Marcello Lanfranchi

Macquarie University, Sydney (NSW) · 2109, Australia · marcello.lanfranchi@mq.edu.au

PERSONAL INFORMATION

LAST NAME	Lanfranchi
FIRST NAME	Marcello
DATE OF BIRTH	Sept 14th, 1993
CITIZENSHIP	Italian
ADDRESS	Office no 719, 7th floor 12 Wally's Walk Macquarie University 2109, Sydney (NSW) Australia
EMAIL	marcello.lanfranchi@mq.edu.au
PHONE	(+61) 0447 356 907
WEBSITE	www.https://marcellolanfranchi.com

EDUCATION

POSTDOCTORAL RESEARCH FELLOW IN CATEGORY THEORY — 2025 - Current
MACQUARIE UNIVERSITY
SYDNEY, NSW AUSTRALIA

SUPERVISOR: Jean-Simon Pacaud Lemay

RESEARCH TOPICS: Categorical Foundations of Forward Differentiation and Reverse Differentiation

DESCRIPTION: The main objective of my research is to expand upon the theory of both forward differential categories and reverse differential categories. Overall, this research projection will continue pushing the field of categorical aspects of differentiation into new and exciting directions.

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PH.D. IN MATHEMATICS — 2020 - 2024
DALHOUSIE UNIVERSITY
HALIFAX, NS CANADA

SUPERVISOR: Dorette Pronk & Geoffrey Cruttwell

RESEARCH TOPICS: A tangent category approach to operadic geometry

DESCRIPTION: In my Ph.D. thesis, I characterize tangent categories generated by operads. These tangent categories can be regarded as the geometrical theory of affine schemes over the considered operad. To motivate this interpretation in the second part, we describe the relationship between operadic constructions, such as enveloping operads, modules over operadic algebras, or derivations, and tangent category constructions, like sliceability, differential bundles, or vector fields. We also analyze some important examples, like the case of Lie algebras and associative algebras, which could lead to a description of algebraic non-commutative geometry in terms of tangent category theory. The final sections are dedicated to deformations of operadic algebras and their relationships with the tangent category of tangent monads.

M.SC. IN MATHEMATICAL PHYSICS 2016 - 2018
UNIVERSITY OF PAVIA
PAVIA, ITALY

SUPERVISOR Claudio Dappiaggi
THESIS 110/110 cum laude
DEGREE An operadic approach to AQFT with an extension to non-globally hyperbolic spacetimes
DESCRIPTION The theory of (*-)coloured operads is applied to algebraic quantum field theory and employed to describe locally covariant quantum field theories. Defining an orthogonal structure on the category of hyperbolic spacetimes, the power of the operadic approach is exploited to build the category of AQFTs as algebras of a suitable operad. Using the independence from geometrical assumptions of the operadic construction, and harnessing its mathematical theory, a universal and natural extension for AQFTs from globally hyperbolic spacetimes to non-globally hyperbolic ones, is defined and studied in detail with a particular emphasis on Klein-Gordon AQFT.

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B.S. IN PHYSICS 2012 - 2015
UNIVERSITY OF PAVIA
PAVIA, ITALY

SUPERVISOR Claudio Dappiaggi
THESIS 103/110
DEGREE Algebraic approach and quantisation via deformation of C*-algebra
DESCRIPTION The algebraic approach to quantum mechanics is studied in detail. This approach, based on the GNS theorem, is in two steps: first, a suitable C*-algebra is chosen to be the mathematical structure for physical observables and, secondly, a suitable positive and normalized functional on the algebra is picked as the state of the system. The GNS theorem is proved and applied in the case of Weyl C*-algebra, defined by Weyl CCR relations. Deformation theory is investigated as a possible framework to study quantization. Specifically, the Moyal theory is discussed using the theory of $\star$-products.

PAPERS

* Ehresmann connections in tangent categories SUBMITTED

SUBMISSION DATE Jun 2026
JOURNAL Symmetry, Integrability, and Geometry: Methods and Applications
CO-AUTHORS Geoffrey Cruttwell

* Local categories: a new framework for partiality SUBMITTED

SUBMISSION DATE Dec 2025
JOURNAL Theoretical Computer Science
CO-AUTHORS Jean-Simon Pacaud Lemay

* The formal theory of tangentads PART II SUBMITTED

SUBMISSION DATE Dec 2025
JOURNAL Theory and Applications of Categories

* The formal theory of tangentads PART I — SUBMITTED

SUBMISSION DATE	Sep 2025
JOURNAL	Journal of Pure and Applied Algebra

* Tangentads: a formal approach to tangent categories — SUBMITTED

SUBMISSION DATE	Mar 2025
JOURNAL	Higher Structures

* Representable tangent structures for affine schemes — PUBLISHED

SUBMISSION DATE	May 2025
JOURNAL	Theory and Applications of Categories
CO-AUTHORS	Jean-Simon Pacaud Lemay

* Pullbacks in tangent categories and tangent display maps — SUBMITTED

SUBMISSION DATE	Feb 2025
JOURNAL	Applied Categorical Structures
CO-AUTHORS	Geoffrey Cruttwell

* The Grothendieck construction in the context of tangent categories — PUBLISHED

SUBMISSION DATE	Nov 2023
JOURNAL	Mathematical Structures in Computer Science

* The differential bundles of the geometric tangent category of an operad — PUBLISHED

SUBMISSION DATE	Oct 2023
JOURNAL	Applied Categorical Structures

* The Rosický Tangent Categories of Algebras over an Operad — PUBLISHED

SUBMISSION DATE	Mar 2023
JOURNAL	Higher Structures
CO-AUTHORS	Sacha Ikonicoff, Jean-Simon Pacaud Lemay

PRESENTATIONS AND TALKS

I have been the organizer of the Australian Category Seminar at Macquarie University from March 2025 to June 2026.

SEMINAR	PLACE	DATE	TITLE OF THE TALK
CT2026	Johns Hopkins University	July 2026	Local categories: a new approach to partiality
FMCS2026	St Francis Xavier University	June 2026	Local categories: a new approach to partiality
Diff Cats Workshop	Kyoto University	Apr 2026	The formal theory of tangentads
Seminar	Stellenbosch University	Mar 2026	Tangent categories: a minicourse
AustMS	La Trobe University	Dec 2025	Local categories
OctoberFest 2025	University of Ottawa	Oct 2025	Local categories
Algebra Seminar	University of Sydney	Aug 2025	Representable tangent structures for affine schemes
UNSW	UNSW	Aug 2025	Representable tangent structures for affine schemes
CT2025	Masaryk University	Jul 2025	The formal theory of vector fields for tangentads
FMCS2025	University of Ottawa	Jun 2025	Representable tangent structures for affine schemes
AusCat	Macquarie University	May 2025	Representable tangent structures for affine schemes
AusCat	Macquarie University	Mar 2025	The formal theory of tangent objects I
Octoberfest 2024	University of Ottawa	Oct 2024	Towards a formal theory of tangent objects
FMCS2024	University of Calgary	Jul 2024	Display systems are things of the past! Tangent display maps are the future!
CT2024	University of Santiago de Compostela	Jun 2024	The Grothendieck construction in the context of tangent categories
Logic Seminar	University of Ottawa	Apr 2024	The Grothendieck construction in the context of tangent categories
Graduate Seminar	University of Melbourne	Feb 2024	Algebraic deformation and tangent categories
ausCat	Macquarie University	Feb 2024	The differential bundles of operadic affine schemes
ausCat	Macquarie University	Feb 2024	The geometric tangent category of an operad
ATCAT	Dalhousie University	Oct 2023	The Grothendieck construction for tangent categories
CT2023	Université catholique de Louvain	Jul 2023	The Tangent Categories of Algebras over an Operad
FMCS2023	Mount Allison University	Jun 2023	Algebraic Deformation and tangent categories
ATCAT	Dalhousie University	Mar 2023	Algebraic Deformation & tangent categories
Peripatetic Seminar	Calgary University	Feb 2023	Tangent categories & tangent monads
Peripatetic Seminar	Calgary University	Feb 2023	Tangent structure for operadic algebras
FMCS2022	Kananaskis Field Station	Jun 2022	Operadic Tangent Categories
Peripatetic Seminar	Calgary University	Apr 2022	Operadic Tangent Categories
ATCAT	Dalhousie University	Mar 2022	Operadic Tangent Categories
ATCAT	Dalhousie University	Nov 2021	Non-Commutative Tangent Categories

ATTENDED SEMINARS

SEMINAR	PLACE	DATE
ATCAT	Dalhousie University	Fall - Winter 2023/2024
ATCAT	Dalhousie University	Fall - Winter 2022/2023
FMCS2022	Kananaskis Field Station	Jun 2022
ATCAT	Dalhousie University	Fall - Winter 2021/2022
ATCAT	Dalhousie University	Fall - Winter 2020/2021
FMCS2021	Banff Institute (BIRS)	Jun 2021
ACT2021	University of Cambridge	Jul 2021

AWARDS/GRANTS

∗ POSTDOCTORAL FELLOWSHIP AT MACQUARIE UNIVERSITY — Feb 2025

∗ AARMS DOCTORAL THESIS AWARD — Nov 2024

∗ COLLABORATIVE RESEARCH GROUP IN GROUPS, RINGS, LIE AND HOPF ALGEBRAS AWARD — Aug 2023

REFEREES

REFEREE — Jean-Simon Paucad Lemay
AFFILIATION — Macquarie University, Sydney (NSW) Australia
EMAIL ADDRESS — js.lemay@mq.edu.au

TEACHING EXPERIENCE

MULTIVARIABLE CALCULUS I (MATH 2001) — 2024
DALHOUSIE UNIVERSITY
HALIFAX, NS CANADA

DESCRIPTION Topics include a review of parametric equations, polar coordinates, conic sections, coordinate systems and vectors, dot product and cross product, vector functions, derivatives and integrals of vector functions, arc length and curvature, functions of several variables and partial derivatives, directional derivatives and double and triple integrals.

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MULTIVARIABLE CALCULUS I (MATH 2001) — 2023
DALHOUSIE UNIVERSITY
HALIFAX, NS CANADA

DESCRIPTION Topics include a review of parametric equations, polar coordinates, conic sections, coordinate systems and vectors, dot product and cross product, vector functions, derivatives and integrals of vector functions, arc length and curvature, functions of several variables and partial derivatives, directional derivatives and double and triple integrals.

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DIFFERENTIAL & INTEGRAL CALCULUS II (MATH 1010) — 2022
DALHOUSIE UNIVERSITY
HALIFAX, NS CANADA

DESCRIPTION A continuation of the study of calculus with topics including Riemann sums, techniques of integration, elementary differential equations and applications, parametric equations and polar coordinates, sequences and series, Taylor series.

WORKING EXPERIENCE

* TEACHING ASSISTANT Jan 2021 - current

Halifax, NS Canada
Dalhousie University
During my Ph.D., I work as a teaching assistant for Dalhousie University, with various duties: marking, managing online discussions, answering questions, managing tutorials and invigilating during exams.

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* TEACHER IN PHYSICS AND MATHEMATICS Nov 2019 - Jul 2020

Pavia, Italy
Studium s.r.l.
As a second job, I used to teach Physics (Structure of matter) and Mathematics (Operator and Distribution theory) to an undergraduate student in Physics, from the University of Pavia.

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* TEACHER IN C# PROGRAMMING Jan 2018 - Oct 2019

Milano, Italy
ICubed s.r.l.
I taught two courses in advanced programming in **C#**. The topics of the courses were: delegates, events, asynchronous code, attributes, unsafe code, garbage collectors and disposable objects.

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* BACKEND AND FRONTEND SOFTWARE DEVELOPER Jan 2018 - Oct 2019

Milano, Italy
ICubed s.r.l.
After an intensive course in programming, concerning the technologies used by ICubed in backend and frontend development, I was hired as an ASP .NET Core and Angular software developer. I worked on four different projects. In the first one, I developed the back-end part of a micro-service architecture, working with an English team, using the AGILE methodology.

COMPUTER SKILLS

PROFICIENT
LaTeX, ASP .NET (Core), C#, Mongodb, Entity Framework (Core), HTML, Git, Angular 7+

INTERMEDIATE
JavaScript, Python

BASIC
Scilab, C++

LINGUISTIC PROFICIENCY

* MOTHER TONGUE	Italian
* ENGLISH	Fluent (7 IELTS, C1)

Marcello Lanfranchi
28th July 2026

This document was written in LaTeX

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