CURRICULUM VITÆ ET STUDIORUM

Chiara GUARDASONI

Department of Mathematics, Physics and Computer Science
University of Parma
Parco Area delle Scienze, 53/A
43124 Parma
Italy

Dept. Mathematics Office: (+39) 0521 906956
Fax: (+39) 0521 906950
e-mail: chiara.guardasoni@unipr.it
Homepage: www.guardasonichiara.com

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Curriculum

- since *January 1, 2018*: permanent position as associate professor in Numerical Analysis.
- *March 28, 2017*: national scientific qualification as associate professor in Numerical Analysis.
- *December 31, 2013 - December 31, 2017*: research assistant in Numerical Analysis at the Department of Mathematics and Computer Science of the University of Parma.
  March 14, 2015 - October 01, 2015: maternity leave.
- *March 1, 2013 - December 30, 2013*: research fellow at the Department of Economics of the University of Parma.
- *March 1, 2010 - February 28, 2013*: research fellow at the Department of Mathematics of the University of Parma.

- *February 23, 2010*: Post Graduate Certificate in Secondary Education of "Physics" at the University of Parma.
- *February 17, 2010*: PhD in Numerical Analysis at the University of Milan
  dissertation title: *Wave Propagation Analysis with Boundary Element Method*
  advisor: Prof. M. Diligenti.
- *May 25, 2006*: Post Graduate Certificate in Secondary Education of "Mathematics" at the University of Parma.
- *2005-2006*: Research activity at the Department of Mathematics of the University of Parma inside the National Project (PRIN) "Mathematical Problems in Kinetic Theories"
  supervisor: Prof. G. Spiga.
- *July 13, 2004*: B.S. in Mathematics at the University of Parma
  dissertation title: *The Boundary Element Method applied to Helmholtz equation* (in Italian)
  advisors: Prof. M. Diligenti, Prof. A. Aimi.

Awards

- *2011*: winner of the INDAM-SIMAI-2010 prize for the best thesis (T1) in Applied Mathematics
- *2010*: publication of the PhD thesis in the series of the University of Milan
- *2006*: winner of a PhD-student grant at the University of Milan

Schools

- *Summer School "Large Scale BEM Computing"*
  Faculty of Engineering, University of Brescia, 29 agosto - 2 settembre 2011.
- *19th Summer School of Parallel Computating*
  Consorzio Interuniversitario di Supercalcolo CINECA di Bologna, 5-16 luglio 2010.
- *Autumn School: Introduction to Numerical Methods for Moving Boundaries*
  École Nationale Supérieure de Techniques Avancées di Parigi, 12-14 novembre 2007.
- *POEMS monthly seminar*
  Promoter: POEMS team of INRIA (Institut National de Recherche en Informatique et en Automatique Bourdeaux Sud-Ouest)
  Rocquencourt-Paris (Francia), 24 novembre 2011.
- *The 9th International Conference on Mathematical and Numerical Aspects of Waves Propagation (WAVE 2009)*
  Promoter: INRIA (Institut National de Recherche en Informatique et en Automatique Bourdeaux Sud-Ouest)
  Pau (Francia), 15-19 giugno 2009.
- *Special day of the Seminario di Matematica Applicata: Robustness of A Posteriori Error Estimators*
  Promoter: Prof. A. Veeser (Università Statale di Milano)
  Dipartimento di Matematica, Università Statale di Milano, 18 settembre 2007.

Research

Research Interests

- B.S. thesis argument: Boundary Element Method (BEM) applied to Helmholtz wave problems.

  The Numerical Analysis group of research of the University of Parma has experience on some topics connected to the application of Galerking BEM. The aim of the activity carried out during the redaction of my Master's thesis was to extend some results already well-established for the Laplace equation in integral form to the case of Helmholtz equation using some new quadrature schemes for weakly singular and Cauchy principal value integrals suitable for h-, p- and h-p versions of Galerking BEM technique. Part of executed work led to some considerations and numerical results described also in [TR4] and after exploited in [P7].
  Moreover these practice turned out to be useful also in PhD research that considered the Galerkin BEM application to transient wave equation.

- *2005-2006*: numerical methods for extended kinetic theory.

  The extended kinetic theory deals with rarefied gas dynamics in presence of non-conservative reactions. The main goal of the activity developed in these years was to study kinetic models describing chemical reactions and inelastic scattering between gases with several energetic levels in their internal structures. The particular case analyzed was the one of a reversible chemical reaction governed by the hyperbolic non-linear BGK-equations: Boltzmann-like equations where the collision part is heavier.
  Together with Numerical Analysis and Mathematical Physics researchers of the University of Parma, I tried to find a numerical strategy to simulate the reactive BGK equations. In particular I focused on problems with axial symmetry, which are of interest in many applications like for instance the classical evaporation-condensation problem. The method I used is based on time splitting techniques, which are widely known in the numerical analysis of the classical Boltzmann equation but their application to kinetic systems describing reacting gas mixtures was not discussed until that moment, to my knowledge.
  The time splitting approach has the advantage of simplifying the problem by treating separately the two steps, the convection or transport step, which solves the free-streaming equations along the characteristic lines, and the collision step, which solves the spatially homogeneous BGK equations. The numerical solution of this latter, which can be regarded as a Cauchy problem, has been evaluated with Runge-Kutta explicit schemes of different order. Some results obtained on time-dependent Riemann problems for reacting mixtures of four gases are published in [P25], [P26] and were presented at VIII SIMAI Congress, at the 3rd Summer School on "Methods and models of kinetic theory" and at the closure workshop for the Galileo Project (see [M47], [M48] and [M49]).

- from *2007* up to now: numerical resolution of hyperbolic transient wave equation.

  In 2007, I started to investigate and study the problems of propagation of elastic waves in stratified media through the BEM method. In particular I considered their formulation in terms of boundary integral equations directly defined in the space-time domain.
  With respect to elliptic problems, the presence of the time variable produces specific difficulties: new problems of stability appear in addition to the practical complexity due to the increase in dimensionality. About the application of the Boundary Element Method to the case of hyperbolic problems, there are three approaches in literature: methods based on the Laplace transform, time-step methods and methods based on an integral representation directly in the space-time domain. The latter strategy has been applied by different authors but only Bamberger and Ha Duong, in 1986, have provided a weak formulation with convergence properties.

▷ *"energetic" formulation*

The first results (presented in [P24]) were obtained through an approximation technique based on a particular weak formulation. This formulation comes from considerations about the energy properties of the whole system related to the transient waves problem and it uses the fundamental solution directly expressed in the space-time domain. Thanks to the simple structure of obtained integral equations, coercivity and continuity properties relative to the *energetic* quadratic form were proven in the case of 1D domains for both Dirichlet and Neumann problems and, consequently, the unconditional stability of derived numerical schemes was proven. From the numerical point of view, this stability has also been shown for problems with mixed boundary conditions and for elastodynamics problems in stratified media in comparisons with the partial instability of other formulations.

The *energetic* formulation was then applied to exterior 2D problems with both Dirichlet and Neumann type conditions by the single and the double layer representation formulas, respectively, and, to interior 2D problems with mixed boundary conditions through the complete integral representation formula (v. [P23] and [P20]). With the use of Fourier transforms, theoretical results of continuity and partial coercivity have been achieved in the simplified case of an unbounded domain outside to a flat obstacle.

The extension of the *energetic* formulation to 3D domains has been a challenging step, for the management of the higher dimensionality and due to the fact that the difficulties emerged in 2D (for example about the numerical integration and the discretization of the boundary) require, in this context, different resolution strategies. In [P15] and [P13] the adopted numerical techniques were examined in detail together with the results obtained for internal and external problems, respectively.

At now the analysis is devoted to more representative wave propagation models that involve material and/or viscous damping ([P6]-[P8]).

▷ *quadrature schemes*

All numerical simulations were carried out using a Galerkin discretization of the weak problem. The approximation of the integral problem solution by piecewise polynomial functions in the space-time domain generates a linear system with block lower triangular matrix of Toeplitz type. The realization of this numerical method implies, in the calculation of matrix entries, an analytical double integration in time variables and subsequently the numerical double integration in space variables. In [T1] and [P19], the difficulties of numerical integration due to the presence of different types of singularities were analyzed in depth together with the strategies adopted to overcome them; then, in [P21], appropriate quadrature techniques for hypersingular integrals developed to obtain adequate accuracy and reliability are illustrated.

▷ *coupling of approximation techniques*

In presence of regions consisting of different materials or different behaviors, the decomposition into subdomains may be both necessary and advantageous to increase the efficiency and to exploit parallel calculation tools. In this context, to apply the BEM method means having a natural way of applying interface conditions (continuity for the main unknown and compatibility for its derivative) as these variables directly appear in the boundary integral formulation. [P18] and [P17] show the results obtained in developing a 2D BEM-BEM coupling technique in the context of the *energetic* formulation.
However, if you want to exploit both the advantages of the BEM method (accuracy, implicit fulfillment of the radiation conditions at infinity, computational savings) and the advantages of the finite element method (FEM) in treating localized non-linearity, you can use a BEM-FEM coupling *energetic* technique as recently introduced in [P11] and [P12] and presented at conferences [M23] and [M22] with further extension also to problems with dissipation.

▷ *fast techniques for construction and resolution of Boundary Integral Equations linear systems*

As the future goal is to extend the application of the *energetic* formulation to more and more elaborate simulations, we need to develop fast techniques for constructing and solving linear systems arising from Boundary Integral Equations.
In this direction, at the ECCM congress in Paris [M34], thanks to GNCS funding of the research project [PR3], some initial results were exposed. These results were obtained by using the method of restriction matrices for problems with geometric symmetries, showing an actual reduction of computational costs without loss of precision (these 2D results are summarized in [P16]). Recently, at the ECCOMAS Congress [M24] and at the WAVES 2013 conference [M22], it was shown the possibility of applying this technique to 3D problems and also of taking advantage of the Platonic solids symmetries.
Moreover, in [P13], a technique based on FFT algorithms is investigated for the accelerated resolution of linear systems arising from the discretization of the wave propagation problems; this technique relies upon the particular shape of Toeplitz type matrices.

In conclusion, the many numerical results obtained in 1D, 2D and 3D, have been compared with the results reported in the literature with strongly positive feedback: *energetic* formulation appears stable in all dimensionalities and regardless of the model and discretization parameters.

- from *01 marzo 2013* up to now: numerical methods for Quantitative Finance.

  The recent financial crisis has highlighted the need for a more scientific approach to the pricing of financial products and to the risk control, exploiting advanced mathematical skills and numerical techniques and ever faster computer systems.
  The Black-Scholes model can be considered the base of differential models for the evaluation of financial options. This model is widely used in practice, however, the academic literature has highlighted its strong limitations due to the fact that the model is based on restrictive and unrealistic assumptions. Other models were then introduced later: models with time-dependent parameters or local volatility models, stochastic volatility models such as Heston model, jump-diffusion models such as the Bates model, etc. For these more advanced models the option price is traditionally based on Monte Carlo type methods that suffer from high computational cost and inaccuracy due to their intrinsic slow convergence.
  In this context, during my research fellowship period at the Department of Economics, I have adapted the Boundary Element Method for the efficient evaluation of financial options with barrier initially under the Black-Scholes model [P10] and later under Heston and Bates models[P9]; efficiency and accuracy of this numerical method were put in comparison with those of other numerical strategies reported in the literature, typically finite difference methods and Monte Carlo methods.
  The advantage of the BEM method to be able to evaluate the solution at a single point instead of globally is accentuated in the context of Quantitative Finance more than in Engineering contexts since practitioners have interest to know the solution only for certain values of the independent "space" variable (the underlying asset) and, although it is a time-dependent problem, only at the present time, not during its evolution throughout the interval of option validity.
  In the pricing of financial options and assessment of credit risk, the method proves to be innovative and has met great interest in the different conferences, also on invitation, where it was presented (M8 and M50) and by researchers of Banca IMI in Milan.
  The extension of the proposed numerical method to more complex models was the research subject in the projects [PR2] and [PR1] and it is still currently underway ([??], [M9], [M7], [PR1]).

Publications

Thesis

T1. C.Guardasoni: *Wave Propagation Analysis with Boundary Element Method*, PhD Thesis, ed. Ledizioni, Milan, (2010), open access copy available at http://air.unimi.it/handle/2434/148419.

Refereed Papers in Journals or Books

P1. C.Guardasoni, M.Rodrigo, S.Sanfelici: *Barrier option pricing exploiting Mellin transform*, submitted to *Journal of Mathematical Analysis and Applications*.

P2. A.Aimi, L.Diazzi, C.Guardasoni: *Numerical Pricing of Geometric Asian Options with Barriers*, submitted to *Mathematical Methods in the Applied Sciences*.

P3. A.Aimi, M.Diligenti, C.Guardasoni: *Platonic Solids, Restrictions Matrices and Space-Time Energetic Galerkin BEM*, submitted to *Journal of Computational and Applied Mathematics*.

P4. C.Guardasoni: *Semi-Analytical method for the pricing of barrier options in case of time-dependent parameters (with Matlab codes)*, accepted for publication in *Communications in Applied and Industrial Mathematics*.

P5. A.Aimi, C.Guardasoni: *Collocation Boundary Element Method for the pricing of Geometric Asian Options*, accepted for publication in *Engineering Analysis with Boundary Elements*.

P6. A.Aimi, M.Diligenti, C.Guardasoni: *Energetic BEM for the numerical analysis of 2D Dirichlet damped wave propagation exterior problems*, Communications in Applied and Industrial Mathematics, 8 (1), pp.103-127, (2017).

P7. A.Aimi, M.Diligenti, C.Guardasoni: *Energetic BEM-FEM coupling for the numerical solution of the damped wave equation*, Advances in Computational Mathematics, 43, pp.627-651, (2017).

P8. A.Aimi, M.Diligenti, C.Guardasoni: *Comparison between numerical methods applied to damped wave equation*, Journal of Integral Equations and Applications, 29 (1), pp. 5-40, (2017).

P9. C.Guardasoni, S.Sanfelici: *A Boundary Element approach to barrier option pricing in Black-Scholes framework*, International Journal of Computer Mathematics, 93 (4), pp.696-722, (2016).

P10. C.Guardasoni, S.Sanfelici: *Fast Numerical Pricing of Barrier Options under Stochastic Volatility and Jumps*, SIAM J. Appl. Math, 76 (1), pp.27-57, (2016).

P11. A.Aimi, L.Desiderio, M.Diligenti, C.Guardasoni: *A numerical study of energetic BEM-FEM applied to wave propagation in 2D multidomains*, Publications de l'Institut Mathématique, 96 (110), pp.5-22, (2014).

P12. A.Aimi, M.Diligenti, A.Frangi, C.Guardasoni: *Energetic BEM-FEM coupling for wave propagation in 3D multidomains*, Internat. J. Numer. Methods Engrg., 97, pp.377-394, (2014).

P13. A.Aimi, M.Diligenti, A.Frangi, C.Guardasoni: *Neumann exterior wave propagation problems: computational aspects of 3D energetic Galerkin BEM*, Comput. Mech., 51, pp. 475-493, (2013).

P14. A.Aimi, M.Diligenti, C.Guardasoni, S. Panizzi: *Energetic BEM-FEM coupling for wave propagation in layered media*, Communications in Applied and Industrial Mathematics, (2012).

P15. A.Aimi, M.Diligenti, A.Frangi, C.Guardasoni: *A stable 3D energetic Galerkin BEM approach for wave propagation interior problems*, Engineering Analysis with Boundary Elements, 36, pp. 1756-1765, (2012).

P16. A.Aimi, M.Diligenti, C.Guardasoni: *Restriction matrices in space-time energetic BEM*, Engineering Analysis with Boundary Elements, 36, pp. 1256-1271, (2012).

P17. A.Aimi, S.Gazzola, C.Guardasoni: *Energetic boundary element method analysis of wave propagation in 2D multilayered media*, Math. Methods Appl. Sci., 35, pp. 1140-1160, (2012).

P18. A.Aimi, S.Gazzola, C.Guardasoni: *Energetic BEM for domain decomposition in 2D wave propagation problems*, Communications in Applied and Industrial Mathematics, 2 (1), pp.1-22, (2011).

P19. A.Aimi, M.Diligenti, C.Guardasoni: *Numerical integration schemes for applications of energetic Galerkin BEM to wave propagation problems*, Riv. Mat. Univ. Parma, 2, pp. 147–187, (2011).

P20. A.Aimi, M.Diligenti, C.Guardasoni: *On the energetic Galerkin boundary element method applied to wave propagation problems*, J. of Comput. and Appl. Math., 235, pp. 1746–1754, (2011).

P21. A.Aimi, M.Diligenti, C.Guardasoni: *Numerical integration schemes for space-time hypersingular integrals in energetic Galerkin BEM*, Num. Alg., 55, pp. 145-170, (2010).

P22. A.Aimi, M.Diligenti, C.Guardasoni, I.Mazzieri, S.Panizzi: *A space-time Galerkin BEM for 2D exterior wave propagation problems*, in Applied and Industrial Mathematics in Italy III, Proceedings of the 9th Conference SIMAI, E. De Bernardis, R. Spigler, V. Valente (Eds.), World Scientific, Singapore, 82, pp. 13-24, (2010).

P23. A.Aimi, M.Diligenti, C.Guardasoni, I.Mazzieri, S.Panizzi: *An energy approach to space-time Galerkin BEM for wave propagation problems*, Internat. J. Numer. Methods Engrg., 80, pp. 1196-1240, (2009).

P24. A.Aimi, M.Diligenti, C.Guardasoni, S.Panizzi: *A space-time energetic formulation for wave propagation analysis by BEMs*, Riv. Mat. Univ. Parma, (7) 8, pp. 171-207, (2008).

P25. A.Aimi, M.Diligenti, M.Groppi, C.Guardasoni: *On the numerical solution of a BGK-type model for chemical reactions*, European J. Mech. B/Fluids, 26, pp. 455-472, (2007).

P26. A.Aimi, M.Diligenti, M.Groppi, C.Guardasoni: *Numerical approximation of a BGK-type relaxation model for reactive mixtures*, in Applied and Industrial Mathematics in Italy II, Series on Advances in Mathematics for Applied Sciences, V. Cutello, G. Fotia, L. Puccio (Eds.), World Scientific, Singapore, 75, pp. 1-12, (2007).

Technical Reports and other publications

TR1. C.Guardasoni: *Analisi della propagazione di onde con il metodo degli elementi al contorno*, La matematica nella Società e nella Cultura: rivista della Unione Matematica Italiana. Serie I, 4 (1), pp. 55-58, (2011).

TR2. A.Aimi, M.Diligenti, C.Guardasoni: *Numerical integration schemes for the Galerkin BEM related to wave propagation problems*, Quaderni Dip. Mat. Univ. Parma, n. 495, (2009).

TR3. A.Aimi, M.Diligenti, C.Guardasoni, I.Mazzieri, S.Panizzi: *An energy approach to space-time Galerkin BEM for wave propagation problems*, Quaderni Dip. Mat. Univ. Parma, n. 487, (2008).

TR4. C. Guardasoni, *Il BEM per il problema di Dirichlet su un dominio esterno ad un arco relativo all'equazione di Helmholtz*, Quaderni Dip. Mat. Univ. Parma, n. 449, (2006).

Reviewer Activity

I am reviewer for the following journals:

- EABE (Engineering Analysis with Boundary Elements)
- Mathematical Problems in Engineering
- Computer Physics Communications
- Mathematical Reviews
- IEEE Access

Communications at Meetings and Seminars

The asterisk indicates that the communications were personally presented.

M1. *15th International Conference of Numerical Analysis and Applied Mathematics (ICNAAM)*, Thessaloniki (Greece), September 25-30, 2017;
communication on: *Energetic BEM for the numerical solution of 2D damped waves propagation exterior problems.*

M2. *17th International Conference Computational and Mathematical Methods in Sciences and Engineering (CMMSE)*, Cadiz (Spain), June 4-8, 2017;
*communication on: *Numerical Pricing of Geometric Asian Options with Barriers*,
*communication on: *Energetic BEM for soft and hard scattering of 2D damped waves by open arcs.*

M3. *Workshop on Kolmogorov-Fokker-Planck Equations: theoretical issues and applications*, Modena (Italy), April 10-11, 2017;
*communication on: *Efficient Method for Barrier Option Evaluation.*

M4. *Two days of numerical linear Algebra*, Como (Italy), February 25-27, 2017;
*communication on: *Platonic Solids, Restriction Matrices and 3D Space-Time Energetic Galerkin BEM.*

M5. *Quantitative Finance Workshop 2017*, Milan (Italy), January 25-27, 2017.

M6. *10th International Conference on Computational and Financial Econometrics*, Seville (Spain), December 9-11, 2016;
communication on: *Semi-Analytical method for pricing Barrier Options with time-dependent parameters.*

M7. *SIMAI Conference 2016*, Milan (Italy), September 13-16, 2016;
*communication on: *A Boundary Element Method applied to Barrier Options Pricing*,
communication on: *Energetic BEM for the numerical analysis of damped wave propagation exterior problems.*

M8. *Workshop*, Ritsumeikan University (Japan), September 07-10, 2016;
comunicazione: *Fast numerical pricing of barrier options via Boundary Element Method.*

M9. *Bachelier Conference*, New York (USA), July 15-19, 2016;
*communication on: *Semi-Analytical method for the pricing of Barrier Options.*

M10. *European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS)*, Crete Island (Greece), June 5-10, 2016;
communication on: *Energetic BEM for the numerical solution of damped wave propagation exterior problems.*

M11. *16th Workshop on Quantitative Finance*, Parma (Italy), January 29-30, 2015.

M12. *12th International Conference of Numerical Analysis and Applied Mathematics (ICNAAM)*, Rhodes (Greece), September 22-28, 2014;
communication on: *Energetic BEM-FEM coupling for the numerical solution of the damped wave equation.*

M13. *5th European Conference on Computational Mechanics*, Barcelona (Spain), July 20-25, 2014;
communication on: *Numerical analysis of the damped wave equation by "energetic" weak formulations.*

M14. *International Conference on Boundary Element and Meshless Techniques (Beteq)*, Florence (Italy), July 15-17, 2014;
*communication on: *Numerical Analysis of Damped Waves Using Energetic BEM-FEM Coupling.*

M15. *International Symposium on Differential Equations and Stochastic Analysis in Mathematical Finance (ISDESAMF)*, Sanya (China), July 12-16, 2014;
communication on: *Fast numerical pricing of barrier options under stochastic volatility & jumps.*

M16. *The 18th European Conference on Mathematics for Industry (ECMI)*, Taormina (Italy), June 09-13, 2014;
*communication on: *A boundary element method for pricing barriers options.*

M17. *Biennial GNCS-INdAM Conference*, Montecatini Terme (Italy), February 19-20, 2014;
communication on: *Fast Methods for the numerical resolution of systems of integro-differential equations.*

M18. *XV Workshop on Quantitative Finance*, Florence (Italy), January 23-24, 2014;
communication on: *Fast Numerical Pricing of Barriers Options under Stochastic Volatility and Jumps.*

M19. *7th International Conference on Computational and Financial Econometrics (CFE)*, London (United Kingdom), December 14-16, 2013;
*communication on: *A boundary element PDE approach to corporate debt.*

M20. *International Workshop on Approximation Theory and Applications (IWATA)*, Potenza (Italy), September 12-13, 2013;
*poster: *Energetic BEM-FEM for 2D wave propagation problems.*

M21. *International Conference on Boundary Element and Meshless Techniques (BETEQ)*, Paris (France), July 16-18, 2013;
*communication on: *Energetic BEM-FEM coupling for wave propagation in layered media.*

M22. *The 11th International Conference on Mathematical and Numerical Aspects of Waves (Waves 2013)*, Tunis (Tunisia), June 3-7, 2013;
*communication on: *Platonic Solids, Restrictions Matrices and Space-Time Energetic Galerkin BEM*,
communication on: *Energetic BEM-FEM coupling for wave propagation in unbounded domains*
communication on: *BEM-FEM coupling for the one-dimensional Klein-Gordon equation.*

M23. *Perspectives on Development of the Applied Mathematics in Italy 2013 (Workshop SIMAI)*, Rome (Italy), March 11, 2013;
*communication on: *The energy based method applied to damped wave equation.*

M24. *ECCOMAS Congress 2012*, Wien (Austria), September 10-14, 2012;
*communication on: *Restriction Matrices for Exploiting Symmetry in 3D Wave Propagation Analysis by Energetic BEM.*

M25. *SIMAI Congress 2012*, Turin (Italy), June 25-28, 2012;
*communication on: *A stable energetic Galerkin BEM for 3D wave propagation interior problems*,
communication on: *An energetic approach to BEM-FEM coupling for wave propagation phenomena.*

M26. *BEM on the Saar 2012*, Saarbrücken (Germany), May 14-16, 2012;
communication on: *An energy based BEM-FEM coupling for wave propagation problems: first results.*

M27. *International Conference on Scientific Computing 2011*, S. Margherita di Pula (Cagliari, Italy), October 10-14, 2011;
poster: *On the regularization of Galerkin BEM hypersingular bilinear forms.*

M28. *XIX Congresso dell'Unione Matematica Italiana*, Bologna (Italy), September 12-17, 2011;
communication on: *Un metodo BEM energetico di tipo Galerkin per problemi di propagazione di onde.*

M29. *Symposium of the International Association for Boundary Element Methods (IABEM)*, Brescia (Italy), September 5-8, 2011;
*communication on: *On the energetic Galerkin BEM applied to 3D wave propagation problems.*

M30. *Time Domain Boundary Integral Equations: Algorithms, Analysis, Applications*, Leipzig (Germany), May 4-6, 2011;
communication on: *Energetic Galerkin BEM and domain decomposition for 2D wave propagation problems in multi-layered media.*

M31. *Perspectives on Development of the Applied Mathematics in Italy 2011 (Workshop SIMAI)*, Rome (Italy), April 8, 2011;
*communication on: *Wave Propagation Analysis with Boundary Element Method.*

M32. *International Conference on Numerical Analysis and Applied Mathematics (ICNAAM)*, Rhodes (Greece), September 19-25, 2010;
*communication on: *Energetic Galerkin BEM for 2D Wave Propagation Problems in Piecewise Homogeneous Media.*

M33. *X SIMAI Congress*, Cagliari (Italy), June 21-25, 2010;
*communication on: *Multi-domain BEM for two dimensional problems of wave propagation.*

M34. *IV European Conference on Computational Mechanics (ECCM)*, Paris (France), May 16-21, 2010;
*communication on: *Exploiting geometrical symmetries in space-time BIEs discretization.*

M35. *Integral Equations: recent numerical developments and new applications*, Parma (Italy), October 29-30, 2009;

M36. *2nd Dolomites Workshop on Constructive Approximation and Applications (DWCAA09)*, Alba di Canazei (Trento, Italy), September 4-9, 2009;
*communication on: *Efficient numerical integration schemes for the discretization of hypersingular BIEs related to wave propagation problems.* *communication by invitation, on: *Numerical integration schemes for the discretization of BIEs related to wave propagation problems.*

M37. *The 9th International Conference on Mathematical and Numerical Aspects of Waves Propagation (WAVES "09)*, Pau (France), June 15-19, 2009.

M38. *Biennial GNCS-INdAM Conference*, Montecatini Terme (Pistoia, Italy), February 3-5, 2009;
*communication on: *Developments in Boundary Element Methods for Wave Propagation Problems.*

M39. *International Workshop: "Advanced Numerical Methods in Seismology"*, Brescia (Italy), November 14, 2008;
communication on: *Boundary element methods for earthquake simulations: an introduction.*

M40. *IX SIMAI Congress*, Rome (Italy), September 15-19, 2008;
*communication on: *An energetic approach for time-domain Boundary Integral Formulations of the wave equation.*

M41. *BEM on the Saar 2008*, Saarbrücken (Germany), May 25-29, 2008;
*communication on: *A space-time approach for BEM related to wave propagation analysis*,
communication on: *On analytical integrations and time marching schemes in 3D BEM elastodynamics.*

M42. *Biennial GNCS-INdAM Conference*, Montecatini Terme (Pistoia, Italy), February 4-6, 2008;
*communication on: *A space-time energetic approach for BEM related to wave propagation analysis in layered media.*

M43. *Boundary Integral Equations: recent numerical developments and new applications*, Parma (Italy), September 27-28, 2007;
communication on: *Numerical results for the wave propagation problem with space-time boundary element method.*

M44. *XVIII AIMETA National Conference*, Brescia (Italy), September 11-14, 2007;
*communication on: *Numerical results for the wave propagation problem with space-time boundary element method*,
communication on: *Space-time variational formulations for BIEs related to the wave problem.*

M45. *BETEQ 2007, International Conference on Boudary Element Techniques*, Naples (Italy), July 24-26, 2007;
*communication on: *Numerical results of one dimensional wave propagation analysis in layered media*,
communication on: *Remarks on space-time variational formulations for BIEs related to the wave problem.*

M46. *SIMAI Conference: "Development of the Applied Mathematics in Italy"*, Parma (Italy), May 18-19, 2007;
*comunicazione: *One dimensional wave propagation analysis in layered media by BEMs.*

M47. *VIII SIMAI Congress*, Baia Samuele (Ragusa, Italy), May 22-26, 2006;
communication on: *Numerical approximation of a BGK-type relaxation model for reactive mixtures.*

M48. *3rd summer school on "Methods and models of kinetic theory"*, Porto Ercole (Grosseto, Italy), June 4-10, 2006;
poster: *On the BGK approximation of reactive flows: theoretical and numerical aspects .*

M49. *Closure Workshop for the Galileo Project*, Paris (France), November 18-19, 2005;
communication on: *On the Riemann Problem for Reactive BGK Equations.*

Communications by invitation

M50. *Seminario su Invito* presso il Dipartimento di Matematica dell'Università di Modena e Reggio Emilia, 28 giugno 2016;
*communication on: *Pricing of Financial Derivatives.*

M51. *Insurance & Finance day*, Parma, 3 luglio 2014;
*communication on: *A boundary element method for pricing barriers options.*

M52. *The 9th International Conference Computational and Mathematical Methods in Science and Engineering (CMMSE)*, Gijón (Spagna), 30 giugno-3 luglio 2009;
*communication on: *Numerical integration schemes for the discretization of BIEs related to wave propagation problems.*

Financed Projects

as supervisor

PR1. Local Funds for Research (FIL-2014) based on peer-review: *Boundary Element Method for barrier options in models with time-dependent parameters;*
participants: S. Sanfelici, M. de Donno, A. Aimi;
external collaborators: M. Rodrigo (University of Wallongong, Australia), J. Akahori (Ritsumeikan University, Japan), L.V. Ballestra (University of Bologna), D. Marazzina (Polytechnic of Milan).

PR2. Research Fellow Program (GNCS-2013): *Integral equations approach for numerical resolution of Quantitative Finance problems;*
participants: S. Sanfelici;
external collaborators: G. Sartorelli and A. Pallavicini (IMI Bank of Milan).

PR3. Research Fellow Program (GNCS-2010): *Application of Restriction Matrices to Boundary Element Method for evolutionary problems;*
participants: A. Aimi, M. Diligenti, S. Gazzola (University of Bath).

as participant

PR4. Research Projet GNCS-2017: *Isogeometric approach and quadrature techniques for 3D Boundary Element Method;*
supervisor: Prof. A. Aimi (University of Parma);
participants: A. Aimi, C. Bracco, F. Calabrò, M. Diligenti, A. Falini, S. Falletta, C. Giannelli, C. Guardasoni, F. Kanduč, G. Monegato, F. Pelosi, F. Roman, M.L. Sampoli, L. Scuderi, A. Sestini, H. Speleers.

PR5. Research Projet GNCS-2016: *Isogeometric approach and quadrature techniques for 3D Boundary Element Method;*
supervisor: Prof. M.L. Sampoli (University of Siena);
participants: A. Aimi, A. Buffa, F. Calabrò, M. Diligenti, C. Garoni, C. Giannelli, C. Guardasoni, T. Kanduč, F. Roman, A. Sestini.

PR6. Research Projet GNCS-2015: *Isogeometric Analysis and Boundary Element Method;*
supervisor: Prof. A. Aimi (University of Parma);
participants: A. Buffa, F. Calabrò, M. Diligenti, S. Falletta, C. Giannelli, C. Guardasoni, F. Pelosi, M.L. Sampoli, L. Scuderi, A. Sestini, H. Speelers, F. Roman, D. Sesana.

PR7. Research Projet GNCS-2013: *Fast methods for the numerical resolution of systems of integro-differential equations;*
supervisor: Prof. A. Aimi (University of Parma);
participants: M.C. De Bonis, M. Diligenti, S. Falletta, C. Guardasoni, C. Laurita, G. Monegato, D. Occorsio, M.G. Russo, L. Scuderi;
external collaborators: S. Chaillat (INRIA Parigi).

PR8. Research Projet GNCS-2012: *Coupling of Numerical Methods for BIEs and PDEs related to external and multi-layers evolutionary problems;*
supervisor: Prof. A. Aimi (University of Parma);
participants: S. Falletta, C. Guardasoni, C. Laurita, G. Mastroianni, G. Monegato, L. Scuderi;
external collaborators: A. Frangi, S. Panizzi.

PR9. Progetti di Ricerca GNCS-2011: *Numerical Methods for problems of elastic waves propagation in multi-domains;*
supervisor: Prof.ssa A. Aimi (University of Parma);
participants: M.C. De Bonis, S. Falletta, C. Guardasoni, G. Mastroianni, G. Monegato;
external collaborators: S. Chaillat (INRIA Parigi).

PR10. Italian Research Program (PRIN 2009): *Boundary Element Method Method for elastic waves propagation problems;*
supervisor: Prof. G. Monegato (Polytechnic of Turin);
research group of Parma: Prof. M. Diligenti, A. Aimi, C. Guardasoni, C. Marchionna, S. Panizzi.

PR11. Italian Research Program (PRIN 2007): *Boundary Element Method Method for elastic waves propagation problems;*
supervisor: Prof. G. Monegato (Polytechnic of Turin);
research group of Parma: Prof. M. Diligenti, A. Aimi, C. Guardasoni, C. Marchionna, S. Panizzi;
external collaborators: L. Gray (Oak Ridge National Laboratory, U.S.A.), F. Pagani.

PR12. Italian Research Program (PRIN 2007): *Advanced Numerical Methods for evolutionary equations and multi-scale problems;*
supervisors: Prof. A. Quarteroni (Polytechnic of Milan) and Prof. G. Naldi (University of Milan).

Teaching Experience

- academic year *2017-2018*: regular teacher of the course **Approximation Methods for Differential and Integral Equations** and of the course **Mathematical Models in Finance** for the degree course in Applied Mathematics at the University of Parma.
- *June 2017*: stage of Mathematics for high school students organized at the University of Parma.
- *winter graduation session 2016/2017*: co-advisor for the graduation thesis with title "Black-Scholes model for the pricing of European options", for the degree course in Mathematics at the University of Parma.

- academic year *2016-2017*: regular teacher of the course **Mathematical Models in Finance** for the degree course in Applied Mathematics at the University of Parma.
- *June 2016*: stage of Mathematics for high school students organized at the University of Parma.
- academic year *2015-2016*: regular teacher of the course **Approximation Methods for Differential and Integral Equations** and of the course **Mathematical Models in Finance** for the degree course in Applied Mathematics at the University of Parma.
- academic year *2014-2015*: collaboration to the course **Numerical Analysis** for the degree courses in Mathematics and in Informatics at the University of Parma.
- academic year *2013-2014*: regular teacher of the course **Approximation Methods for Differential and Integral Equations** for the degree course in Applied Mathematics at the University of Parma and regular teacher of the course **Financial and Computational Mathematics** for the teaching qualification course in Applied Mathematics at the University of Parma.
- *September 2013*: cycle of seminars "**Mathematics of Secondary School in the study of economic disciplines**" for the degree course in Economics at the University of Parma.
- *graduation session 28/02/2012*: assistant advisor for the graduation thesis in **Numerical Analysis** with title "BEM-FEM coupling for the numerical resolution of boundary elliptic problems", for the degree course in Applied Mathematics at the University of Parma.
- academic year *2011-2012*: regular teacher of the course **Mathematical Analysis** for the degree course in Applied Mathematics at the University of Parma.
- academic year *2010-2011*: regular teacher of the course **Approximation Methods for Differential and Integral Equations** for the degree course in Applied Mathematics at the University of Parma.
- *graduation session 19/10/2010*: assistant advisor for the graduation thesis in **Numerical Analysis** with title "An energetic boundary elements technique for wave propagation problems in multi-domains", for the degree course in Applied Mathematics at the University of Parma.
- academic year *2009-2010*: collaboration to the course **Laboratory of Numerical Computation** for the degree courses in Mathematics and Informatics at the University of Parma.
- *November-December 2009*: training in Secondary Education Schools in Parma.
- *November 2008*: lessons at the basic course of **Mathematics** for the degree course in Biotechnology at the University of Milan.
- academic year *2008-2009*: collaboration to the course **Laboratory of Numerical Computation** for the degree courses in Mathematics and Informatics at the University of Parma.
- academic year *2007-2008*: collaboration to the course **Numerical Analysis** for the degree courses in Civil, Environmental and Telecommunications Engineering and to the course **Laboratory of Numerical Computation** for the degree courses in Mathematics and Informatics at the University of Parma.
- academic year *2006-2007*: collaboration to the course **Numerical Analysis** for the degree courses in Civil, Environmental and Telecommunications Engineering at the University of Parma.

- *January 1-November 30, 2006*: tutorial activities at the course **Numerical Analysis** for the degree courses in Civil, Environmental and Telecommunications Engineering at the University of Parma.
- *2005-2006*: training and temporary posts in Secondary Education Schools in Parma.

Organization Activities and Membership

- Since Academic Year 2017/2018, faculty member of *PhD School in Mathematics* hold by Universities of Parma, Modena and Ferrara.
- Member of the Italian Group for Scientific Computing GNCS-INdAM.
- Organizer of the following minisymposia at the SIMAI conference 2016:
  - *Advances in Quantitative Finance* in collaboration with D. Marazzina and S. Sanfelici
  - *Applications and Numerical Methods for Integral Equations* in collaboration with A. Aimi, M. Diligenti, S. Falletta and L. Sampoli.
- Part of the organizing committee of the second edition of the workshop
  Integral Equations: recent numerical developments and new applications
  that took place at the University of Parma, October 29-30, 2009.
- Part of the organizing committee of the workshop
  Boundary Integral Equations: recent numerical developments and new applications
  that took place at the University of Parma, September 27-28, 2007.

Parma, December 19, 2017

Chiara GUARDASONI