistics

2011-2013

Instituto Mexicano del Petróleo (IMP, Mexican Petroleum Institute)

Adapted mathematical models and developed computational code for fracture network characterization, modeling and simulation. Commercial software like FracaFlow and the Petrel Fracture Modeling module were used to validate our software. Besides fixing the import/export lack of compatibility between these two software, the programs written also added more general functions that were applied in real datasets. This was an interdisciplinary project in which I worked along with a structural geologist, and a flow simulation expert. The Geostatistics team, which I belonged to, had weekly meetings, and several general meetings with the other research areas of the project were held every month.

Professor

2006-2008

University: Instituto Tecnológico Superior De La Región Sierra (ITSS)

As a Professor of Mathematics (PDE, Numerical methods, Linear Algebra, Univariate Calculus) and Physics (Electromagnetism), I designed and wrote course notes which included software tutorials for MATLAB, university-grade laboratory experiments and theoretical exercises.



SKILLS

<i>Languages</i>	Spanish (native), English (fluent) Portuguese (intermediate), French (basic reading)
<i>Software</i>	LINUX (UBUNTU, ARCH), WINDOWS (7, 10), VIM (intermediate), L ^A T _E X(advanced) R (expert), C++, PYTHON3, MATLAB, GIT(-HUB), shell scripting, GMSH PETREL (intermediate), FRACAFLOW



SOFTWARE DEVELOPED

Package name	Description
gmshR	An R package to export geometric elements to .geo gmsh files in order to mesh spatial domains.
percolation	Percolation analysis utilities.
bernstein	Tensor approach of the Bernstein-Bézier approximation of a function.
empiricalDistribution	Univariate and multivariate empirical distribution functions.
inverseFunction	Numerical inverse of a univariate function.



VOLUNTEER EXPERIENCE

- Volunteer in the International Conference and Exhibition (ICE) of the AAPG and SEG societies in Cancun, September/2016. I gave help to presenters and applied surveys to attendees.
- Participation in the PUMA oceanographic vessel campaign MORTIC08 in the Pacific Ocean in order to gather bathymetric data. 2-23, March, 2009.
- Participation as volunteer (workshop instructor) in the Earths day Fair in the Palacio de Minería, Mexico City. 13-25, January, 2009.
- Volunteer in several natural disasters (flooding, earthquake).

PUBLICATIONS

- Mendoza-Torres F, Díaz-Viera MA, Erdely A. *Bernstein copula modeling for 2D discrete fracture network simulations*. Journal of Petroleum Science and Engineering. 2017 Jul 1;156:71020. Available from: <http://www.sciencedirect.com/science/article/pii/S0920410517305193>
- Díaz-Viera MA, Erdely A, Kerdan T, del-Valle-García R, Mendoza-Torres F. *Bernstein Copula-Based Spatial Stochastic Simulation of Petrophysical Properties Using Seismic Attributes as Secondary Variable*. In: Gómez-Hernández JJ, Rodrigo-Ilarri J, Rodrigo-Clavero ME, Cassiraga E, Vargas-Guzmán JA, editors. Geostatistics Valencia 2016. Springer International Publishing; 2017. p. 487504. (Quantitative Geology and Geostatistics). Available from: http://link.springer.com/chapter/10.1007/978-3-319-46819-8_33
- Casar-González R, Díaz-Viera MA, Méndez-Venegas J, Hernández-Maldonado VM, Checa-Rojas P, Mendoza-Torres F. *Nuevas metodologías y herramientas de caracterización estática y dinámica considerando las propiedades fractales de los yacimientos petroleros*. Mexico City: Instituto Mexicano del Petróleo; 2014.
- Díaz-Viera MA, Casar-González R, Checa-Rojas P, Hernández-Maldonado VM, Méndez-Venegas J, Mendoza-Torres F, et al. *Modelo geológico-petrofísico de la macropera 331, campo coyotes, cuenca de chicontepec*. Mexico City: Instituto Mexicano del Petróleo; 2013 Nov. Report No.: 03-2013-110512112200-01.
- Díaz-Viera MA, Casar-González R, Hernández-Maldonado VM, Méndez-Venegas J, Mendoza-Torres F, Checa-Rojas P. *Metodología para la modelación geológica-petrofísica usando métodos geoestadísticos fractales*. Mexico City: Instituto Mexicano del Petróleo; 2013 Sep. Report No.: 03-2013-911122153001.
- Casar-González R, Díaz-Viera MA, Méndez-Venegas J, Hernández-Maldonado VM, Checa-Rojas P, Mendoza-Torres F, et al. *Modelo geológico-petrofísico del intervalo de la prueba piloto de inyección de CO₂ en la macropera 331, campo Coyotes, Cuenca de Chicontepec*. Mexico City: Instituto Mexicano del Petróleo; 2013 Sep. Report No.: 03-2013-911122345001.
- Díaz-Viera MA, Mendoza-Torres F. *Análisis estadístico de las propiedades de la red de fracturas observadas en una muestra de mano del afloramiento de Xochitlán, Veracruz*. In: Nuevas metodologías y herramientas de caracterización estática y dinámica considerando las propiedades fractales de los yacimientos petroleros. Mexico City; 2013. (Proyecto Fondos SENER-CONACYT No. 143935 (Y-00114)).
- Díaz-Viera MA, Mendoza-Torres F, Casar-González R, Méndez-Venegas J, Checa-Rojas P, Hernández-Maldonado VM. *Análisis estadístico de las propiedades alineamientos de Acatepec*. In: Nuevas metodologías y herramientas de caracterización estática y dinámica considerando las propiedades fractales de los yacimientos petroleros. Mexico City; 2013. (Proyecto Fondos SENER-CONACYT No. 143935 (Y-00114)).
- Casar-González R, Díaz-Viera MA, Hernández-Maldonado VM, Méndez-Venegas J, Mendoza-Torres F, Checa-Rojas P. *Metodología para obtener modelos geológicos-petrofísicos basados en la aplicación de métodos geoestadísticos*. Mexico City: Instituto Mexicano del Petróleo; 2012 Jul. Report No.: 03-2012-717121908001.



PRESENTATIONS

- Mendoza-Torres F, Díaz-Viera MA. *Dependencia probabilística bivariada entre propiedades intrínsecas de objetos booleanos distribuidos en 2D.* To be presented at: 50 Congreso Nacional de la Sociedad Matemática Mexicana; 2017 Oct 22; Facultad de Ciencias e Instituto de Matemáticas de la UNAM, Mexico city. Available from: www.smm.org.mx
- Mendoza-Torres F, Díaz-Viera MA. *Dependencia probabilística en propiedades intrínsecas de objetos booleanos: aplicación a redes de fracturas discretas.* Oral presentation at: 50 Congreso Metropolitano de Modelado y Simulación Numérica 2017; 2017 May 17; Facultad de Ciencias, Ciudad Universitaria, Mexico City.
- Díaz-Viera MA, Erdely A, Kerdan T, del-Valle-García R, Mendoza-Torres F. *Geostatistical Prediction of Reservoir Petrophysical Properties by Copula-Based Dependence Models Between Seismic Attributes and Petrophysical Properties.* Oral presentation at: AAPG — SEG 2016 International Conference & Exhibition; 2016 Sep 9; Cancun, Mexico. Available from: <http://www.aapg.org/events/conferences/ice>
- Díaz-Viera MA, Erdely A, Kerdan T, del-Valle-García R, Mendoza-Torres F. *Bernstein copula-based spatial stochastic simulation of petrophysical properties using seismic attributes as secondary variable.* Oral presentation at: 10th International Geostatistics Congress; 2016 Sep 8; Valencia, Spain. Available from: <http://geostats2016.webs.upv.es/>
- Mendoza-Torres F, Díaz-Viera MA. Una metodología general y flexible para modelar dependencias en simulaciones de propiedades de redes de fracturas discretas utilizando el enfoque de cópulas de Bernstein. Poster presented at: 3a Reunión Anual del Capítulo Mexicano de InterPore; 2016 Oct 6; UNAM, Mexico City. Available from: <https://www.interpore.org/activities/national-chapters/mexico>
- Mendoza-Torres F, Díaz-Viera MA. A general and flexible methodology to model dependencies in discrete fracture network simulations using Bernstein copula approach. Poster presented at: 8th International Conference on Porous Media & Annual Meeting; 2016 May 11; Cincinnati, Ohio, USA. Available from: <https://www.interpore.org/events/8th-international-conference-on-porous-media-annual-meeting>
- Mendoza-Torres F, Díaz-Viera MA. *Bernstein copula approach to model direction-length dependency for 2D discrete fracture network simulation.* Poster presented at: AGU Fall Meeting; 2015 Dec 8; Moscone Center, San Francisco, California, USA. Available from: <https://agu.confex.com/agu/fm15/webprogram/Paper58431.html>
- Mendoza-Torres F, Díaz-Viera MA. *Un Modelo de Dependencia de Orientación-Longitud usando Cópulas de Bernstein para la Simulación de Sistemas de Fracturas Discretas en 2D.* Oral presentation at: 2a Reunión Anual del Capítulo Mexicano de InterPore; 2015 Apr 22; UNAM Instituto de Geofísica, Mexico City. Available from: <https://www.interpore.org/activities/national-chapters/mexico>
- Mendoza-Torres F, Díaz-Viera MA. *Cluster analysis to discriminate between two families of fractures in 3D.* Oral presentation at: XXVIII Technical Conference of the Association of Petroleum Engineers of Mexico, 2013 October; Mexican Petroleum Institute.
- Multiple presentations in the weekly seminars promoted by my advisor, PhD. Martín Díaz Viera.