

Margherita Maria Ferrari

Curriculum Vitae

Department of Mathematics and Statistics
University of South Florida
4202 E. Fowler Ave, CMC342, Tampa, FL 33620, US
✉ www.mmferrari.net

Research Interests

- Graph Theory (with applications to DNA self-assembly)
- Enumerative Combinatorics (permutations, partitions of integers, generating functions)
- Combinatorics on Words (with applications to DNA recombination and DNA:RNA interactions)

Education

- Jan 2017 **Ph.D. in Mathematical Models and Methods in Engineering**, Politecnico di Milano
Thesis: *Integer compositions and DNA self-assembly strategies: a combinatorial and a geometric approach*
Advisor: Norma Zagaglia, Professor
- Oct 2013 **M.S. cum laude in Mathematics**, Università degli studi di Modena e Reggio Emilia
Thesis: *Cayley graphs: complete rotations, spectrum and maximum cliques*
Advisor: Arrigo Bonisoli, Professor
Co-advisor: Mathieu Bogaerts, Ph.D. (Université libre de Bruxelles)
- Sep 2011 **B.S. cum laude in Mathematics**, Università degli studi di Modena e Reggio Emilia
Thesis: *Grafi 1-fattorizzabili: condizioni sufficienti (Sufficient conditions for the 1-factorization of graphs)*
Advisor: Arrigo Bonisoli, Professor

Academic Positions

- Jan 2019 - **Postdoctoral Scholar**, Southeast Center for Mathematics and Biology (SCMB) - an NSF-Simons Research Center for Mathematics of Complex Biological Systems
Project housed at the University of South Florida, Department of Mathematics and Statistics
Advisor: Nataša Jonoska, Distinguished Professor
- Nov 2017 - **Postdoctoral Scholar**, University of South Florida, Department of Mathematics and
Dec 2018 Statistics
Research group: Biomathematics Research Group
Advisor: Nataša Jonoska, Distinguished Professor and Masahiko Saito, Professor

Awards

- Grand Prize Travel Award - Postdoctoral Research Symposium, University of South Florida, 2021
- Postdoctoral Scholar Travel Award - University of South Florida, 2020
- Politecnico di Milano Ph.D. Scholarship, 2013 - 2016
- “Premio di Laurea” - Excellence in performance for the academic year 2012/2013 (master’s studies), Università degli studi di Modena e Reggio Emilia

“Premio di Studio” - Excellence in performance for the academic year 2011/2012 (master’s studies), Università degli studi di Modena e Reggio Emilia

“Fondo per il Sostegno dei Giovani” - 50% tuition fees reimbursement for the academic years 2011/2012 and 2012/2013 (master’s studies), Università degli studi di Modena e Reggio Emilia

Publications

14. H. Du, M.M. Ferrari, C. Heitsch, F. Hurley, C.V. Mennicke, B.D. Sullivan, B. Xu, Secondary structure ensemble analysis via community detection, in R. Segal, B. Shtylla, and S. Sindi, eds, *Using Mathematics to Understand Biological Complexity*, Association for Women in Mathematics Series **22** (Springer, Cham, 2021), pp. 55-81. DOI: 10.1007/978-3-030-57129-0_4
13. M.M. Ferrari, E. Munarini, N. Zagaglia Salvi, Some combinatorial properties of the generalized derangement numbers, *Rivista di Matematica della Università di Parma* **11**, 217-249 (2020).
12. D.A. Cruz, M.M. Ferrari, N. Jonoska, L. Nabergall, M. Saito, Insertions yielding equivalent double occurrence words, *Fundamenta Informaticae* **171**(1-4), 113-132 (2020). DOI: 10.3233/FI-2020-1875
11. S. Bonvicini, M.M. Ferrari, On the minimum number of bond-edge types and tile types: an approach by edge-colorings of graphs, *Discrete Applied Mathematics* **277**, 1-13 (2020). DOI: 10.1016/j.dam.2019.09.004
10. M.M. Ferrari, E. Munarini, Decomposition of some Hankel matrices generated by the generalized rencontres polynomials, *Linear Algebra and its Applications* **567**, 180-201 (2019). DOI: 110.1016/j.laa.2018.12.029
9. M.M. Ferrari, N. Zagaglia Salvi, Cyclic compositions and cycles of the hypercube, *Aequationes Mathematicae* **92**(4), 671-682 (2018). DOI: 10.1007/s00010-018-0554-7
8. M.M. Ferrari, A. Cook, A. Houlihan, R. Rouleau, N.C. Seeman, G. Pangborn, J. Ellis-Monaghan, Design formalism for DNA self-assembly of polyhedral skeletons using rigid tiles, *Journal of Mathematical Chemistry* **56**(5), 1365-1392 (2018). DOI: 10.1007/s10910-018-0858-9
7. S. Capparelli, M.M. Ferrari, E. Munarini, N. Zagaglia Salvi, A generalization of the “Problème des Rencontres”, *Journal of Integer Sequences* **21**, Article 18.2.8 (2018).
6. F. Beggas, M.M. Ferrari, N. Zagaglia Salvi, Combinatorial interpretations and enumeration of particular bijections, *Rivista di Matematica della Università di Parma* **8**, 161-169 (2017).
5. M.M. Ferrari, N. Zagaglia Salvi, Aperiodic compositions and classical integer sequences, *Journal of Integer Sequences* **20**, Article 17.8.8 (2017).
4. M.M. Ferrari, N. Zagaglia Salvi, Recent results on the adjacent vertex distinguishing chromatic index of the direct product of graphs, *Lecture Notes of Seminario Interdisciplinare di Matematica* **14**, 57-69 (2017).
3. M.M. Ferrari, N. Zagaglia Salvi, Minimal edge colorings of class 2 graphs and double graphs, *Le Matematiche* **71**(2), 17-25 (2016). DOI: 10.4418/2016.71.2.2
2. F. Beggas, M.M. Ferrari, H. Kheddouci, N. Zagaglia Salvi, On circular disarranged strings of sequences, *Advances and Applications in Discrete Mathematics* **17**(3), 275-292 (2016). DOI: 10.17654/DM017030275

1. G. Cesari, M.M. Ferrari, On the position value for special classes of networks, in L. Petrosyan and V. Mazalov, eds, *Recent Advances in Game Theory and Applications, Static & Dynamic Game Theory: Foundations & Applications* (Birkhäuser, Cham, 2016), pp. 29-47. DOI: 10.1007/978-3-319-43838-2_2

Publications in Progress

- S. Bonvicini, M.M. Ferrari, Dominating set bounds for self-assembling DNA complexes.
- T. Channagiri, M.M. Ferrari, N. Jonoska, Combinatorial methods for distinguishing next-generation sequencing libraries.
- L. Fajardo Gómez, M.M. Ferrari, N. Jonoska, M. Saito, Homology of directed graphs with application to DNA recombination.
- M.M. Ferrari, N. Jonoska, S. Poznanović, M. Riehl, M. Vazquez, Algebraic system modeling three-stranded DNA:RNA braids.
- M.M. Ferrari, N. Jonoska, Mathematical models for describing molecular self-assembly.
- Y. Jeon, M.M. Ferrari, T. Channagiri, N. Jonoska, F. Storici, Analysis of RNA-templated double-strand break repairs in mammalian cells.

Presentations

Invited One Hour Lectures

- Jun 2021 Mathematics Seminar, Aarhus University, DK, *online
Title: *Combinatorial insights into biomolecular interactions*
- Apr 2021 Algebra and Discrete Mathematics Seminar, Clemson University, US, *online
Title: *Graph clustering for RNA secondary structure analysis*
- Mar 2021 Department of Mathematics and Statistics, Texas A&M University - Corpus Christi, US, *online
Title: *Combinatorial questions arising from biomolecular processes*
- Mar 2021 Department of Mathematics and Statistics Colloquium, University of South Alabama, US, *online
Title: *Combinatorial questions arising from biomolecular processes*
- Mar 2021 Department of Mathematics, Kennesaw State University, US, *online
Title: *Combinatorial questions arising from biomolecular processes*
- Feb 2021 Mathematical Biology Seminar, University of California, Davis, US, *online
Title: *Insertions on double occurrence words motivated by DNA rearrangement*
- Jan 2021 Department of Mathematics and Statistics, Auburn University, US, *online
Title: *Graph-theoretical questions arising from biomolecular processes*
- May 2020 Discrete Mathematics Seminars, Università di Verona, IT, *online
Title: *Insertions on double occurrence words motivated by DNA rearrangement*
- Oct 2017 La Matematica che non ti aspetti (Unexpected Mathematics), Università degli studi di Modena e Reggio Emilia, IT
Conference cycle sponsored by “Piano Lauree Scientifiche”
Title: *Modelli matematici per nanostrutture di DNA (Mathematical models for DNA nanostructures)*

Other Invited Talks

- Jan 2022 Joint Mathematics Meetings, Seattle (WA), US
AWM Special Session “Women in Mathematical Biology”
Title: *Formal grammar modeling three-stranded DNA:RNA braids*
- Nov 2021 Fall Southeastern Sectional Meeting, University of South Alabama, Mobile, US, *online
AMS Special Session “Algebra, Combinatorics, and Topology in Biological Structures”
Title: *Formal grammar modeling three-stranded DNA:RNA braids*
- Nov 2021 Fall Southeastern Sectional Meeting, University of South Alabama, Mobile, US
AMS Special Session “Enumerative Combinatorics”
*Special session canceled due to COVID-19
- Sep 2021 Postdoctoral Research Symposium, University of South Florida, US, *online
Title: *Designing DNA nanostructures* (5-minutes research “lightning” talk)
- Jun 2021 8th European Congress of Mathematics, Portorož, SI, *online
Mini-symposium “Graphs, Polynomials, Surfaces, and Knots”
Title: *Formal grammar modeling three-stranded DNA:RNA braids*
- Jun 2021 SMB Annual Meeting, University of California, Riverside, US, *online
Mini-symposium “Algebra, Combinatorics, and Topology in Modern Biology”
Title: *Formal grammar modeling three-stranded DNA:RNA braids*
- Jan 2021 Joint Mathematics Meetings, Washington (DC), US, *online
AMS Special Session “Topology, Structure and Symmetry in Graph Theory”
Title: *Homology of directed graphs with application to DNA recombination*
- Dec 2020 3rd SCMB Annual Symposium, Georgia Institute of Technology, US, *online
Joint talk with biology Ph.D. student Youngkyu Jeon
Title: *Discrete models for understanding mechanisms of RNA-mediated DNA break repair*
- Jun 2020 SIAM Conference on the Life Sciences, Garden Grove (CA), US
Mini-symposium “Algebra, Combinatorics, and Topology in Biological Structures”
Title: *Modelling RNA-DNA interaction*
*Mini-symposium canceled due to COVID-19
- Nov 2019 Fall Southeastern Sectional Meeting, University of Florida, US
AMS Special Session “Crystallographic and Highly Symmetric Structures”
Title: *Mathematical models for describing molecular self-assembly*
- Oct 2019 International Symposium on Biomathematics and Ecology Education and Research, University of Wisconsin - La Crosse, US
Special Session “Discrete, Algebraic, and Topological Methods in Mathematical Biology”
Title: *Mathematical models for describing molecular self-assembly*
- Jan 2019 Joint Mathematics Meetings, Baltimore (MD), US
AMS Special Session “Topology, Structure and Symmetry in Graph Theory”
Title: *Mathematical models for describing molecular self-assembly*
- Jan 2017 Trends in Graph Theory and Combinatorics 2017, Politecnico di Milano, IT
Title: *Formalism and design strategies for DNA tile assembly*

Contributed Talks

- May 2019 31st Cumberland Conference on Combinatorics, Graph Theory and Computing, University of Central Florida, US
Title: *Insertions yielding equivalent double occurrence words*

- Feb 2019 Florida Women in Mathematics Day, Florida Atlantic University, US
Title: *Insertions yielding equivalent double occurrence words*
- Jun 2018 Combinatorics 2018, Arco, IT
Title: *Mathematical models for describing molecular self-assembly*
- Apr 2018 2018 Zassenhaus Group and Friends Conference, University of South Florida, US
Title: *Mathematical models for describing molecular self-assembly*
- Feb 2018 Discrete Mathematics Seminar, University of South Florida, US
Title: *Design strategies for DNA tile assembly*
- Jul 2015 25th British Combinatorial Conference, University of Warwick, UK
Title: *On the partition graph of a positive integer*
- May 2015 Chromatic and Colored Structures in Geometry and Statistical Physics, Cortona, IT
Title: *Minimal edge coloring of class 2 graphs and double graphs*

Poster Presentations

- Feb 2020 2nd SCMB Annual Symposium, Georgia Institute of Technology, US
Title: *R-loops role in RNA-templated DNA repair*
- Nov 2019 USF Genomics Annual Symposium, University of South Florida, US
Title: *R-loops role in RNA-templated DNA repair*

Teaching Experience

University of South Florida

- *MAC 2282 - Engineering Calculus II*
Instructor (Fall 2021)
- *MAS 3105 - Linear Algebra* (hybrid class)
Instructor (Fall 2020)
- *MAC 2281 - Engineering Calculus I* (coordinated class)
Instructor (Fall 2019)

Università di Verona

- *Combinatorial Strategies for Modern Biology* (online class, delivered in English)
Instructor (Spring 2021, canceled due to COVID-19 in Spring 2020)
Invited to deliver a mini-course for master's degree program on combinatorial tools to address mathematical problems motivated by biological and chemical processes.

Politecnico di Milano

- *Geometria e Algebra Lineare (Geometry and Linear Algebra)*
Exercise sessions (Fall 2016, Fall 2015, Spring 2015, Spring 2014)
- *Discrete Mathematics* (course delivered in English)
Exercise sessions (Fall 2016, Fall 2015, Fall 2014)

Università degli studi di Modena e Reggio Emilia

- *Precorso di Matematica (Introductory Course of Mathematics)*
Instructor (Fall 2017)
- *Geometria/Algebra Lineare (Geometry/Linear Algebra)*
Tutor (Fall 2012)

Pedagogical Training

- Academy for Teaching and Learning Excellence - Professional Development Distinction, University of South Florida (A.Y. 2020/2021, 2019/2020)
- *The Inclusive STEM Teaching Project* by BUx (2021)
Topics: DEI in Higher Education, Instructor Identity, Student Identity, Course Design, Classroom Climate

Advising Experience

- Working with students on one-on-one basis for studying DNA recombination in ciliates
 - Lina Fajardo Gómez (Ph.D. student), University of South Florida, 2018-
 - Devon Conant (undergraduate student), University of South Florida, 2020-2021
 - Daniel A. Cruz (Ph.D. student), University of South Florida, 2018
 - Lukas Nabergall (master's student), University of Waterloo, 2018
- Working with students on one-on-one basis for studying double-strand break repairs
 - Tejasvi Channagiri (master's student), University of South Florida, 2021-
- Mentor for research experience in mathematical biology
 - Shrikar Modukuri (high school student), Summer 2020
 - Anna Cook (undergraduate student), Saint Michael's College, Summer 2016, REU project on DNA self-assembly
 - Alana Houlihan (undergraduate student), Saint Michael's College, Summer 2016, REU project on DNA self-assembly
 - Rebecca Rouleau (undergraduate student), Saint Michael's College, Summer 2016, REU project on DNA self-assembly
- Other supervising experience
 - Olta Tarko, University of South Florida, Spring 2020. Co-advisor for Engineering Calculus II project.

Computer Skills

GitHub <https://github.com/mmferrari>

Programming Languages Python, Java, C++, MATLAB, PHP, Turbo Pascal

Teaching Environments Canvas, WebAssign, Gradescope, MathMatize

Drawing Editors IPE, AutoCAD, Xfig, Inkscape, GIMP

Video Editing OBS, OpenShot Video Editor

Other \LaTeX , Git, HTML, Cabri, GeoGebra

Grants

2019 Travel Grant - 31st Cumberland Conference on Combinatorics, Graph Theory and Computing

2019 Travel Grant - FWIMD, Florida Women in Mathematics Day

2019 Travel Grant - 1st SCMB Annual Symposium

2018 Travel Grant - SUMTOPO 2018, 33rd Summer Conference on Topology and its Applications

Professional Engagement

Research and Outreach Projects

- Activity Organizer, *SCMB Undergraduate Workshop*, 5-9 August 2019, Georgia Institute of Technology, US
Designed hands-on activities (with two colleagues) to show the intersection between mathematics and molecular origami. Led lectures and interactive problem sessions targeted at biology and mathematics undergraduate students.
- Research Project Member, *Collaborative Workshop for Women in Mathematical Biology*, Institute for Pure and Applied Mathematics, US (2019)
Research project *Discrete Mathematical Biology: New Approaches to Ensemble Analysis* coordinated by Christine Heitsch, Professor and Blair Sullivan, Associate Professor.
- Research Project Member, Saint Michael's College, US (2016)
REU project coordinated by Joanna Ellis-Monaghan, Professor and Greta Pangborn, Associate Professor to investigate design strategies for self-assembly and related topics. Led a research group and delivered a preliminary course in graph theory.
- Research Project Member, Politecnico di Milano, IT (2013 - 2017)
Research project *Strutture Geometriche, Combinatoria e loro Applicazioni (Geometric Structures, Combinatorics and Applications)* - PRIN 2012 coordinated by Norma Zagaglia, Professor.

Professional Development Workshops

- *SMB Workshop on Diversity, Equity and Inclusion* (2021) *online
The goal of the workshop is to promote discussion for building a welcoming and inclusive environment within the scientific community.
- *SMB Education & REU Workshop* (2021) *online
The goal of the workshop is to facilitate the exchange of experiences on education, diversity and research. The workshop also aims at providing background information about organizing REUs.
- *NSF AGEP Research University Alliance - Faculty Job Search Bootcamp* (2021) *online
Accepted to attend this series of workshops aimed at supporting graduate students and postdocs from underrepresented groups who are pursuing academic careers.

Professional Development Courses

- *Data Science* by HarvardX (in progress)
Topics: R Basics, Visualization, Probability, Inference and Modeling, Productivity Tools, Wrangling, Linear Regression, Machine Learning, Capstone
- *The Postdoc Academy: Building Skills for a Successful Career* by BUx (2021)
Topics: Leadership, Building and Supervising a Team, Project Management, Applying Teaching Skills Beyond the Classroom, Strategic Communications, Preparing Job Application Materials

Invited Workshop Participation

- BIRS workshop on *Novel Mathematical Methods in Material Science: Applications to Biomaterials*, Banff, CA (2021) *online

Professional Service

Conferences Organized

- Co-organizer, *26th International Conference on Developments in Language Theory (DLT 2022)*, 9-13 May 2022, University of South Florida, US
- Co-organizer, AMS Special Session “*Mathematical Models for Biomolecular and Cellular Interactions*”, Joint Mathematics Meetings, 5-8 January 2022, Seattle (WA), US
- Co-organizer, Mini-symposium “*Algebra, Combinatorics, and Topology in Modern, Biology*”, SMB Annual Meeting, 13-17 June 2021, University of California, Riverside, US, *online

- Co-organizer, *24th International Conference on Developments in Language Theory (DLT 2020)*, 11-15 May 2020, University of South Florida, US, *canceled due to COVID-19
- Co-organizer, *Trends in Graph Theory and Combinatorics 2017*, 26-27 January 2017, Politecnico di Milano, IT

Workshops Organized

- Co-organizer, *2022 SCMB Workshop on Discrete and Topological Models in Molecular Biology (DTMB 2022)*, 9-13 May 2022, University of South Florida, US
- Co-organizer, *2020 SCMB Workshop on Discrete and Topological Models in Molecular Biology (DTMB 2020)*, 10-13 May 2020, University of South Florida, US, *canceled due to COVID-19

Community Service

- *SMB Annual Meeting*, University of California, Riverside, US (2021) *online
Judged contributed talks in the “Methods for Biological Modeling” section.
- *Annual Graduate Student Research Symposium*, University of South Florida, US (2021) *online
Judged poster presentations in the “Physical Life Sciences and Mathematics” session.

Reviewer

- Fundamenta Informaticae
- Journal of Algebra Combinatorics Discrete Structures and Applications
- International Conference on DNA Computing and Molecular Programming (DNA 26)
- International Conference on Developments in Language Theory (DLT 2020)
- International Conference on Algebraic Informatics (AIC 2019)
- Mathematical Reviews
- zbMATH Open

Language Skills

Italian Mother Tongue

English Fluent

Active Memberships

AMS American Mathematical Society

AWM Association for Women in Mathematics

MAA Mathematical Association of America

NAM National Association of Mathematicians

SIAM Society for Industrial and Applied Mathematics

SMB Society for Mathematical Biology