Lauro
Morales Montesinos

PhD. Science

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LinkedIn

ABOUT ME

I consider myself a curious, skilled, and adaptable individual with extensive expertise in applied mathematics and science.

I am interested in studying coherent structures that emerge from nonlinear models of continuous media. My recent work includes research on phase transitions in complex materials, the spectral and nonlinear stability of magnetic domains in ferromagnetic thin films, and the spectral stability of gas diffusion in glassy polymers

EDUCATION

PhD science (Mathematics)
Mathematics Institute – UNAM 2016-2020
Minimizing structures for elastic energy in phase transitions under the regime of linear geometric theory in thin film

Msc. Mathematics
Mathematics Institute – UNAM 2014-2016
Phase transitions in thin film geometric linear theory

Bsc. Physics
Science Faculty – UNAM 2005-2010
Existence of annular vortices with boundaries close to internal Hill's spherical vortex streamlines

LANGUAGES

Native
Spanish

Conversational
English

RESEARCH INTERESTS

- Calculus of variations
- Nonlinear stability theory
- Partial Differential Equations
- Analysis
- Probability and Statistics
- Data Science

CURRENT JOB

Postdoctoral position (CONAHCYT)
IIMAS – UNAM 2022-2025
Variational analysis and stability of coherent structures in continuum mechanics

The projects that I am currently analyzing along other partners at IIMAS are:
(1) To determine the spectral stability of a traveling wave solution on a model for gas diffusion in a glassy polymer under convective perturbations by means of analytical and numerical methods.
(2) To study the nonlinear stability of a martensite-martensite phase transition under plane wave perturbations using under-compressive shock stability theory and numerical computations.

Subject Instructor
Science Faculty – UNAM 2024-2025
Differential and Integral Calculus IV

TEACHING

Subject Instructor / Science Faculty – UNAM / 2019-2024

- *Differential and Integral Calculus I-IV*

Subject Instructor /ENP1 – UNAM / 2022-2023

- *Mathematics IV, V, VI areas 2 & 3*

On-line Instructor / Mathematics – UnADM / 2021-2022

- *Introduction to Mathematical thinking*
- *Statistics I*
- *Multivariable Calculus I*

Teacher Assistant /Science Faculty – UNAM / 2010-2017

- *Differential and Integral Calculus I-IV*
- *Complex Variable*
- *Fourier Analysis*
- *Stochastic Processes I y II*
- *Electromagnetism I*

SOFTWARE

8/10
Python

7/10
Arduino

8/10
Matlab

6/10
R

AWARDS & DISTINTIONS

2024-2028 CONAHCYT – *SNII candidacy.*

2022-2025 CONAHCYT –P*ostdoctoral position by Mexico.*

2016-2020 CONACYT - *PhD Scholarship.*

2014-2016 CONACYT - *Master's Scholarship.*

2012-2013 CONACYT -*SNI 3 - Research assistant.*

INDUSTRY EXPERIENCE

Estimation of water consumption in Mexico City
ACCUBO-SACMEX-UNAM
March 2022 - August 2022

Dr. Antonio Capella, Mat. Sergio Fernández, and myself developed predictive models of water consumption at different levels of aggregation at Mexico City.
My main contributions were:
Model development & implementation:

- A Bayesian Gaussian mixture regressor to estimate meter's mechanical tear.
- Automative predictive variable selector based on different metrics (Variables used on predictive models).
- Classical and Bayesian regressors for per-capita consumption.

Developed software:

- Cleaning and coupling of databases from different public and private sources as Catastro & SACMEX databases.
- Address' splitting.
- Implementation, training and selection of regressors.
- Final-user webapp

REFERENCIAS

Dr. Antonio Capella Kort

IMATE-UNAM

capella@im.unam.mx

Dr. Ramón G. Plaza Villegas

IIMAS-UNAM

plaza@aries.iimas.unam.mx

Dr. Luis Fernando López Ríos

IIMAS-UNAM

Luis.lopez@aries.iimas.unam.mx

PUBLICATIONS

Capella, A., Melcher C., Morales, L. & Plaza R. *Stability of Moving Néel Walls in Ferromagnetic Thin Films.*
Preprint. (2024).
https://arxiv.org/abs/2409.04023

Capella, A., Melcher C., Morales, L. & Plaza R. *Nonlinear Stability of Static Néel Walls in Ferromagnetic Thin Films.*
Accepted for publication on Arch. Ration. Mech. Anal. (2024).
https://arxiv.org/abs/2309.04432

Capella, A., Morales, L. *On the Quasiconvex Hull for a Three-well Problem in Two-Dimensional Linear Elasticity.*
Calc. Var. 61, 100 (2022).
https://doi.org/10.1007/s00526-022-02209-4

Capella, A., Morales, L. *On the Symmetric Lamination Convex and Quasiconvex Hull for the Coplanar n-Well Problem in Two Dimensions.*

J Elast 148, 27–54 (2022).
https://doi.org/10.1007/ s10659-021-09878-w

TALKS

The symmetric quasiconvex and lamination convex hull for the coplanar n-well problem and its relation to pattern formation in thin-film shape memory alloys
UJED Durango "57th SMM National congress"
October -2024

Spectral and Nonlinear stability of Néel walls in ferromagnetic thin films
IMATE-UNAM "SEDNOL seminary"
April -2024

Nonlinear stability of coherent structures in PDEs (mini course).
CIMAT - Guanajuato
November -2023.

Nonlinear stability of magnetic Néel walls in thin film
IIMAS-UNAM Mexico city: "Applied Mathematics Colloquium"
September-2023.

Some Results on the Quasiconvex Hull for a n-well Problem in 2D Under Geometrically Linear Elastic Regime.
MPI - Leipzig Germany: "AG seminar Arbeitsgemeinschaft Applied Analysis"
December-2019.

The Quasiconvex Hull for a Three-well problem in 2D under Geometrically Linear Elastic Regime.
CIMAT – Guanajuato: "12th Americas Conference on Differential Equations and Nonlinear Analysis"
December – 2019.

Microstructure in alloys and the n-well problem in geometrically linear elasticity.
UAM-I Mexico City: "Mathematical Analysis Seminar"
November – 2018.

CONGRESS ATTENDANCE

October 2024 – 57th *National Congress SMM.* UJED-Durango México.

September 2023 - *Potential Theory Workshop: Intersections in Harmonic Analysis, Partial Differential Equations and Probability.* CIMAT-Guanajuato México.

July 2023 – *Annual Meeting SIAM Section Mexico: Building Bridges for Interdisciplinary Research*. ITAM- Mexico City.

May 2021 - *Integrative Think Tank on Environmental shock resilience in Mexico; data, models and policy.* CIMAT-Guanajuato Mexico.

May 2019 - *Workshop on differential equations and calculus of variations: The Monge-Ampere equation.* CIMAT-Guanajuato Mexico.

March 2019 - *Mathematical Models for Pattern Formations.* CNA Pittsburgh PA.

December 2018 - *Workshop on Multiscale Models: Theory and Applications.* CIMAT-Guanajuato Mexico.

May 2018 - BUC13-GUQ2018: *Workshop on Uncertainty Quantification.* CIMAT-Guanajuato México.

September 2016 - CMO-BIRS 16w5021: *Mathematical Problems of Orientationally Ordered Soft Solids*. CMO-Oaxaca Mexico.

June 2016 - PIRE-CNA 2016 Summer School: *New Frontiers in Nonlinear Analysis for Materials.* CNA Pittsburgh PA.

October 2015 - IMA workshop: *Mathematics and Mechanics in the 22nd Century: seven decades and counting…* Eugene OR.

POSTERS

Quasiconvex hull for three wells in 2D under Geometrically linear Elastic Regime.
CNA Pittsburgh PA: "Mathematical Models for Pattern Formations"
March-2019

Rigidity and non-Rigidity for Cubic-to-Tetragonal Phase Transition in GL Thin Film Theory.
PIRE-CNA Pittsburgh PA: "2016 Summer School: New Frontiers in Nonlinear Analysis for Materials"
June - 2016

Rigidity results for cubic-to-tetragonal phase transition in geometrically linear thin-film theory.
IMA Eugene OR: "IMA workshop: Mathematics and Mechanics in the 22nd Century: seven decades and counting..."
October-2015