PUBLIC CURRICULUM VITAE · 2026-09-06

Fermín Franco

Mathematician and computational scientist

Collaborating Researcher · UABC Ensenada Campus
National Researcher · Mexico (SNII–SECIHTI)

Investigador colaborador · UABC Campus Ensenada
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UABCエンセナダ校 連携研究者
メキシコ国家研究者（SNII–SECIHTI）

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Profile and current roles

I work across nonlinear systems, mathematical and computational fluid mechanics, numerical methods, scientific computing, and reproducible scientific software. I connect Mexico and Japan through peer-reviewed research, teaching, applied R&D, leadership, and multilingual technical collaboration.

- **Collaborating Researcher, Autonomous University of Baja California, Ensenada Campus** — 2026–present.
- **National Researcher · Mexico (SNII–SECIHTI)** — current.
- **Visiting Researcher, Institute of Mathematics for Industry, Kyushu University — 1 April–26 June 2026**; focused on evaporating-surface stability and jet modeling.
- **Founding Partner and Consultant, KUMIAY International Services of Mexico** — Japan–Mexico industrial mathematics, scientific-computing, translation, and professional services.

Education

2016

PhD in Mathematics

Kyushu University, Japan · Thesis: *Dynamics of a full-cone atomizing liquid jet*

2013

MSc in Applied Mathematics

CIMAT, Mexico · Thesis: *Stability and Chaos in Real Polynomial Maps*

2010

BSc in Applied Mathematics

UABC, Mexico

2006

BSc in Physics

UABC, Mexico · Thesis: *The Effect of Mass Segregation in Globular Clusters*

Selected research appointments and stays

1 April–26 June 2026

Visiting Researcher

Institute of Mathematics for Industry, Kyushu University. Appointment beginning 1 April 2026 focused on variational dissipative fluid mechanics, evaporating-surface stability, and improved jet predictions.

March 2017

Research stay

Technical University of Denmark. Supported by the Scandinavia-Japan Sasakawa Foundation.

Selected research and industrial work

- **Jet and atomization mathematics.** Reduced-order theory, entrainment, noncircular geometry, Basilisk VOF, an early-time laminar OpenFOAM VOF study with 25 native states, and SPH/DualSPHysics visualization.
- **Biomedical mathematical physics.** Mathematical modeling and fluid-dynamics simulation for a JST-CREST project at Osaka University on cytoskeletal organization and mucociliary function.
- **Water-atomization modeling for the steel industry.** Mathematical-modeling contribution within a Kyushu University collaboration. An anonymized industrial-mathematics case; client and plant data remain private.
- **Kyushu University–Mazda automotive R&D collaboration.** Postdoctoral research contribution at the Institute of Mathematics for Industry. Numerical implementation and a preliminary two-dimensional comparison.
- **Six Sigma process-improvement and quality projects.** Consulting and instruction through Lean Sigma Academy. Industrial-mathematics and statistical-quality experience.
- **Wine-region microclimate analysis.** Project supervision and principal-investigator work at UABC with CEVIT. Regional agrometeorological research.

Peer-reviewed journal articles

2026 Tanjina Sharmin, Toshihiro Takeshita, Sihyung Kim, Atsuki Nishihara, Yuki Shirouzu, Mikio Ouchi, Koji Yoshida, Kazuhisa Matsunaga, Hussein Znad, Agus Saptoro, Md Zaidul Islam Sarker, Sahena Ferdosh, Salim Mustofa, Fermin Franco Medrano, Kazusa Mishima, Kai Bin Liew, Keiichi Irie, Tomomitsu Satho, Yi-Ming Sun, Kenji Mishima. “Controlled Precipitation and Microcoating Formation of Shellac via Sequential Ethanol–Water Solvent Exchange.” *Langmuir 42(29), 21435–21444*. DOI 10.1021/acs.langmuir.6c02287

2026 J. Segura-Villarreal, H. Binns-Hernandez, Fermin Franco-Medrano, S. Magdaleno-Gatica, M. Herrera-Martinez. “Herramienta de planeación para la eficiencia profesional y estratégica: Un ensayo crítico.” *Revista Logos 7(1)*. Official record

2025 U. Habibah, Fermin Franco Medrano, A. C. Permana, D. Ardiana, Trisilowati. “An Improved Fifth-Order Runge-Kutta Method with Higher Accuracy and Efficiency for Solving Initial Value Problems.” *Science and Technology Indonesia 10(3), 802–816*. DOI 10.26554/sti.2025.10.3.802-816

2017 Fermín Franco Medrano, Yasuhide Fukumoto, Clara Marika Velte, Azur Hodžić. “Mass entrainment rate of an ideal momentum turbulent round jet.” *Journal of the Physical Society of Japan 86, 034401*. DOI 10.7566/JPSJ.86.034401

2015 Fermín Franco-Medrano, Francisco Javier Solís Lozano. “Stability of Real Parametric Polynomial Discrete Dynamical Systems.” *Discrete Dynamics in Nature and Society, Article 680970*. DOI 10.1155/2015/680970

Conference papers and proceedings

2026 Fermín Franco–Medrano, Fernando Cabrera–Ward, Yasuhide Fukumoto. “Extension of an Ideal Atomizing Jet Model to Noncircular Nozzle Geometries and Recovery of the Circular Nozzle Limit.” 37th Japan Society of Fluid Mechanics Chugoku–Shikoku and Kyushu Branch Conference (2026).

2023 “The Ciliar Alignment Index for Multiciliated Epithelial Cells revisited.” Symomath 2023.

2021 “Analytical model of the dynamics and entrainment of a turbulent atomized liquid jet with non-circular geometry.” ILASS-Americas 2021.

2020 “Energy and momentum loss approaches to modeling a round turbulent atomized liquid jet.” ILASS-Asia 2020.

2018 “MCC Polar Cytoskeleton's Self-organization Simulations using Active Hydrodynamics.” Japan Society for Industrial and Applied Mathematics Annual Meeting.

2017 “Mathematical models for turbulent round jets based on ideal and lossy conservation.” ILASS-Europe 2017. DOI 10.4995/ILASS2017.2017.4778

2016 “Mathematical models for the dynamics of a round full-cone high-speed atomized liquid jet.” Water Jet Technology Society of Japan proceedings. DOI 10.13140/RG.2.1.2629.6084

2015 “Mathematical modeling of an ideal atomizing liquid jet.” Helix 2015 proceedings. DOI 10.13140/RG.2.1.5032.8162

2013 “On the collision rate of key conversion prior modulo for multiple hash tables of any size.” WSEAS Applications of Computer Engineering proceedings. Official record

Invited talks, contributed talks, and posters

2023	**Invited talk.** “Generalized Ideal Momentum Jet Model for Non-Circular Nozzle Geometries in Turbulent Pressure-Atomized Liquid Jets.” ICIAM 2023.
2023	**Conference contribution.** “The Ciliar Alignment Index for Multiciliated Epithelial Cells revisited.” Symomath 2023.
2021	**Conference presentation.** “Analytical model of the dynamics and entrainment of a turbulent atomized liquid jet with non-circular geometry.” ILASS-Americas 2021.
2020	**Conference presentation.** “Energy and momentum loss approaches to modeling a round turbulent atomized liquid jet.” ILASS-Asia 2020.
2019	**Invited talk.** “MTEC MCC Polar Cytoskeleton Self-organization Simulations.” JSPS mathematical-oncology annual meeting.
2018	**Conference presentation.** “MCC Polar Cytoskeleton Self-organization Simulations.” JSIAM annual meeting.
2018	**Conference presentation.** “Single Multi-ciliated Cell Apical Cytoskeleton Active-Hydrodynamic Model Simulation.” JSPS mathematical-oncology annual meeting.
2017	**Poster.** “Multiciliated Cells' Cytoskeleton Active Hydrodynamic Simulation with FreeFEM++.” JST-CREST Biodynamics conference. DOI 10.13140/RG.2.2.23422.02885
2017	**Conference presentation.** “Mathematical models for turbulent round jets based on ideal and lossy conservation.” ILASS-Europe 2017. DOI 10.4995/ILASS2017.2017.4778
2017	**Conference presentation.** “The ideal momentum turbulent round jet.” HeKKSaGOn Winter School.
2017	**Conference presentation.** “Application of the Lossy Energy Jet model to an atomizing liquid jet.” Japanese Society of Fluid Mechanics Western Branch meeting.
2016	**Conference presentation.** “Mathematical models of a turbulent atomized liquid jet through conservation of mass flux and power.” JSIAM annual meeting.
2016	**Conference presentation.** “Theoretical derivation of the gas entrainment rate coefficient from the ideal atomizing liquid jet model.” Physical Society of Japan annual spring meeting. DOI 10.11316/jpsgaiyo.71.1.0_3109

2016	**Conference presentation.** “Mathematical models for the dynamics of a round full-cone high-speed atomized liquid jet.” Water Jet Technology Society of Japan annual meeting. DOI 10.13140/RG.2.1.2629.6084
2016	**Poster.** “Theoretical derivation of the gas entrainment rate coefficient of an atomizing liquid jet.” Mathematics for Materials Science and Processing. DOI 10.13140/RG.2.1.2724.0723
2015	**Invited talk.** “Mathematical modeling of an ideal atomizing liquid jet.” Helix 2015.
2015	**Poster.** “Mathematical modeling of an ideal atomizing liquid jet.” Helix 2015. DOI 10.13140/RG.2.1.2094.4882

Theses, technical report, and preprint

2016	**Doctoral thesis.** *Dynamics of a full-cone atomizing liquid jet*. Kyushu University. DOI 10.15017/1785354
2013	**Master's thesis.** *Stability and Chaos in Real Polynomial Maps*. CIMAT. Official record
2006	**Undergraduate thesis.** *The Effect of Mass Segregation in Globular Clusters*. UABC / UNAM. DOI 10.13140/RG.2.1.2860.7527
2005	**Technical report.** *Noise analysis in automotive-use fans*. Industrial statistics. DOI 10.13140/RG.2.1.4957.9049
2017	**arXiv preprint.** Fermin Franco, Yasuhide Fukumoto. *Dynamical model of a turbulent round jet through conservation of mass flux and power*. Official record

Scientific software and computational workflows

- **Ideal Momentum Jet Explorer.** An interactive TypeScript application for a reduced-order ideal momentum jet model. React, TypeScript, browser-side computation, unit and visual checks. Designed for model exploration, teaching, and technical communication.
- **VisualOpenFOAM.** A Linux-first CLI for reproducible OpenFOAM and VTK scenes and field reports. Linux CLI, six JSON schemas, deterministic dry runs, synthetic fixtures, and 21 pytest checks. The implemented workflow uses explicit case and field contracts, deterministic plans, and synthetic reference fixtures for reproducible scientific visualization.
- **VisualBasilisk.** A bridge from compact Basilisk facet manifests to reproducible visualization plans. Python CLI, manifests, dry-run Blender plans, synthetic fixtures. Validates explicit facet manifests and reproducible render planning.
- **DualSPHysics / VisualsPhysics workflow.** A reproducible particle-simulation post-processing and scientific-media workflow. DualSPHysics outputs, VTK/IsoSurface processing, Blender, and ffmpeg. Focuses on reproducible post-processing and scientific visualization of solver outputs.

- **CIMAP.** An agrometeorological-index platform in the Ensenada regional research context. Python data processing and a software platform interface. Demonstrated as a reproducible pilot using partial real data.

Teaching and mentoring

- **University and professional teaching** (More than ten years). Undergraduate, graduate, and professional teaching in numerical methods, applied mathematics, physics, data science, project management, and bilingual or intercultural settings.
- **Supervision and applied-project support** (Including 2025). Supervision, co-supervision, research-project support, and conference or outreach preparation, including wine-region microclimate and physical-characterization projects.
- **Teaching Assistant, Fukuoka University** (April 2016–March 2017). Assisted Prof. Kenji Mishima with Physical Chemistry and Academic English classes for chemical-engineering students; supported classes and contributed physical-mathematical modeling to materials and nanoparticle-coating research.
- **Teaching Assistant, Kyushu University** (October 2014–September 2015). Assisted Prof. Yasuhide Fukumoto with Mathematics for Engineering and differential equations, primarily through preparation and grading with limited classroom assistance; did not hold responsibility for the lectures.

Selected courses at UABC

Numerical Methods. Undergraduate Applied Mathematics, Physics, and Computer Science; taught in Spanish in 2020-1, 2020-2, 2021-1, 2022-1, 2022-2, 2023-1, and 2023-2.

Deformable Media. Undergraduate Physics; taught in Spanish in 2022-1, 2022-2, 2023-1, 2023-2, 2024-1, and 2024-2.

Two credit-bearing student projects

From January to July 2025, I supervised applied projects at UABC with CEVIT-CETYS:

- Computer Science: analysis of microclimate data from a wine-growing region.
- Physics: physical characterization of Ensenada wine.

Science on university radio

From February 2021 to June 2023, I contributed to the production, design, and hosting of 22 Hablemos de Ciencias programs, co-produced by UABC Radio and the Faculty of Sciences.

Leadership

- **Northwest Regional Coordinator**, Mexican Association of Japan Alumni (AMEJ) (Reelected March 2025). Reelected Northwest Regional Coordinator after the 2023 election.
- **Vice President**, Association of Hispanic Professionals in Japan (Elected August 2017). Served as Vice President after the August 2017 election.
- **Coordinator**, Ensenada ATP Semiconductor Community (From February 2025). Regional community leadership connecting education, technology, and semiconductor-sector development.
- **Coordinator of Credit-Bearing Outreach Projects**, UABC Faculty of Sciences (September 2023–August 2025). Coordinated academic outreach projects carrying university credit.

- **Coordinator of Alternative Learning Modalities Committee**, UABC Faculty of Sciences (September 2023–August 2025). Coordinated work on alternative learning modalities.
- **Coordinator, Undergraduate Program in Applied Mathematics**, UABC (March–June 2023). Coordinated the undergraduate Applied Mathematics program.
- **Coordinator of Internationalization**, UABC Faculty of Sciences (March 2022–June 2023). Coordinated internationalization activities.
- **Applied Mathematics accreditation leadership**, UABC (October 2020–June 2023). Led and supported Applied Mathematics accreditation and reaccreditation, then collaborated on Computer Science and Physics reaccreditation.
- **Technical Advisory Council Member**, COTAPREP (March–June 2021). Served during Baja California's 2020–2021 local electoral process.
- **Northwest Regional Coordinator**, Mexican Association of Japan Alumni (AMEJ) (Elected March 2023). Elected Northwest Regional Coordinator.

Awards and funding

- **Excellent Poster Award** — JST-CREST Biodynamics research-group conference (November 2017).
- **Excellent Poster Award** — Math-for-Industry forum (October 2014).
- **MEXT doctoral scholarship** — Doctoral studies at Kyushu University (From April 2012).
- **Scandinavia-Japan Sasakawa Foundation research support** — Technical University of Denmark research stay (March 2017).
- **Competitive biomedical research support** — Mathematical methods and computational fluid dynamics for the mucociliary system (November 2020).

Official registrations and professional competency certifications

Baja California Judiciary auxiliary-expert registry. Registered auxiliary expert eligible for judicial appointment to provide specialized opinions in Mathematics, Computing and Forensic Informatics, and Japanese–Spanish Interpretation and Translation in support of judicial proceedings.

Mexican federal official occupational-competency certifications (SEP-CONOCER). Four certificates document independently assessed ability in general consulting, competency assessment, in-person group instruction, and entrepreneurship-project development.

- **EC0249** · Proporcionar servicios de consultoría general (2025)
- **EC0076** · Evaluación de la competencia de candidatos con base en estándares de competencia (2024)
- **EC0217.01** · Impartición de cursos de formación del capital humano de manera presencial grupal (2024)
- **EC1223** · Desarrollo de proyectos de emprendimiento (2026)

Languages and public profiles

Languages: Spanish · English · Japanese

Public profiles: GitHub · Google Scholar · Researchmap · ORCID · LinkedIn

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