

Chiara Sorgentone

Curriculum Vitae

Education

- 14/01/2015 **Ph.D. in Applied Mathematics**, *“La Sapienza”*, Rome, Italy
Title: Energy, enstrophy and symmetry preserving schemes for the numerical integration of non-linear advective problems
Supervisor: Prof. Bernardo Favini
Internal Prof. Maurizio Falcone
advisor:
- 28/03/2011 **Master’s Degree in Applied Mathematics**, *“La Sapienza”*, Rome, Italy, (joint work with CNR Roma Tor Vergata)
Title: Lagrangian Model for pollutant dispersion
Supervisors: Prof. C. Mascia and Dott. R. Sozzi (ARPALAZIO)
Final grade: 110/110 cum laude
- 2008-2009 **Erasmus Experience**, *Queen Mary University of London, School of Mathematical Sciences*, UK
- 29/10/2008 **Bachelor’s degree in Mathematics**, *“La Sapienza”*, Rome, Italy, (joint work with Roma Tre University)
Title: Cut Elimination Theorem
Supervisors: Prof. C. Bernardi and Prof. L. Tortora De Falco
Final grade: 110/110

Experience

- 01/09/2021 - **Fixed-term assistant professor in numerical analysis (RTDa)**, *Department of Basic and Applied Sciences for Engineering, La Sapienza*, Rome, Italy
ongoing
- 01/09/2020 - **SAPIexcellence Research Fellowship**, *Department of Basic and Applied Sciences for Engineering, La Sapienza*, Rome, Italy
31/08/2021
- 01/02/2019 - **Researcher**, *KTH Royal Institute of Technology*, Stockholm, Sweden
31/12/2019
- 01/03/2017 - **Dahlquist Research Fellowship**, *KTH Royal Institute of Technology*, Stockholm, Sweden
31/01/2019
Fellowship financed by Comsol AB and KTH.
<https://www.kth.se/en/sci/the-dahlquist-resear/the-dahlquist-research-fellowship-1.856773>

- 01/02/2015 - **Postdoc position**, *KTH Royal Institute of Technology*, Stockholm, Sweden
 28/02/2017 Postdoc position on a Research Project funded by the Knut and Alice Wallenberg Foundation in Applied and Computational Mathematics on 'An integral equation method for 3D surfactant-covered drops', Supervisor: Prof. Anna-Karin Tornberg.
<https://www.youtube.com/watch?v=ciddKOcUZss&feature=youtu.be> (my project from 5.43)
<https://kaw.wallenberg.org/forskning/matematik-som-simulerar-mikrofloden>
- 2011 **Scholarship at CNR ISAC Institute**, *Institute of Atmospheric Sciences and Climate*, Consiglio Nazionale delle Ricerche, Tor Vergata, Italy
 Study of micrometeorology and pollutants dispersions in Civitavecchia harbor

Languages

Italian	Native
English	Proficient
French	Beginner
Swedish	Beginner

Interruptions

- Parental Leave 01/08/2017 - 02/02/2018 (1st child); 01/07/2019 - 29/03/2020 (2nd child)
- Sick Leave 30/04/2019 - 15/06/2019.

Prizes and grants

- 2021 **"Progetti di Ateneo": Research Project funded by La Sapienza University of Rome for Medium Projects (participant)**, *"Wavelets, frames e basi multiscala. Nuove costruzioni, sviluppi e applicazioni nell'analisi numerica, nella probabilità e nella statistica."*, PI: Prof. Claudio Durastanti
- 2021 **"Progetti di Ateneo": Sapienza Starting Grant (PI)**, *(progetti di avvio alla ricerca, tipo 2)*, La Sapienza University of Rome, "Novel numerical methods for drop electrohydrodynamics"
- 2020 **1st classified at SAPIExcellence 2020 (PI)**, *SAPIExcellence is an initiative promoted by Sapienza University of Rome to attract the best and most promising researchers, encouraging them to participate in the Marie Skłodowska-Curie (MSCA) and ERC programmes*
- 2018 **Seal of Excellence (PI)**, *Certificate delivered by the European Commission, as the institution managing Horizon 2020, the EU Framework Programme for Research and Innovation 2014-2020*
 The project proposal 841876, BOUNDARIES, submitted under the Horizon 2020's Marie Skłodowska-Curie actions call H2020-MSCA-IF-2018 of 12 September 2018 by Chiara Sorgentone following evaluation by an international panel of independent experts was scored as a high-quality project proposal in a highly competitive evaluation process.
- 2017 **Dahlquist Research Fellowship (PI)**, *The fellowship is awarded every two years to a young promising numerical analyst to pursue her or his own research interests*
- 2013 **"Progetti di Ateneo": Research Project funded by La Sapienza University of Rome for Medium and Small Projects (participant)**, *Analisi ed approssimazione di problemi differenziali non lineari ed applicazioni*, PI: Prof. Elisabetta Carlini

Publications

- **Tandem droplet locomotion in a uniform electric field**
Chiara Sorigentone, Petia Vlahovska, Journal of Fluid Mechanics (JFM Rapids), 951, R2. (2022)
- **Approximation of the Riesz–Caputo derivative by cubic splines**
Francesca Pitolli, Chiara Sorigentone, Enza Pellegrino, Algorithms 15, 69 (2022)
- **Quadrature error estimates for layer potentials evaluated near curved surfaces in three dimensions**
Ludvig af Klinteberg, Chiara Sorigentone, Anna-Karin Tornberg, Computers and Mathematics with Applications 111, 1-19 (2022)
- **Pairwise interactions of surfactant-covered drops in a uniform electric field;**
Chiara Sorigentone, Petia Vlahovska. Physical Review Fluids 6, 053601 (2021)
- **Numerical and asymptotic analysis of the three-dimensional electrohydrodynamic interactions of drop pairs;**
Chiara Sorigentone, Jeremy I. Kach, Aditya S. Khair, Lynn M. Walker, Petia Vlahovska. Journal of Fluid Mechanics, vol. 914, A24, Special JFM volume in celebration of the George K. Batchelor centenary (2021)
- **A 3D boundary integral method for the electrohydrodynamics of surfactant-covered drops**
Chiara Sorigentone, Anna-Karin Tornberg, Petia Vlahovska, Journal of Computational Physics 389, p. 111-127 (2019)
- **Numerical simulation of 3D surfactant-covered drops in a strong electric field**
Chiara Sorigentone, Anna-Karin Tornberg, Rend. Sem. Mat. Univ. Politec. Torino, NuMA 2018. Turin, September 19-21, 2018 Vol. 76, 2 (2018)
- **A highly accurate boundary integral equation method for surfactant-laden drops in 3D**
Chiara Sorigentone, Anna-Karin Tornberg, Journal of Computational Physics 360, p. 167-191 (2018)
- **Adaptive time-stepping for surfactant-laden drops**
Sara Palsson, Chiara Sorigentone, Anna-Karin Tornberg, D.J. Chappel (Ed.), on Boundary Integral Method (UKBIM11), Nottingham Trent University: Publications, Nottingham, pages 161 - 170, (2017)
- **A systematic method to construct mimetic finite-difference schemes for incompressible flows**
Chiara Sorigentone, Bernardo Favini, International Journal of Numerical Analysis & Modeling (IJNAM) 14(3), p.419-436 (2017)
- **A New High Order Energy and Enstrophy Conserving Arakawa-like Jacobian Differential Operator**
Chiara Sorigentone, Cristina La Cognata, Jan Nordström, Journal of Computational Physics 301, p.167-177 (2015)

PhD Thesis

- **Energy, enstrophy and symmetry preserving schemes for the numerical integration of non-linear advective problems**
Chiara Sorigentone, PhD Thesis (2015)
<http://www1.mat.uniroma1.it/ricerca/dottorato/TESI/ARCHIVIO/sorigentonechiara.pdf>

Talks and Posters

- 21st September 2022 Contributed talk, **Layer potentials near surfaces with spherical topology**, SMART 2022, Rimini, Italy
- 12th July 2021 Invited speaker, **Quadrature error estimates for layer potentials near curved surfaces**, ICOSAHOM 2021 (Zoom), Vienna, Austria
- 20th November 2020 Invited speaker, **Electrohydrodynamic interactions of surfactant-covered drop pairs**, Fluid Dynamics Group Seminars (Zoom), Department of Mathematics, Imperial College London, London, UK
- 6th November 2020 Invited speaker, **Pairwise interaction of surfactant-covered drops: numerical simulations**, Talk for Ciclo di seminari per il Dipartimento di Scienze di Base e Applicate per l'Ingegneria, La Sapienza, Roma, Italy
- 16th June 2020 Invited speaker, **Simulation of 3D drops in uniform and quadrupole electric fields using a highly accurate boundary integral method**, Ciclo di seminari di modellistica differenziale numerica (Zoom), Dipartimento di Matematica, La Sapienza, Roma, Italy
- 28th February 2019 Invited speaker, **Numerical Simulations of 3D Surfactant-covered Drop Electrohydrodynamics**, SIAM Conference on Computational Science and Engineering, Spokane, USA
- 10th January 2019 Invited speaker, **Simulation of 3D drops in uniform and quadrupole electric fields using a highly accurate boundary integral method**, FLOW Annual Meeting 2019, Stockholm, Sweden
- 10th October 2018 Contributed talk, **Drop electrohydrodynamics**, Scientific Computing in Sweden, Lund, Sweden
- 19th September 2018 Contributed talk, **Simulation of 3D drop electrohydrodynamics using a highly accurate boundary integral method**, NUMA 2018, International Workshop on Numerical Mathematics and its Applications, Torino, Italy
- 10th July 2018 Invited speaker, **A Highly Accurate Boundary Integral Equation Method for Simulating Surfactant-Covered Drops in 3D**, ICOSAHOM International Conference on Spectral and High Order Methods, London, UK
- 4th July 2018 Invited speaker, **A Boundary Integral Equation Method for Surfactant-Covered Drop Electrohydrodynamics**, SIMAI 2018 Congress of the Italian Society of Applied and Industrial Mathematics, Rome, Italy
- 19th June 2017 Invited speaker, **Numerical simulation of 3D surfactant-covered drops based on integral equations**, X-DMS 2017 Extended Discretization Methods for partial differential equations on complex and evolving domains (ECCOMAS), Umea, Sweden
- 1st June 2017 Invited speaker, **A highly accurate boundary integral equation method for 3D surfactant-covered drops**, Numerical methods for PDEs and their application, Institut Mittag-Leffler, Stockholm, Sweden
- 27th February 2017 Invited speaker, **An integral equation method for 3D surfactant-covered drops**, SIAM Conference on Computational Science and Engineering, Atlanta, USA
- 19th October 2016 Contributed talk, **An integral equation method for simulating 3D drops with insoluble surfactant**, Scientific Computing in Sweden, Uppsala, Sweden
- 12th April 2016 Invited speaker, **A high order discretization method based on integral equations for simulating 3D deformable drops**, Department of Mathematics, "La Sapienza" University of Rome

- 14th September 2015 Contributed talk, **An integral equation method based on discretization of deformable drops by spherical harmonics**, ENUMATH 2015, Ankara, Turkey
- 18th March 2015 Contributed talk, **A New High Order Energy and Enstrophy Conserving Arakawa-like Jacobian Differential Operator**, European Conference on High Order Nonlinear Numerical Methods for Evolutionary PDEs: Theory and Applications (HONOM 2015), Trento, Italy
- 16th December 2014 Invited speaker, **Mimetic methods for non-linear advective problems**, "La Sapienza" University of Rome.
- 7th April 2014 Contributed talk, **Generalization of Arakawa's Jacobian**, Workshop on Partial Differential Equations on the Sphere (PDEs), NCAR (National Centre for Atmospheric Research, Boulder (CO), USA)
- 24-28 March 2014 **Generalization of Arakawa's Jacobian**, Poster presented at ECMWF, Reading, England
- 28th May 2013 Invited speaker, **Numerical Simulation of quasi-geostrophic turbulence**, "La Sapienza" University of Rome.

Administration and scientific responsibilities

○ Organization of scientific events

- 28/02/2019 Organizer with Lukas Bystricky of the Minisymposium *Boundary Integral Methods for Particulate Flows* at SIAM CSE 2019
- 11/01/2019 Co-organizer of the one-day-workshop at KTH Royal Institute of Technology, meeting with the numerical analysis group of Bergen, talks and poster session
- 10-11/01/2019 Co-organizer of the FLOW Annual Meeting at Skogshem Wijk, Hustegavägen 1, Lidingo, Stockholm

○ Referee activity

- BIT Numerical Mathematics
- Journal of Computational Physics
- Mathematics and Computers in Simulation
- Mathematics, MDPI
- Fractal and Fractional, MDPI
- AMS American Mathematical Society

○ Projects

- Feb 2015 - Involved in the Linné FLOW Centre (<http://www.flow.kth.se/>) activities within the Dec 2019 focus area Micro and Complex flows; from March 2018 part of the Management Group.
- Mar 2018 - Part of the Management Group for the Linné FLOW Centre Dec 2019 (<https://www.flow.kth.se/about-flow/management-group-1.763365>).
- Nov 2022 - PCTO (Educational guidance for high schools): "Mathematical models and numerical Apr 2023 methods to simulate population interactions"; Sapienza University of Rome

Teaching

- AY 2022-2023 *Numerical Methods for boundary integral equations*, PhD course, "La Sapienza" University of Rome

- AY *Analisi Numerica (Numerical Analysis)*, Department of Electrical Engineering, "La Sapienza" University of Rome
2022-2023
- AY *Calcolo Numerico (Numerical Analysis)*, Department of Mechanical Engineering, "La Sapienza" University of Rome
2022-2023
- AY *Analisi Numerica (Numerical Analysis)*, Department of Electrical Engineering, "La Sapienza" University of Rome
2021-2022
- AY *Calcolo Numerico (Numerical Analysis)*, Department of Mechanical Engineering, "La Sapienza" University of Rome
2021-2022
- AY *Analisi e Calcolo Numerico (Numerical Analysis)*, Department of Energy Engineering, "La Sapienza" University of Rome - (Teaching Assistant)
2020-2021
- AY *Applied Numerical Methods*, Advanced course for Master and PhD students, KTH Royal Institute of Technology - (Teaching Assistant)
2018-2019
- AY *Precorsi di matematica (Introductory Course in Mathematics)*, Department of Mathematics, "La Sapienza" University of Rome
2012-2013
- AY *Precorsi di matematica (Introductory Course in Mathematics)*, Department of Physics, "La Sapienza" University of Rome
2011-2012

Collaborations

- 2021 - ongoing Joint project Prof. Anna-Karin Tornberg (KTH Royal Institute of Technology, Stockholm) "Evaluation of the quadrature error for nearly singular integrals close to surfaces with spherical topology". The idea is to develop 3D error estimates for boundary integral methods to compute layer potentials close to the boundary of surface with spherical topologies. For the special case where the surface is a sphere, analytical solutions can be obtained, and this is starting point to study the behaviour of more difficult shapes.
- 2020- ongoing Joint project with Prof. Maria Rosaria Lancia (La Sapienza, University of Rome) "Boundary Integral Methods for Fractal Geometries". In the framework of heat propagation, a Venttsel' problem models the heat flow across highly conductive thin boundaries, which turns out to have several applications in physical and industrial processes (e.g. hydraulic fracturing, electrochemistry etc). We will reformulate this problem using a boundary integral approach for non-smooth surfaces and develop a suitable numerical method to study the problem numerically.
- 2018 - ongoing Joint project with Prof. Petia Vlahovska (Northwestern University) "Drop Electrohydrodynamics". The idea is to bring together theoretical, numerical and experimental results to better understand the effect of electric fields on surfactant-covered drops.
- 2018 - 2021 Joint project with Dr. Ludvig af Klinteberg and Prof. Anna-Karin Tornberg (KTH Royal Institute of Technology, Stockholm) "Error estimates for the evaluation of nearly singular integrals". The idea is to develop 3D error estimates for boundary integral methods where it is often necessary to evaluate layer potentials on or close to the boundary and where the underlying integral may be difficult to evaluate numerically and for which specialized quadrature techniques must be employed.

- 2014 During May and November 2014, I was a guest of Jan Nordström, Professor in Scientific Computing and Head of Division of Computational Mathematics in the Department of Mathematics at Linköping University, Sweden. The Professor, another PhD student, Cristina La Cognata and I worked together in the project "The Arakawa scheme reinvented using the splitting technique and SBP operators". We developed a finite difference discretization of the Jacobian operator in a mimetic way using SBP operator and compared this general formulation with the original formulation of Arakawa.
- 2011 During the year 2011 I worked at CNR ISAC Institute of Tor Vergata together with Michele Spada, Ilaria Pietroni, Andrea Bolignano, Igor Petenko, Matteo Morelli, Roberto Sozzi and Stefania Argentini on the project *The meteorological forecast operative at ARPA-Lazio: model results and comparison against measurements from the ARPA micrometeorological network* presented at *32 nd NATO/SPS International Technical Meeting on Air Pollution Modelling and its Application, ITM 2012, May 7 - 11, Utrecht, The Netherlands*.

Visiting

- May and November 2014 Linköping, Sweden. Visiting Prof. Jan Nordström at the Department of Mathematics, Linköping University.
- October and December 2021, June 2022 Stockholm, Sweden. Visiting Prof. Anna-Karin Tornberg at KTH Royal Institute of Technology.

Summer/Winter Schools and Trainings

- 15-26 August 2016 PDC Summer School: Introduction to High Performance Computing, KTH, Stockholm, Sweden
- 24-28 March 2014 Advanced numerical methods for Earth-System modelling Course, ECMWF (European Centre for Medium-Range Weather Forecasts), Reading, England
- 2013-2014 Training at ENEA, Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Centro ricerche Casaccia, Rome, Italy; *Study of the energy spectrum for a quasi-geostrophic model*
- June 2012 Course on parallelization, CASPUR, Rome, Italy

IT skills

- UNIX and Windows
- LateX, Microsoft Office Programs
- FORTRAN 90, C++
- MATLAB
- Mathematica

Certificates

- 2020 24 CFU - Italian teaching certification