

CURRICULUM VITÆ

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Name: **Andrea CORLI**

Birth date: 22.8.1958

Nationality: Italian

University and address: Dipartimento di Matematica – Università di Ferrara, Via N. Machiavelli 35 – I-44100 Ferrara – Italy

Studies: Degree in Mathematics (Ferrara, 1981, 110/110 cum laude)

Istituto Nazionale di Alta Matematica (1981–82, 1982–83)

Ph.D. Program in Mathematics (Bologna, 1983–84, 1984–85, 1985–86, then interrupted for hiring at the University of Ferrara)

Grants: University of Rennes 1 (9.1989–9.1990, CNR)

University of Rennes 1 (9.1990–2.1991, CNR)

University of Nice (1.3.1997–21.3.1997, CNR)

Professional Career: Researcher (Faculty of Sciences, University of Ferrara, 1986)

Confirmed Researcher (Ferrara, 1989)

Associate Professor (Faculty of Sciences, University of Bari, 1998)

Associate Professor (Faculty of Engineering, University of Ferrara, 2001)

Main topics of research: Hyperbolic systems of conservation laws, nonlinear geometric optics.

Brief description of scientific research

My scientific research concerns mainly partial differential equations and is summarized in the following topics.

Linear differential equations in Gevrey classes. In a first series of papers I studied some properties of solutions to linear partial differential equations in Gevrey classes. The topics include the propagation of singularities of solutions, the analysis of hyperbolic-elliptic equations, the local solvability and hypoellipticity of operators.

Nonlinear geometric optics. In the framework of weakly nonlinear geometric optics I focused on nonlinear hyperbolic systems. In the case of a single space dimension the topics considered are the oscillatory analysis of solutions having a single discontinuity (shocks or contact discontinuities).

Systems of balance laws. My main contributions in this field are about the global existence of solutions to strictly hyperbolic systems of balance laws, in one space dimension. They refer to solutions having large total variation, their stability, uniqueness, existence of semigroups and the analysis of special systems of two conservation laws. Applications have been given to phase transitions, combustion waves, vehicular traffic flows, chromatography, crystal growth. In addition to these papers I contributed to the study of stratified solutions for hyperbolic systems in one space dimension and to the analysis of the stability of shock waves for second order systems, in several space dimensions.

Miscellanea. This include a study of a diffusion equation with free boundary arising in nanophased thin films and the development of an agent-based model for the spread and persistence of the classical swine fever in wild boar populations.

Scientific activity

Degree Thesis:

- *Su alcune congetture di E. de Giorgi sui sistemi sovradeterminati di equazioni alle derivate parziali*, (italian) advisor L. Cattabriga; Ferrara, 1981.

Publications in scientific journals:

1. *Un teorema di rappresentazione per certe classi generalizzate di Gevrey*, (italian) Boll. Un. Mat. Ital., Anal. Funz. Appl. (VI)IV-C(1) (1985), 245–257.
2. *Propagation of singularities for operators with constant coefficient hyperbolic-elliptic principal part*, Ann. Mat. Pura Appl. (IV) 147 (1987), 303–341 (with M. Cicognani).
3. *Gevrey solvability for hyperbolic operators with constant multiplicity*, in: L. Cattabriga et al. (ed.): *Recent Developments in Hyperbolic Equations, Longman 1988*, 290–304 (with L. Rodino).
4. *On local solvability in Gevrey classes of linear partial differential operators with multiple characteristics*, Comm. Partial Differential Equations 14 (1989), 1–25.
5. *On local solvability of linear partial differential operators with multiple characteristics*, J. Differential Equations 81 (1989), 275–293.
6. *The problem of local solvability of the linear partial differential equations*, in: Th. Rassias: *Constantin Carathéodory: An international tribute*, World Sci. Publ. Co. 1991, 142–180 (with L. Rodino).
7. *Life span of rapidly oscillating shock waves*, Rend. Sem. Mat. Univ. Pol. Torino. 51 (4) (1993), 397–411.
8. *Weak shock waves for second-order multi-dimensional systems*, Boll. Un. Mat. Ital. (7) 7-B (1993), 493–510.
9. *Weakly nonlinear geometric optics for hyperbolic systems of conservation laws with shock waves*, Asymptotic Anal. 10 (1995), 117–172.
10. *Perturbations à variation bornée d'un choc de grande amplitude*, C. R. Acad Sci. Paris Sér I Math. 321 (1995), 537–540 (with M. Sablé-Tougeron).
11. *Asymptotic analysis of contact discontinuities*, Ann. Mat. Pura Appl. 173(1997), 163–202.
12. *Perturbations of bounded variation of a strong shock wave*, J. Differential Equations 138 (1997), 195–228 (with M. Sablé-Tougeron).
13. *Stability of contact discontinuities under perturbations of bounded variation*, Rend. Sem. Mat. Fis. Univ. Padova 97 (1997), 35–60 (with M. Sablé-Tougeron).
14. *Continuous dependence in hyperbolic models of phase transitions*, STAMM '98, in: G. Iooss, O. Guès, A. Nouri (ed.): *Trends in Applications of Mathematics to Mechanics*, Chapman and Hall/CRC, 2000, 161–171 (with R. M. Colombo).
15. *Noncharacteristic phase boundaries for general systems of conservation laws*, Ital. J. Pure Appl. Math. 6 (1999), 43–62.

16. *Continuous dependence in conservation laws with phase transitions*, SIAM J. Math. Anal. 31 (1999) (1) 34–62 (with R. M. Colombo).
17. *The visco-capillarity kinetic condition for sonic phase transitions*, Ann. Univ. Ferrara, Sez. VII, Sc. Mat., 46 (2000), 181–196.
18. *Subsonic and sonic phase transitions*, Int. J. Differ. Equ. Appl. 1A (2000), no. 1, 31–39.
19. *Stratified solution to hyperbolic systems*, Workshop on Partial Differential Equations - in memory of L. Cattabriga, Ferrara, (1999). Ann. Univ. Ferrara, Sez. VII, Sc. Mat. Suppl. 45 (1999), 109–119 (with O. Guès).
20. *Kinetic stabilization of a sonic phase boundary*, Arch. Rat. Mech. Anal. 152 (2000), 1–63 (with M. Sablé-Tougeron).
21. *Stratified solutions of systems of conservation laws*, Trans. Amer. Math. Soc. 353 (2001), 2459–2486 (with O. Guès).
22. *Hypoellipticity and local solvability in Gevrey classes*, Math. Nach. 242 (2002), 5–16 (with A. Albanese and L. Rodino).
23. *Sonic phase transitions and Chapman-Jouguet detonations*, J. Differential Equations 184 (2002), 321–347 (with R. M. Colombo).
24. *On 2×2 conservation laws with large data*, NoDEA Nonlinear Differential Equations Appl. 10 (2003), 255–268 (with R. M. Colombo).
25. *Phase transitions and Chapman-Jouguet combustions*, in Thomas Hou, Eitan Tadmor (eds): “Hyperbolic Problems: Theory, Numerics, Applications”. Proceedings of the “Ninth International Conference on Hyperbolic Problems”, Pasadena, 2002. Springer, 2003, 463–472 (with R. M. Colombo).
26. *Sonic and kinetic phase transitions with applications to Chapman-Jouguet deflagrations*, Math. Mod. Meth. Appl. Sci. 27 (2004), 843–864 (with R. M. Colombo).
27. *Stability of the Riemann semigroup with respect to the kinetic condition*, Quart. Appl. Math. 62 (2004), 541–551 (with R. M. Colombo).
28. *A semilinear structure on semigroups in a metric space*, Semigroup Forum 68 (2004), 419–444 (with R. M. Colombo).
29. *The Riemann problem for reversible reactive flows with metastability*, SIAM J. Appl. Math. 65 (2004), 426–457 (with H. Fan).
30. *On a class of hyperbolic balance laws*, J. Hyperbolic Diff. Equations 1 (2004), 725–745 (with R. M. Colombo).
31. *Conservation versus balance laws in traffic flow*, in S. P. Hoogendoorn, S. Luding, P. H. L. Bovy, M. Schreckenberg, D. E. Wolf (eds.): “Traffic and Granular Flow '03”. Proceedings of the Conference “Traffic and Granular Flow '03”, Delft, 2003. Springer, 2005, 235–240 (with P. Bagnerini, R. M. Colombo and S. Pedretti).
32. *The Riemann problem for a three-phase flow*, Far East J. Appl. Math. 15 (2004), 243–256 (with H. Fan).
33. *Dynamic parameters identification in traffic flow modeling*, Discrete Contin. Dyn. Syst. (2005), suppl., 190–199 (with R. M. Colombo).

34. *On the role of source terms in continuum traffic flow models*, Math. Comp. Model. 44 (2006), 917–930 (with P. Bagnerini and R. M. Colombo).
35. *Well posedness for multilane traffic models*, Ann. Univ. Ferrara Sez. VII (N.S.) 52 (2006), 291–301 (with R. M. Colombo).
36. *On the operator splitting method: nonlinear balance laws and a generalization of Trotter-Kato formulas*. In: M. Padula and L. Zanghirati (eds.): “Hyperbolic problems and regularity questions”, Birkhäuser, 2006, 91–100 (with R. M. Colombo).
37. *On source terms in multilane traffic models*, Communications to SIMAI Congress 2 (2007), (with R. M. Colombo).
38. *Non local balance laws in traffic models and crystal growth*, Z. Angew. Mat. Mech. 6 (2007), 449–461 (with R. M. Colombo and M. Rosini).
39. *A hyperbolic model of multiphase flow*, in: S. Benzoni-Gavage and D. Serre (eds.): “Hyperbolic problems: Theory, Numerics, Applications”, Springer, 2008, 407–414 (with D. Amadori).
40. *On a model of multiphase flow*, SIAM J. Math. Anal. 40 (1), 134–166 (with D. Amadori).

Preprints:

1. *On a diffusion problem arising in nanophased thin films*, (2008), submitted (with V. Guidi and M. Primicerio).

In preparation:

1. *Global existence of solutions for a model of multiphase flow*, (with F. Asakura).
2. *A model of multiphase reactive flow*, (with D. Amadori).
3. *An agent-based model for classical swine fever in wild boar populations*, (with M. Fenati, E. Ganzaroli, V. Guberti, G. Zanghirati).

Announcements and Reports in Proceedings of Conferences, without editorial board:

1. *Onde d’urto deboli per sistemi del secondo ordine*, (italian) Proceedings 14th Congress U.M.I., Catania (1991).
2. *Perturbazioni BV di onde d’urto e discontinuità di contatto*, (italian) Proceedings 15th Congress U.M.I., Padova (1995).
3. *A stability criterion for phase boundaries*, Proceedings 3rd Congress S.I.M.A.I., Salice Terme (1996).
4. *Hyperbolic phase-mixing flows: a global existence result for large data*, Proceedings of the mini-workshop: Hyperbolic aspects of phase transition dynamics, Oberwolfach Reports (2008) (in print).

Talks in Conferences:

1. *La condizione di Kreiss-Lopatinski per una classe di sistemi iperbolici del secondo ordine*, “Partial Differential Equations”, Bologna, 1991.
2. *Onde d’urto deboli per sistemi del secondo ordine*, “14th National Congress, Italian Mathematical Union”, Catania, 19–25.9.1991.
3. *Discontinuità di contatto rapidamente oscillanti*, “IperPi”, Pisa, 1993.
4. *Life span of rapidly oscillating shock waves*, “Partial Differential Equations”, Torino, 1993.
5. *Perturbazioni BV di onde d’urto e discontinuità di contatto*, “14th National Congress, Italian Mathematical Union”, Padova, 11–16.9.1995.
6. *Esistenza globale di onde d’urto di grande ampiezza*, “IperBo” (Giornate di studio su problemi differenziali iperbolici), Bologna, 1995.
7. *A stability criterion for phase boundaries*, “3rd Congress S.I.M.A.I.”, Salice Terme, 27–31.5-1996.
8. *A condition of stability for systems of hyperbolic conservation laws involving phase boundaries*, “Partial Differential Equations”, Ferrara, 1996.
9. *Il semigruppato di Riemann standard per le transizioni di fase*, “IperAq97”, L’Aquila, 11–13.11.1997.
10. *Global existence and continuous dependence of phase transitions in hyperbolic conservation laws*, “STAMM ’98 (International Symposium on Trends in Applications of Mathematics to Mechanics)”, Nice, 25–28.5.1998.
11. *Stratified solutions to balance laws*, “Theoretical and numerical aspects of hyperbolic systems”, Heraklion, 1998.
12. *Solutions to balance laws with unbounded total variation*, “Seminar on systems of conservation laws - Stability of solutions”, Aachen, August 1998.
13. *Soluzioni a variazione non limitata di leggi di bilancio*, “IperPv98”, Pavia, 1–3.10.1998.
14. *Global existence with the Glimm scheme of phase boundaries* “Workshop on Phase Transitions”, Paris, 1999.
15. *Local existence of stratified solutions to systems of balance laws*, “Workshop on Partial Differential Equations - in memory of L. Cattabriga”, Ferrara, 11–13.10.1999.
16. *The visco-capillarity kinetic condition for sonic phase transitions*, “Navier-Stokes equations and related nonlinear problems”, Ferrara, 13–17.9.1999.
17. *Subsonic and sonic phase transitions*, “Tenth International Colloquium on Differential Equations”, Plovdiv, 18–23.8.1999.
18. *Transizioni di fase soniche e detonazioni di Chapman-Jouguet*, “IperBs00”, Brescia, 30.11–2.12.2000.
19. *Sonic phase transitions and Chapman-Jouguet detonations*, “Dynamics of phase transitions and nonclassical waves”, Kirchzarten, 7–9.5.2001.

20. *Hyperbolic phase transitions and Chapman-Jouguet detonations*, “International Conference on Nonlinear Evolutionary Partial Differential Equations”, Huang Shan, 10–15.6.2001.
21. *Ipoellitticità e risolubilità locale in spazi di Gevrey*, “IperCt01”, Catania, 22–24.11.2001.
22. *Phase transitions and Chapman-Jouguet combustion waves*, “Workshop on Partial Differential Equations”, Ferrara, 6–7.2.2002.
23. *Phase transitions and Chapman-Jouguet combustions*, “Hyp2002”, Pasadena, 25–29.3.2002.
24. *Stability of solutions with respect to kinetic criteria*, “Workshop on kinetic criteria for hyperbolic conservation laws”, Cambridge, Isaac Newton Institute, 10–12.2.2003.
25. *Some recent results on phase transitions*, “Leggi di conservazione iperboliche: recenti risultati e prospettive di ricerca”, Bologna, 3–4.6.2003.
26. *The Riemann problem for a three-phase flow*, “Directions in partial differential equations”, Ferrara, 6–9.11.2003.
27. *A class of hyperbolic systems of balance laws*, “Third meeting on Hyperbolic Conservation Laws: Recent results and research perspectives ”, Trieste, 21–22.6.2004.
28. *Existence and stability results for a class of hyperbolic balance laws*, “IperPisa”, Pisa, 20–22.10.2004.
29. *Well-posedness in the large for a class of hyperbolic systems of balance laws*, “SIAM Conference on Analysis of Partial Differential Equations”, Houston, 6–8.12.2004.
30. *The operator splitting method: nonlinear hyperbolic balance laws and a generalization of Trotter-Kato formulas*, “Partial Differential Equations and Applications”, Ferrara, 31.3–3.4.2005.
31. *A dynamical approach to phase transitions*, “Mathematical Modeling in Continuum Mechanics and Structures ”, Alghero, 10–14.5.2005.
32. *Well-posedness for single and multilane vehicular traffic flow*, “Around Hyperbolic Systems”, Ferrara, 15–17.6.2005.
33. *Rigorous results for multilane traffic flows*, “Traffic Flow Modeling and Management”, Brescia, 19–20.1.2006.
34. *Source terms in multilane traffic flows*, “VIII SIMAI Conference”, Baia Samuele, 22–26.5.2006.
35. *Global existence of solutions for a model of multiphase flow*, “Eleventh International Conference on Hyperbolic Problems - Theory, Numerics, Applications”, Lyon, 17–21.7.2006.
36. *Global existence results for a model of phase transition with phase mixing*, “Joint International Meeting UMI - DMV ”, Perugia, 18–22.6.2007.
37. *Hyperbolic phase-mixing flows: a global existence result for large data*, “Fifth meeting on Hyperbolic Conservation Laws: Recent results and Research perspectives ”, SISSA, Trieste, 21–22.6.2007.

38. *Non-local traffic flow models*, “Traffic Flow: a Microscopic and Macroscopic Perspective”, Hamburg, 11–12.10.2007.
39. *Hyperbolic phase-mixing flows: a global existence result for large data*, “Mini-Workshop: Hyperbolic aspects of phase transition dynamics”, Oberwolfach, 24.2–1.3.2008.

Posters in Conferences:

1. P. Bagnerini, R. M. Colombo, A. Corli and S. Pedretti: *Conservation versus balance laws in traffic flow*, Delft, “TGF03 - Traffic and granular flow 2003”, October 1–3 2003.

Lecture Notes:

1. *Esercizi di Istituzioni di Analisi Superiore*, (italian) Lecture Notes, Ferrara, 1995–96 (with R. Agliardi and M. Cicognani).
2. *Esercizi di Analisi Matematica I*, (italian) Ferrara, 2004 (con A. Ascanelli),
<http://web.unife.it/utenti/andrea.corli/>
3. *Esercizi di Analisi Matematica II*, (italian) Ferrara, 2004 (con A. Ascanelli),
<http://web.unife.it/utenti/andrea.corli/>
4. *Esercizi di Complementi di Analisi Matematica*, (italian) Ferrara, 2004 (con A. Ascanelli),
<http://web.unife.it/utenti/andrea.corli/>
5. *Analisi Matematica: Esercitazioni con MATLAB*, (italian) Ferrara, 2006 (con N. Cavallini),
<http://web.unife.it/utenti/andrea.corli/>

Main invitation abroad:

- University of Rennes 1 (march 1992)
- University of Nice (april 1994)
- University of Rennes 1 (15 days, june 1997)
- University of Aachen (15 days, august 1998)
- Chinese Universities (Jiao Tong University and Fudan University, Shanghai; Wuhan University, Wuhan; Tsing Hua University and Peking University, Peking; may 2000)
- Max Planck Institut – Leipzig (june 2000)
- Shanghai Jiao Tong University (15 days, may 2001)
- Isaac Newton Institute for Mathematical Sciences, Cambridge (february 2003)
- Osaka Electro-Communication University (18 days, september 2007)

Participation to schools and courses:

- “Partial Differential Equations”, july 1982; Scuola Normale Superiore, Cortona. Teachers: L. Cattabriga, M. Tsuji.
- “Harmonic Analysis”, july 1983; Scuola Normale Superiore, Cortona. Teachers: M. Cowling, R. Zimmer.
- “Microlocal Analysis and Applications”, 3–11.7.1989; Montecatini Terme. Teachers: J.M. Bony, G. Grubb, L. Hörmander, H. Komatsu, J. Sjöstrand.
- “Winter School on Transport Equations and Control Theory for Partial Differential Equations”, 12–17.1.2004; Bressanone. Teachers: F. Bouchut, R. Triggiani.
- “Lectures on Transport Equations and Multi-D Hyperbolic Conservation Laws”, 17–20.1.2005; Bologna. Teachers: L. Ambrosio, C. De Lellis, F. Otto.
- “Lectures on Boltzmann equation and fluiddynamic limits”, 12–17.6.2006; SISSA, Trieste. Teachers: L. Saint-Raymond, C. Villani.

Other scientific activities:

1. Local responsible of the european project *Geometrical Optics and Related Topics*, 1994–96. Universities of Bordeaux, Bruxelles, Ferrara, Pisa, Rennes, Torino (coordinator Nicolas Lerner).
2. Member of the scientific committee and of the organizing committee of the Conference *IperFe 2002*, held in Ferrara, 2002.
3. Co-organizer (with Ch. Rohde) of the Minisymposium *Phase Transitions*, at the Annual Scientific Conference of the “Gesellschaft für Angewandte Mathematik und Mechanik”, 2003, Abano Terme - Padua.
4. Member of the academic staff for the Ph.D. in Engineering, curriculum Mathematics, years 2002–2005. Member of the academic staff for the Ph.D. in Mathematics and Computer Science, years 2006–2008.
5. Member of the center “Mathematics for Technology - Math4Tech” University of Ferrara.
6. Representant for the University of Ferrara of UMI (Unione Matematica Italiana, Italian Mathematics Association) commission of mathematics teachers in Engineering Faculties (since October 2007).

Membership to scientific projects:

1. Participant to the European Project *HCL, Hyperbolic Systems of Conservation Laws*, October 1998–September 2000 (coordinator Pierangelo Marcati).
2. Participant to the European Project *HYPKE, Hyperbolic and Kinetic Equations*, August 2002–July 2004 (coordinator Norbert Mauser).
3. Participant to the italian project *Analysis of hydrodynamical models of vehicular traffic flows*, sponsored by GNAMPA, INDAM, 2003 (coordinator Roberto Natalini).
4. Participant to the italian project *Traffic flows: models and control*, sponsored by GNAMPA, INDAM, 2004 (coordinator Rinaldo Colombo).

5. Participant to the italian project *Nonlinear waves - Applications to compressible and incompressible fluids and to transport of charged particle*, sponsored by GNAMPA-GNFM-GNCS, INDAM, 2004 (coordinator Roberto Natalini).
6. Participant to the italian project *Nonlinear waves*, sponsored by GNAMPA, INDAM, 2005 (coordinator Corrado Lattanzio).
7. Participant to the PRIN italian project *Fluid dynamics and conservation laws*, 2005, (coordinator Paolo Secchi).
8. Participant to project *Multifunction nanophysics materials for sensoristics*, 2006 (coordinator Giuliano Martinelli), admitted to second level financing on university (Ferrara) budget.

Main scientists invited at the University of Ferrara:

1. Monique Sablé-Tougeron (two weeks, 1995; three weeks 1996);
2. Guy Métivier (two weeks, 1997);
3. Olivier Guès (two weeks, 1998);
4. Sylvie Benzoni-Gavage (two weeks, 1999);
5. Ya-Guang Wang (one month, 2000);
6. Fumioki Asakura (one week, 2001; one week 2002);
7. Haitao Fan (two weeks, 2002);
8. Harumi Hattori (one month, 2004);
9. Fumioki Asakura (two weeks, 2006).

Advisor of Degree Theses:

1. S. Maltoni: *Regolarizzazione di problemi mal posti*, (italian) 1998.
2. E. Gresi: *Aspetti della regolarizzazione in tomografia Compton*, (italian) 1998, co-advisors C. Bonifazzi, G. Maino. The results of this thesis have been exposed to the SIMAI Congress, 1998.
3. C. Monesi: *La trasformata di Wigner*, (italian), 1998.

Other Students:

1. A. Museux (Université Nice); post-doc grant provided by project *HYKE*, October 2002–July 2003.
2. P. Bagnerini; italian *Research Chequer*, January–July 2003 (co-tutoring L. Pareschi).