CURRICULUM VITAE ET STUDIORUM
Roberto Ferretti

March 17, 2019

1 Personal Data

Name: Roberto Ferretti

Birth place and date: Roma, 31.03.59

Address and other contacts: Dipartimento di Matematica e Fisica, Università Roma Tre, L.go San Leonardo Murialdo, 1, 00146 Roma – Tel.: +39-0657338218/+39-3290571477, Fax: +39-0657338080, e-mail: ferretti@mat.uniroma3.it, robe.ferretti@gmail.com

Position: Professore Associato (Associate Professor) in Numerical Analysis (2005–).

2 Academic titles

- Master Degree in Electronic Engineering cum laude, Università degli Studi di Roma "La Sapienza", 1984
- PhD in Mathematics, Università degli Studi di Roma "La Sapienza", 1992
- Habilitation as an associate professor in Numerical Analysis, 2001
- Habilitation as a full professor in Numerical Analysis, 2017

3 Recent research periods abroad

- Visiting researcher, UPM Madrid, September 2003
- Visiting researcher, ENPC Marne-La-Vallée, November 2007
- Participation to the intensive trimester "Control of PDEs and Applications", Institut Henri Poincarè, Paris, October–November 2010
- Visiting researcher, ENSTA–ParisTech, Saclay, various periods between October 2012 and June 2016
- Visiting researcher, TUM Munich, November 2016
- Visiting researcher, IRMA Strasbourg, January and June 2017

4 Scientific activity (recent and planned)

Optimal control and Dynamic Programming equations This research line has been initiated in [3] to obtain a high-order time discretization for convex Hamilton–Jacobi (including Dynamic Programming) equations, while high-order space discretisations have been considered in a more recent work [23]. The search for more efficient approximations, which could, at least partially, circumvent the so-called *curse of dimensionality*, has been pursued by more and more authors in recent years, and Dynamic Programming numerical techniques have much improved their feasibility and efficiency (see, e.g., the numerical tests in [12]). In other recent works [21, 22, 28, 32, 57], applications to hybrid control systems are presented. This line of work goes in a strongly applicative direction (hybrid vehicles, spacecrafts, optimal route planning,...) and will be the object of further studies (possibly in cooperation with industrial partners) in the next future. Other current lines of research go in the direction of adaptive RBF implementation of Semi-Lagrangian schemes for Bellman equations (some preliminary results are given in [44]). These works are in collaboration with H. Zidani and A. Sassi (ENSTA Paris), O. Junge and A. Schrieber (Munich), L. Grüne (Bayreuth), A. Festa (L'Aquila).

Finally, the study of a numerical optimal control technique of open-loop type for delay systems has been proposed and analysed in [46].

Hyperbolic/degenerate parabolic equations and high-order Semi-Lagrangian schemes This appears to be the main focus of my recent and current research and can be split in several subtopics. The hyperbolic line of work is summarised in the monograph [1] and in the chapter [48].

SL methods for linear equations and theoretical issues – Semi-Lagrangian methods are a class of generalized Godunov methods in which large Courant numbers are allowed by using characteristic lines at the numerical level. My interest towards a satisfactory stability theory for SL schemes has generated a series of papers [7, 41, 15, 19, 20, 55], analysing more and more general situations (relationship with Lagrange–Galerkin schemes, variable coefficient equations, finite element interpolation, spline interpolation, conservative SL schemes), and providing what is probably the most general theoretical analysis for high-order SL schemes in the hyperbolic case. The case of linear advection–diffusion equations is treated in [16, 23, 25], treating a class of SL schemes based on a stochastic representation formula for the solution, used especially in the field of the so-called *Markov chain approximations*. This treatment of diffusion terms may also be applied to nonlinear diffusions, and we plan to study in the future its applications, in particular to Dynamic Programming equations for stochastic control problems. Moreover, this large time-step, explicit solver has been used in a Navier–Stokes code, both in the vorticity–streamfunction [29] and in the Chorin–Temam [45] formulation. Part of this works are in collaboration with L. Bonaventura (Milano "Politecnico"), E. Carlini and E. Calzola (Roma "Sapienza") and M. Mehrenberger (Marseille).

SL schemes for Hamilton–Jacobi equations – Starting from [3], and with the goal of an in-depth analysis of high-order schemes, we have moved from Dynamic Programming equations towards more abstract forms of HJ equations. The endpoint of this research is given in [10, 12, 13] for the construction of schemes and in [11, 23] for their theoretical analysis. In particular, we study in [12] a high-dimensional implementation of the SL schemes, with application to control problems with a state space up R^5, and in [30] a theoretical analysis, extended to general monotone schemes, for the case of HJ equations arising in hybrid control.

Level set models for Mean Curvature Motion – A degenerate, singular, nonlinear diffusion equation arises from the level set formulation of the Motion by Mean Curvature. The application of stochastic representation formulae (as in [16]) to this situation has been first studied in [39, 17]. Several extensions are presented in [40, 42, 14]. Some interesting results, which also represent a line of research for the future, have been obtained applying the SL scheme to other curvature-related models of use in image and shape processing [18, 43, 26] (see also the review [49]). The plan is to extend the technique to 3-d filtering of images and shapes, to improve the treatment of singularities of the underlying equation and to study new methods of space reconstruction for the solution. This line of work is a collaboration in progress with E. Carlini (Roma "Sapienza").

Optimal control in infinite dimensions and applications This research line concerns the discretization of optimal control problems in Hilbert spaces, and its basic ideas are sketched in [6, 4]. The approach consists in constructing approximate optimal solutions of a control problem for linear evolution equations via semi-discrete approximations. While at the moment the problem seems to have a prohibitive computational complexity, at least when attempting to apply Dynamic Programming techniques, a careful mixing with space reduction techniques will be the object of future works. In addition, a work on the construction (via open-loop techniques) of approximate stabilising controls for degenerate parabolic equations has been published [31], in collaboration with P. Cannarsa (Roma "Tor Vergata") and P. Martinez (Tolouse "Paul Sabatier").

A relevant application is shown in [9], where a suitable optimal stopping time problem is used to obtain an adaptive behaviour for an image denoising model of Perona–Malik type. This approach has been first proposed in [9], and has been followed by various authors since.

5 Recent invited talks

- Workshop "Numerical Methods for Optimal Control in High Dimensions", Palo Alto (USA), September 2005 (invited speaker).
- Workshop "Numerical Methods for Degenerate Elliptic Equations", Banff (Canada), December 2006 (invited speaker).
- Workshop "Nonlinear Partial Differential Equations", Roma, 1–2 Septembre 2008 (invited speaker).
- Workshop "Numerical Methods for Hyperbolic Problems", Banff (Canada), September 2008 (invited speaker).
- Seminar "Numbers and Computers", Università di Roma Tre, May 2009.
- Seminar "Some Recent Results on the Stability of Semi–Lagrangian Methods", MOX–Politecnico di Milano, February 2010.
- Seminar "Some Topics in Optimization", Tribhuvan University, Kathmandu (Nepal), August 2010.
- Seminar "Some Recent Results on the Stability of Semi-Lagrangian Schemes", ENSTA–ParisTech, Paris, November 2010.
- Conference "Matematica e Cultura 2012" (Mathematics and Culture), Venezia, March 2012 (invited speaker).
- Workshop "Applied and Numerical Optimal Control", Paris, April 2012 (invited speaker).
- Seminar "Monotone Approximations for Hybrid Control Problems", Dipartimento di Matematica, "Sapienza" Università di Roma, May 2012.
- Seminar "Semi-Lagrangian Approximations for Parabolic Operators in Divergence Form", Dipartimento di Matematica, "Sapienza" Università di Roma, November 2013.
- Workshop "New Horizons in Optimal Control", Cascais, September 2014 (invited speaker).
- Workshop "Numerical Aspects of Hyperbolic Balance Laws and Related Problems", Ferrara, December 2015 (invited speaker).
- Seminar "An Adaptive RBF-Based Semi-Lagrangian Scheme for HJB equations", Dipartimento di Matematica, Università di Padova, April 2016.
- Workshop "NETCO – HJ 2016", Rennes, June 2016 (invited speaker).
- Workshop "Numerical Methods for Hamilton–Jacobi Equations in Optimal Control and Related Fields", Linz, November 2016 (invited speaker).

- Seminar "An explicit, large time-step advection–diffusion solver for Navier–Stokes Equations", Dipartimento di Matematica, "Sapienza" Università di Roma, November 2017.
- Workshop "Numerical Aspects of Hyperbolic Balance Laws and Related Topics", Ferrara, April 2018 (invited speaker).
- Workshop "Well-Posedness of Optimization Problems and Related Topics", Borovets, Bulgaria, August 2018 (invited speaker).

6 Editorial activity

- Referee for:
  - SIAM Journal of Control and Optimization
  - SIAM Journal of Numerical Analysis
  - SIAM Journal of Scientific Computing
  - Mathematical Modelling and Numerical Analysis
  - Journal of Optimization Theory and Applications
  - Mathematics of Computation
  - IMA Journal of Numerical Analysis
  - Journal of Computational Physics
- Former guest editor for:
  - Applied Numerical Mathematics (2004–2006 and 2011–2013)
  - Communication in Applied and Industrial Mathematics (2015–2016)
- Editor of the proceedings volume "Numerical Methods in Optimal Control", Springer–INdAM series, 2018

7 Recent management activities

- Member of the Organising/Scientific board of the Workshop "Numerical Methods for Viscosity Solutions and Applications" (Roma "La Sapienza", 2004). Together with M. Falcone, guest editor for a related special issue of the journal *Applied Numerical Mathematics*
- Main Organizer of the Workshop "Advancing Numerical Methods for Viscosity Solutions and Applications" (Banff International Research Station, Canada, 2011). Together with M. Falcone, guest editor for a related special issue of the journal *Applied Numerical Mathematics*
- Member of the Organising/Scientific board of the Workshop "Recent Advances on Theory and Applications of Semi-Lagrangian Methods" (Roma "La Sapienza", 2011)
- Member of the Recruitment Committee of both the Department of Mathematics and the Science Faculty of the University Roma Tre (about 2005 to 2013)
- Member of the Divulgation Committee of both the Department of Mathematics and the Science Faculty of the University Roma Tre (about 2002 to 2013)
- Coordinator of the GNCS (National Group for Scientific Computing) research projects "Theoretical Methods and Advanced Applications of Semi-Lagrangian Schemes" (2012) and "High Resolution Methods for Strongly Nonlinear Evolutive Problems" (2014).
- Member of the Organising Committee for the European Researchers' Night at Roma Tre (2015–)
- Member of the Organising/Scientific board of the INdAM Workshop "Numerical Methods in Optimal Control" (INdAM Roma, 2017)

8 Didactic activity for Master/PhD

Standard classes: basic Numerical Analysis (solution of equations and systems, interpolation, integration), intermediate N.A. (approximate solution of ODEs and basic principles of approximation for PDEs). Past experience in Analysis classes.

8.1 Recent research theses

Current

- B. Beco – "Fast algorithms for Finite Element interpolation on an unstructured mesh" (Master thesis in Mathematics, Roma Tre).

Past

- E. Carlini – "High-Order Semi-Lagrangian Schemes for First- and Second-Order Geometric Evolution Equations" (PhD in Applied Mathematics, Roma "La Sapienza", 2004).
- G. Perrone – "On the Stability of High-Order Semi–Lagrangian Schemes (Master thesis in Mathematics, Roma Tre, 2006).
- S. Garra – "Conservative High-Order Semi–Lagrangian Schemes" (Master thesis in Mathematics, Roma Tre, 2012).
- F. Bonghi – "Symplectic Reduction of Barotropic Quasigeostrophic Equation on the Rotating Sphere, and Applications in Planetary Fluid Dynamics" (PhD in Applied Mathematics, Roma "La Sapienza", 2013).
- R. Pecorella – "Semi–Lagrangian Treatment of Turbulent Viscosity Models for the Atmosphere" (Master thesis in Mathematics, Roma Tre, 2013).
- A. Sassi – "Monotone Schemes for Hybrid Optimal Control Problems" (Master thesis in Mathematics, Roma Tre, 2013).
- S. Mastrodonato – "Semi-Lagrangian Schemes for Nonlinear Advection–Diffusion Equations Arising in Ground Filtration Models" (Master thesis in Mathematics, Roma Tre, 2015).
- G. Ferretti – "Adaptive Schemes for Stationary Bellman Equations, and Application to the Optimal Control of Chemotherapy Models" (Master thesis in Mathematics, Roma Tre, 2016).
- L. Rocchi – "Semi-Lagrangian solvers for the Navier–Stokes Equations" (Master thesis in Mathematics, Roma Tre, 2016).
- M. Francucci – "Semi-Lagrangian schemes for the Richards equation" (Master thesis in Mathematics, Roma Tre).
- F. Pasanisi – "Semi-Lagrangian solvers for projection-based formulation of the Navier–Stokes equations" (Master thesis in Mathematics, Roma Tre).
- E. Gioffrè – "Semi-Lagrangian schemes for viscous nonlinear conservation laws in multiple space dimensions" (Master thesis in Mathematics, Roma Tre).

8.2 Recent PhD courses

- "Selected Numerical Methods", CIMPA summer school "Number Theory in Cryptography and Its Applications", Kathmandu University, Dhulikel (Nepal), July 2010.
- "Semi-Lagrangian Methods", workshop "Advancing Numerical Methods for Viscosity Solutions and Applications", Banff International Research Station, Banff (Canada), February 2011. Similar courses have been given in preparation of the workshops "Recent advances on theory and applications of Semi-Lagrangian methods" (Roma, January 2012) and "Semi-Lagrangian day" (Milano, February 2013).

- "Monotone and Semi-Lagrangian Schemes for Dynamic Programming Equations", Dipartimento di Matematica, "Sapienza" Università di Roma, Roma, March 2014.
- "Time Series Analysis", Dipartimento di Matematica e Fisica, Università Roma Tre, Roma, 2014–2019.

9 Divulgation activity

- Participation to the italian Ministry of Education "Scientific Degrees Project" (PLS) for High Schools, by coordinating the laboratories
  - "Astro-math" (L.S.S. "Arisotele" and "Virgilio", Roma, 2006/2007)
  - "Digital image processing" (L.S.S. "Spallanzani", Tivoli, 2009; L.S.S. "Peano", Roma, 2017)
- Development of the exhibition "Future with Mathematics" (Science Festival, Genova, 2009)
- Contribution to the "European Researchers' Night 2011", with the interactive exhibition "The Two- and Three-Body Problem in Celestial Mechanics" (Università Roma Tre, 2011)
- Contribution to the "European Researchers' Night 2014", with the conference "Numerical Analyst's Guide to the Galaxy" (Università Roma Tre, 2014)
- Contribution to the "European Researchers' Night 2016", with the conference "If Verhulst and Lagrange went fishing together" (Università Roma Tre, 2016)
- Contribution to the "European Researchers' Night 2017", with the conference "Straight ahead? Minimal paths and light rays" (Università Roma Tre, 2017)
- Supervision of the web-radio divulgation program "Sputnik" on Roma Tre Radio, `http://radio.uniroma3.it/sputnik/`

Publications

Monographs

[1] M. Falcone e R. Ferretti, Semi-Lagrangian approximation schemes for linear and Hamilton–Jacobi equations, "Other Titles in Applied Mathematics" vol. 133, SIAM, Philadelphia, 2013

Refereed papers on international journals

[2] R. Ferretti, B. Larrouturou, *Error estimates for bounded–domain approximations of travelling–front solutions of a combustion model*, J. Nonl. Anal. TMA, **17** (1991), 1177–1200

[3] M. Falcone, R. Ferretti, *Discrete–time high–order schemes for viscosity solutions of Hamilton–Jacobi–Bellman equations*, Num. Math., **67** (1994), 315–344

[4] R. Ferretti, *Convergence of semidiscrete approximations to optimal control problems in Hilbert spaces: a counterexample*, Syst. Contr. Lett., **27** (1996), 125–128

[5] R. Ferretti, *High–order approximations of linear control systems via Runge–Kutta schemes*, Computing, **58** (1997), 351–364

[6] R. Ferretti, *Internal approximation schemes for optimal control problems in Hilbert spaces*, J. Math. Syst. Estim. Contr., **7** (1997), 115–118

[7] M. Falcone, R. Ferretti, *Convergence analysis for a class of semi–lagrangian advection schemes*, SIAM J. Num. Anal., **35** (1998), 909–940

[8] R. Ferretti, S. Finzi Vita, *On a variational approximation of superlinear indefinite elliptic problems*, Num. Funct. Anal. Opt., **19** (1998), 759–772

[9] I. Capuzzo Dolcetta, R. Ferretti, *Optimal stopping time formulation of adaptive image filtering*, Appl. Math. Opt., **43** (2001), 245–258

[10] M. Falcone, R. Ferretti, *Semi–Lagrangian schemes for Hamilton–Jacobi equations, discrete representation formulae and Godunov methods*, J. Comp. Phys., **175** (2002), 559–575

[11] R. Ferretti, *Convergence of semi–Lagrangian approximations to convex Hamilton–Jacobi equations under (very) large Courant numbers*, SIAM J. Num. Anal., **40** (2003), 2240–2253

[12] E. Carlini, M. Falcone, R. Ferretti, *An efficient algorithm for Hamilton–Jacobi equations in high dimension*, Comp. Visual. Sci., **7** (2004), 15–29

[13] E. Carlini, R. Ferretti, G. Russo, *A weighted essentially non–oscillatory, large time–step scheme for Hamilton–Jacobi equations*, SIAM J. Sci. Comp., **27** (2005), 1071–1091

[14] E. Carlini, M. Falcone, R. Ferretti, *A semi–Lagrangian scheme for the curve shortening flow in codimension 2*, J. Comp. Phys., **225** (2007), 1388–1408

[15] R. Ferretti, *Equivalence of semi–Lagrangian and Lagrange–Galerkin schemes under constant advection speed*, J. Comp. Math., **28** (2010), 461–473

[16] R. Ferretti, *A technique for high–order treatment of diffusion terms in semi–lagrangian schemes*, Comm. Comp. Phys., **8** (2010), 445–470

[17] E. Carlini, M. Falcone, R. Ferretti, *Convergence of a large time–step scheme for Mean Curvature Motion*, Interf. Free Bound., **12** (2010), 409–441

[18] E. Carlini, R. Ferretti, *A Semi–Lagrangian approximation for the AMSS model of image processing*, Appl. Num. Math., **73** (2013), 16–32

[19] R. Ferretti, *On the relationship between Semi–Lagrangian and Lagrange–Galerkin schemes*, Num. Math., **124** (2013), 31–56

[20] R. Ferretti, *Stability of some generalized Godunov schemes with linear high-order reconstructions*, Journal of Sci. Comp., **57** (2013), 213–228

[21] R. Ferretti, H. Zidani, *Monotone numerical schemes and feedback construction for hybrid control systems*, Journal of Optim. Theory Appl., **165** (2015), 507–531

[22] R. Ferretti, *Choosing between two fluctuating options: a hybrid control approach*, Appl. Math. Sci, **8** (2014), 139–146

[23] L. Bonaventura, R. Ferretti, *Semi-Lagrangian methods for parabolic problems in divergence form*, SIAM J. Sci. Comp., **36** (2014), A2458–A2477

[24] O. Bokanowski, M. Falcone, R. Ferretti, L. Grüne, D. Kalise, H. Zidani, *Value iteration convergence of ϵ-monotone schemes for stationary Hamilton–Jacobi equations*, Discr. Cont. Dyn. Syst. ser. A, **35** (2015), 4041–4070

[25] L. Bonaventura, R. Ferretti, *Flux-form Semi-Lagrangian methods for parabolic problems*, Commun. Appl. Ind. Math., **7** (2016), 53–70

[26] E. Carlini, R. Ferretti, *A Semi–Lagrangian scheme with radial basis approximation for surface reconstruction*, Comput. Visual. Sci., **18** (2017), 103–112

[27] S. Cacace, E. Cristiani, R. Ferretti, *Blended numerical schemes for the advection equation and conservation laws*, ESAIM Math. Model. Numer. Anal., **51** (2017), 997–1019

[28] R. Ferretti, A. Sassi *A semi-Lagrangian algorithm in policy space for hybrid optimal control problems*, ESAIM Contr. Opt. Calc. Var., **24** (2018), 965–983

[29] L. Bonaventura, R. Ferretti, *A fully semi-Lagrangian discretization for the 2D Navier–Stokes equations in the vorticity–streamfunction formulation*, Appl. Math. Comp., **323** (2018), 132–144

[30] R. Ferretti, A. Sassi, H. Zidani, *Error estimates for numerical approximation of Hamilton–Jacobi equations related to hybrid control systems*, Appl. Math. & Opt. (2018), DOI: `https://doi.org/10.1007/s00245-018-9515-8`

[31] P. Cannarsa, R. Ferretti, P. Martinez, *Null Controllability of a parabolic equation with interior degeneracy and one-sided control*, SIAM J. Contr. Optim., to appear

[32] R. Ferretti, A. Festa, *Optimal Route Planning for Sailing Boats: a Hybrid Formulation*, Journal of Optim. Theory Appl., to appear

Refereed conference proceedings

[33] M. Falcone, R. Ferretti, *High–order approximation for viscosity solutions of Hamilton–Jacobi–Bellman equations*, "Nonlinear variational problems and partial differential equations (Isola d'Elba, 1990)", 197–209, Pitman Res. Notes Math. Ser., 320, Longman Sci. Tech., Harlow, 1995

[34] R. Ferretti, *On a class of approximation schemes for linear boundary control problems*, "Boundary control and variation (Sophia Antipolis, 1992)", 233–240, Lecture Notes in Pure and Appl. Math., 163, Dekker, New York, 1994

[35] R. Ferretti, *Dynamic programming techniques in the approximation of optimal stopping time problems in Hilbert spaces*, "Partial differential equation methods in control and shape analysis (Pisa)", 153–162, Lecture Notes in Pure and Appl. Math., 188, Dekker, New York, 1997

[36] I. Capuzzo Dolcetta, R. Ferretti, *On an optimal stopping time formulation of adaptive signal filtering*, "Singular solutions and perturbations in control systems (Pereslavl-Zalessky, 1997)", 87–90, IFAC Proc. Ser., IFAC, Laxenburg, 1997

[37] M. Falcone, R. Ferretti, *A–priori estimates for a semi–lagrangian approximation scheme for the wave equation*, "Godunov methods (Oxford, 1999)", 293–300, Kluwer/Plenum, New York, 2001

[38] M. Falcone, R. Ferretti, T. Manfroni, *Optimal discretization steps for a class of semi–lagrangian schemes*, "Numerical methods for viscosity solutions and applications (Heraklion, 1999)", 95–117, Ser. Adv. Math. Appl. Sci., 59, World Sci. Publishing, River Edge, NJ, 2001

[39] M. Falcone, R. Ferretti, *Consistency of a large time–step scheme for mean curvature motion*, "Numerical Mathematics and Advanced Applications – ENUMATH 2001", 495–502, Springer, Milano, 2003

[40] E. Carlini, M. Falcone, R. Ferretti, *A time-adaptive Semi-Lagrangian approximation to Mean Curvature Motion*, "Numerical Mathematics and Advanced Applications – ENUMATH 2005", 732–739, Springer, Berlin, 2006

[41] R. Ferretti, G. Perrone, *On the stability of semi-Lagrangian advection schemes under finite element interpolation*, "Applied and industrial mathematics in Italy II", 339–350, Ser. Adv. Math. Appl. Sci., 75, World Sci. Publishing, Singapore, 2007

[42] E. Carlini, R. Ferretti, *A semi–Lagrangian approximation of min–max type for the stationary Mean Curvature equation*, "Numerical Mathematics and Advanced Applications – ENUMATH 2007", 679–686, Springer, Berlin, 2008

[43] E. Carlini, R. Ferretti, *A Semi–Lagrangian scheme for area-preserving flows*, IEEEXplore, proceedings of the conference "ICPR2012" (2012)

[44] G. Ferretti, R. Ferretti, O. Junge, A. Schreiber, *An adaptive multilevel radial basis function scheme for the HJB equation*, proceedings of the conference "IFAC 2017" (2017)

[45] L. Bonaventura, E. Calzola, E. Carlini, R. Ferretti, *A fully semi-Lagrangian method for the Navier–Stokes equations in primitive variables*, proceedings of the conference "Finite Elements in Fluids 2017" (2018)

[46] S. Cacace, R. Ferretti, Z. Rafiei, *Computation of Optimal Trajectories for Delay Systems: An Optimize-Then-Discretize Strategy for General-Purpose NLP Solvers*, in: M. Falcone, R. Ferretti, L. Grüne, W. McEneaney (eds.), "Numerical Methods for Optimal Control Problems", Springer–INdAM series n. 29, Springer, Milano, 2018

Refereed book chapters

[47] F. Bonghi, R. Ferretti, *Extracting information from chaos: a case in climatological analysis*, in: M. Emmer (ed.), "Imagine Math 2 – Between Culture and Mathematics" (2013), 173–180

[48] M. Falcone, R. Ferretti, *Numerical methods for Hamilton–Jacobi type equations*, in: R. Abgrall, C.-W. Shu (eds.), "Handbook of numerical methods for hyperbolic problems", North-Holland, Amsterdam, 2016, 603–626

[49] M. Falcone, R. Ferretti, *Numerical Techniques for Level Set Models: an Image Segmentation Perspective*, in: El-Baz, Jiang, Suri (eds.), "Biomedical Image Segmentation: Advances and trends", Taylor & Francis, Boca Raton, in print

Other unrefereed papers

[50] R. Ferretti, B. Larrouturou, *Estimations d'erreur pour des approximations tronquees de solutions d'onde simple d'un modele de combustion*, C. R. Academie des Sciences, **310** (1990), 249–252

[51] R Ferretti, *Numerical analysis of optimal control problemn in finite and infinite dimensions*, PhD thesis, Roma (1992)

[52] P. Cannarsa, R. Ferretti, A. Schiaffino, *Qualitative and numerical aspects in the optimal control of some biological systems*, proceedings of the Conference IMACS '97, Berlin, 1997

[53] R. Ferretti, *Equicontinuity of some large time-step approximations to convex Hamilton–Jacobi equations*, proceedings of HJB2000 workshop, Paris, 2000

[54] M. Falcone, R. Ferretti, *Editorial: Numerical methods for viscosity solutions and applications*, Appl. Numer. Math., **59** (2006), 1135.

Preprints

[55] R. Ferretti, M. Mehrenberger, *Stability of Semi-Lagrangian schemes of arbitrary odd degree under constant and variable advection speed*, preprint, under revision for Math. Comp.

[56] F. Bonghi, R. Ferretti, *Construction and validation of a fully symplectic code for a model of climatological interest*, preprint

[57] S. Cacace, R. Ferretti, A. Festa, *Hybrid differential games and their application to a match race problem*, preprint

Didactic material

[58] R. Ferretti, *Notes on the problems of minimization of functionals and their approximation*, didactic notes, Roma (1996)

[59] R. Ferretti, *Notes on FORTRAN 77 language for numerical applications*, didactic notes, Roma (1998)

[60] R. Ferretti, T. Isola and G. Tarantello, *Exercises of advanced Calculus*, Aracne editrice, Roma (1998)

[61] R. Ferretti, *Solved Numerical Analysis exercises*, didactic notes, on the web page `http://www.matfis.uniroma3.it/` (1999–2016)

[62] R. Ferretti, *Notes of the Numerical Analysis course*, didactic notes and e-book, on the web page `http://www.matfis.uniroma3.it/` (2002–2016)

[63] R. Ferretti, *Slides of the Numerical Analysis course (parts I–VI)*, electronic material, on the web page `http://www.matfis.uniroma3.it/` (2005–2016)

[64] R. Ferretti, *Notes on the "Astro-math" laboratory*, didactic notes, Roma (2006)