

# Margherita Maria Ferrari

## Curriculum Vitae

Department of Mathematics and Statistics  
University of South Florida  
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### 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

### 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.
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).

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).
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).
9. M.M. Ferrari, N. Zagaglia Salvi, Cyclic compositions and cycles of the hypercube, *Aequationes Mathematicae* **92**(4), 671-682 (2018).
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).
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).
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).
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.

## Publications in Progress

M.M. Ferrari, N. Jonoska, Mathematical models for describing molecular self-assembly.

S. Bonvicini, M.M. Ferrari, Dominating set bounds for self-assembling DNA complexes.

L. Fajardo Gómez, M.M. Ferrari, N. Jonoska, M. Saito, Homology of directed graphs with application to DNA recombination.

## Invited Talks

Jun 2021 Mathematics Seminar, Aarhus University, DK, \*virtual due to COVID-19  
Title: *Combinatorial insights into biomolecular interactions*

Apr 2021 Algebra and Discrete Mathematics Seminar, Clemson University, US, \*virtual due to COVID-19  
Title: *Graph clustering for RNA secondary structure analysis*

- Mar 2021 Department of Mathematics and Statistics, Texas A&M University - Corpus Christi, US, \*virtual due to COVID-19  
Title: *Combinatorial questions arising from biomolecular processes*
- Mar 2021 Department of Mathematics and Statistics Colloquium, University of South Alabama, US, \*virtual due to COVID-19  
Title: *Combinatorial questions arising from biomolecular processes*
- Mar 2021 Department of Mathematics, Kennesaw State University, US, \*virtual due to COVID-19  
Title: *Combinatorial questions arising from biomolecular processes*
- Feb 2021 Mathematical Biology Seminar, University of California, Davis, US, \*virtual due to COVID-19  
Title: *Insertions on double occurrence words motivated by DNA rearrangement*
- Jan 2021 Department of Mathematics and Statistics, Auburn University, US, \*virtual due to COVID-19  
Title: *Graph-theoretical questions arising from biomolecular processes*
- Jan 2021 Virtual Joint Mathematics Meetings 2021  
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, \*virtual due to COVID-19  
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, \*cancelled due to COVID-19  
Mini-symposium “Algebra, Combinatorics, and Topology in Biological Structures”  
Title: *Modelling RNA-DNA interaction*
- May 2020 Discrete Mathematics Seminars, Università di Verona, IT, \*virtual due to COVID-19  
Title: *Insertions on double occurrence words motivated by DNA rearrangement*
- 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 2019, Baltimore (MD), US  
AMS Special Session “Topology, Structure and Symmetry in Graph Theory”  
Title: *Mathematical models for describing molecular self-assembly*
- Oct 2017 La Matematica che non ti aspetti 2017 (Unexpected Mathematics 2017), Università degli studi di Modena e Reggio Emilia, IT  
Conference cycle sponsored by “Progetto Lauree Scientifiche”  
Title: *Modelli matematici per nanostrutture di DNA (Mathematical models for DNA nanostructures)*
- Jan 2017 Trends in Graph Theory and Combinatorics 2017, Politecnico di Milano, IT  
Title: *Formalism and design strategies for DNA tile assembly*

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## 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*

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## 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*

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## Teaching Experience

### University of South Florida

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

### Università di Verona

- *Combinatorial Strategies for Modern Biology*  
Instructor (Spring 2021, cancelled due to COVID-19 in 2020)  
Invited to deliver an online 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)

## Teaching Credentials

- Academy for Teaching and Learning Excellence - Professional Development Distinction, University of South Florida (2021, 2020)

## Student Supervision

- Shrikar Modukuri (high school student), Summer 2020. Mentor for research experience in mathematical biology.
- Olta Tarko, Spring 2020, University of South Florida. Co-advisor for Engineering Calculus II project.

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## Grants and Awards

- 2020 Postdoctoral Scholar Travel Award, University of South Florida
- 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
- 2013 - 2016 Scholarship (Ph.D.), Politecnico di Milano
- 2011 - 2013 Awards - 50% tuition fees reimbursement for the academic years 2011/2012 and 2012/2013 (master's studies), Università degli studi di Modena e Reggio Emilia
- 2011 - 2013 Awards - Excellence in performance for the academic years 2011/2012 and 2012/2013 (master's studies), Università degli studi di Modena e Reggio Emilia

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## Professional Engagement and Service

### Conferences Organized

- Co-organizer, AMS Special Session “*Mathematical Models for Biomolecular and Cellular Interactions*”, Joint Mathematics Meetings 2022, 5-8 January 2022, Seattle (WA), US
- Co-organizer, Mini-symposium “*Algebra, Combinatorics, and Topology in Modern Biology*”, Virtual SMB 2021 Annual Meeting, 13-17 June 2021
- Co-organizer, *24th International Conference on Developments in Language Theory (DLT 2020)*, 11-15 May 2020, University of South Florida, US, \*cancelled 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, *2020 SCMB Workshop on Discrete and Topological Models in Molecular Biology (DTMB 2020)*, 10-13 May 2020, University of South Florida, US, \*cancelled due to COVID-19
- Activity organizer, *SCMB Undergraduate Workshop on Molecular Origami*, Georgia Institute of Technology, US (2019)  
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.

## Professional Development Workshops

- *SMB Workshop on Diversity, Equity and Inclusion* (2021) \*virtual due to COVID-19  
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) \*virtual due to COVID-19  
The goal of the workshop is to facilitate the exchange of experiences on education, diversity and research. The workshop also aims to provide background information about organizing REUs.
- *NSF AGEP Research University Alliance - Faculty Job Search Bootcamp* (2021) \*virtual due to COVID-19  
Accepted to attend this series of workshops aimed at providing professional development opportunities for underrepresented groups in academia.

## Professional Development Courses

- *Data Science* by HarvardX  
Topics: R Basics, Visualization, Probability, Inference and Modeling, Productivity Tools, Wrangling, Linear Regression

## Research Projects

- 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.

## Community Service

- *2021 Graduate and Professional Research Symposium*, University of South Florida, US (2021)  
Judged posters and 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*

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## Language Skills

Italian Mother Tongue

English Fluent

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## 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

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## Active Memberships

AMS American Mathematical Society

AWM Association for Women in Mathematics

SIAM Society for Industrial and Applied Mathematics

SMB Society for Mathematical Biology