Curriculum vitæ

Nicola Guglielmi

General

Current position:

Professor (Italian Professore Ordinario),
Dipartimento di Ingegneria, Scienze dell'Informazione e Matematica,
Chair of Numerical Analysis,
University of L'Aquila, Italy.

Associate Editor of SIAM Journal on Numerical Analysis.

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Education

High school	Maturità scientifica, Liceo Righi di Bologna (final mark 60/60)
Laurea	Electronic Engineering, University of Bologna, 4/12/1991 (summa cum laude)
PhD	Computational Mathematics, University of Padova, 12/11/1996

Laurea dissertation:

Pattern recognition for the quality analysis of mechanical machined parts: a neural approach to the recognition problem. (Riconoscimento di pattern per l'analisi di qualità di pezzi meccanici: un approccio neurale al problema del riconoscimento.) Advisor: Professor G. Baccarani (Università di Bologna).

PhD dissertation

On the stability of one step methods for the numerical solution of delay differential equations. (Sulla stabilità dei metodi a un passo per la soluzione numerica di equazioni differenziali con ritardo). Advisor: Professor A. Bellen (Università di Trieste).

Positions after graduation

From 3/92 to 2/93	**Fellowship** S.G.S. Thomson Company — D.E.I.S., Università di Bologna
From 2/93 to 1/96	**PhD student** Dipartimento di Matematica Università di Padova
From 1/97 to 12/97	**Post-doctoral fellow** Dipartimento di Scienze Matematiche Università di Trieste
From 1/98 to 10/01:	**Research Associate** in Numerical Analysis Faculty of Sciences MM.FF.NN. Università di L'Aquila
From 11/01 to 7/05:	**Associate Professor** in Numerical Analysis Faculty of Sciences MM.FF.NN. Università di L'Aquila
From 7/05 to 2/06 :	**Associate Professor** in Numerical Analysis Faculty of Biotechnologies Università di L'Aquila
From 3/06 to present:	**Full Professor** in Numerical Analysis Department of Engineering, Information Science and Mathematics Università di L'Aquila

Scientific interests

Numerical methods for delay and functional differential equations, stability properties, stiff problems, development of a code for the numerical integration of stiff and implicit systems of delay differential equations, stiff partial differential equations, numerical linear algebra, joint spectral radius of sets of matrices, matrix perturbation theory, pseudospectral and stability measures, mathematical physics, singularly perturbed problems, discontinuous differential equations and their regularization, non-smooth optimization, engineering applications.

Fellowships

1992	C.N.R. Program in Bioelectronics, University of Bologna - SGS Thomson company
1993-1996	University of Padova, PhD fellowship in mathematics
1997	University of Trieste, Post-doc fellowship in mathematics

Honors and Awards

1) Selected communication at Volterra Centennial meeting, Tempe (USA), 1996. (young researcher prize of $300) (see C4)).

2) New Talent Award: SciCADE-99 meeting, Fraser Island (Australia), 1999. Awarded plenary lecture (see P1)).

3) Selected lecture in numerical analysis at UMI-99 workshop (convegno dell'Unione Matematica Italiana) (see C13)).

Recent grants and research projects

- 2014 INDAM GNCS Project: **Numerical analysis of differential infinite-dimensional and discontinuous problems** (8000 Euro) (as Scientific Responsible).
- 2013 INdAM GNCS Project: **Numerical methods for evolution problems: infinite dimensional functional equations and discontinuous differential equations** (7500 Euro) (as Scientific Responsible)
- 2012 InDAM: **Workshop: Recent trends in delay differential equations: models, theory and numerics, June 2012, Scuola Normale Superiore, Cortona** (15000 Euro) (as Director)
- 2010 Fondazione Carispaq: **High Performance Computation Cluster** (20000 Euro) (as Scientific Responsible)
- 2007-9 MIUR/COFIN Project: **Numerical methods for delay and fractional differential equations** (17000 Euro) (as Scientific Responsible of the Research Unit of the University of L'Aquila)).

  The whole project entitled **Numerical methods for ordinary differential equations** (67000 Euro) is coordinated by Professor A. Bellen (Universita' of Trieste).
- 2007: Internationalization Project - University of L'Aquila: **Systems with several preferred states: study of singular behavior due to lack of convexity** (20000 Euro) (coordinated by Prof. G. Fusco (Universita' dell'Aquila, Italy)
- 2006 INDAM Project: **Mathematical modelling and numerical analysis of quantum systems with applications to nanosciences** (38000 Euro) (coordinated by Prof. A. Sacchetti (Universita' di Modena e Reggio Emilia, Italy))
- 2005-6 MIUR/COFIN Project: **Numerical methods for functional differential equations** (42000 Euro) (coordinated by Prof. M. Zennaro (Universita' di Trieste, Italy))
- 2004 Progetto Intergruppo INDAM: **Numerical methods and mathematical software for evolution problems** (coordinated by Prof. M. Zennaro (Universita' di Trieste, Italy))
- 2004 Intergroup INDAM Project: **Integration of complex systems in biomedicine: models and simulation** (coordinated by Prof. A. Quarteroni (Politecnico di Milano, Italy e EPFL Lausanne, Switzerland))
- 2003 GNCS Project: **Problems and interfacing numerical methodologies for ordinary and partial differential equations.** (coordinated by Prof. M. Zennaro (Universita' di Trieste, Italy))

- 2003 Intergroup INDAM Project: **Methods and mathematical models in population dynamics** (coordinated by Prof. M. Iannelli (Universita' di Trento, Italy)).

Referee's activity

- Reviewer for the Mathematical Review.
- Refereed hundreds of papers for the following journals.

  SIAM Journal on Numerical Analysis, SIAM Journal on Scientific Computing, SIAM Journal on Matrix Analysis and Applications, Numerische Mathematik, Numerical Algorithms, Advances in Computational Mathematics, Mathematics of Computation, IMA Journal of Numerical Analysis, Journal of Applied and Numerical Mathematics, BIT, Computers and Mathematics with Applications, Applied Numerical Mathematics, Calcolo, International Journal of Computer Mathematics, International Journal of Control, Journal on Differential Equations, and others.

Teaching

Undergraduate: Calculus, Programming, Basic numerical analysis, Advanced numerical analysis, Linear algebra and Laboratory of Biomathematics at the University of L'Aquila. Numerical calculus and Mathematical methods for engineers at the University of Trieste.

Laurea magistralis: Advanced numerical analysis, Numerical analysis of differential equations, Stiff problems.

PhD programs: Implicit integration of differential equations (L'Aquila), Numerics of functional differential equations (University of Bari, 2003 and University of Modena, 2006), Joint spectral radius: theory and applications (Universities of Bologna, 2003 and Padova, 2005), Spectral properties of families of matrices and application to the stability analysis of linear dynamical systems (University of Roma La Sapienza, 2011). Spectral properties of sets of matrices, pseudospectra and applications (PhD and Master Program, University of Zürich, 2013).

Summer schools: Continuous methods for ordinary differential equations (Perugia, InDAM students, 2003), Numerical integration of delay differential equations (Dobbiaco Summer school, Dobbiaco, 2006), Numerical methods for discontinuous ODEs (Dobbiaco Summer school, Dobbiaco, 2009), Stability of linear problems: joint spectral radius of sets of matrices (CIME-EMS Summer school, Cetraro, 2011).

Administrative reponsibilities

- Member (since 2002) of the didactic committee (Italian commissione didattica) of the degree course in Mathematics.
- Till 2006 President of the orientation commettee for the Mathematical area at the University of L'Aquila.
- President of the development commitee (Italian commissione programmazione e sviluppo) for the faculty of Biotechnology at the University of L'Aquila.
- Member of the PhD council of the Department of Mathematics.

Organization of Conferences and Schools

(1) Member of the organizing committee of the International Conference "SciCADE97" (Grado (Italy), 15 September– 19 September 1997).

(2) Organizer of the minisymposium **Delay differential equations**, at the International Conference "SciCADE03" (Trondheim (Norway), 30 June– 4 July 2003).

(3) Member of the organizing committee of the International Conference "Sixth IFAC Workshop on Time-Delay Systems", (L'Aquila (Italy), 10 July– 12 July 2006) (www.diel.univaq.it/IFACTDS06).

(4) Organizer of the minisymposium **Delay differential equations**, at the International Conference "SciCADE07" (Saint Malo (Francia), 9 July– 13 July 2007) (scicade07.irisa.fr).

(5) Member of the scientific committee of the International Conference "Seventh IFAC Workshop on Time-Delay Systems" (Nantes (Francia), 17 September – 19 September 2007) (www2.irccyn.ec-nantes.fr/TDS07).

(6) Member of the organizing committee of the Workshop "Recent advances in Biomathematics" (L'Aquila (Italy), 31 January– 1 February 2008).

(7) Director (with L. Dieci) of the CIME-EMS Summer School in applied mathematics "Current challenges in stability issues for numerical differential equations" (Cetraro, Italy, 27 June – 1st July 2011).

(8) Organizer (with A.R. Humphries) of the minisymposium "Numerical methods for delay differential equations", at the International Conference "ICIAM 2011" (Vancouver, Canada, 18-22 July 2011).

(9) Organizer of the INdAM Meeting "Recent trends in delay differential equations: models, theory and numerics" (Cortona, Italy, 4-8 June 2012).

10) Organizer (with P. Benner) of the minisymposium "Numerical methods for linear and nonlinear eigenvalue problems" ("ENUMATH 2013", Lausanne (Switzerland), 26-30 August 2013).

Editorial activity

2014 – Associate editor of the **Applied Mathematics and Computation.** (http://ees.elsevier.com/amc/).

2013 – Associate editor of the **SIAM Journal on Numerical Analysis.** (http://www.siam.org/journals/sinum.php).

2010 – Associate editor of the **Journal of Applied Mathematics.** (http://www.hindawi.com/journals/jam/).

2007 – Associate editor of the International Journal **Bollettino della Matematica Italiana, New Series 2008.** (http://bumi.dm.unibo.it).

Some further activities

- Member of the committee of the PhD program in Mathematics of the University of L'Aquila, 2004–present.
- Member of the committee of the PhD program in Computational Fluiddynamics of the University of Trieste, 2005–present.
- Member of the didactic committee of the degree program in Mathematics of the University of L'Aquila, 2002–present.
- Member of the final committee of the PhD in Mathematics at the University of Catania, 20 October 2006.
- Member of the final committee of the PhD in "Matematica Computazionale" at the University of Padova, 25 November 2006.
- Member of the final committee of the PhD in "Ingegneria e Modellistica Fisico-Matematica - XIX ciclo" at the University of L'Aquila, 30 January 2007.
- Member of the final committee of the PhD in Mathematics - VIII ciclo, Nuova serie - at the University of Salerno, 19 March 2010.
- Member of the final committee of the PhD in Mathematics - VIII ciclo, Nuova serie - at the University of Padova, 18 November 2011.

Scientific activity

Main areas

1. Computation of the joint spectral radius of a family of matrices and applications.
2. Numerical methods for ordinary and functional differential equations.
3. Computation of pseudospectra and pseudospectral measures; perturbation theory for eigensystems.
4. (Structured) Linear algebra and robust control. Low rank manifold methods.
5. Singularly perturbed problems.
6. Software development of a code for *stiff* retarded differential equations (RADAR5).
7. Time integration of gradient systems associated to regularized forward-backward parabolic partial differential equations.

Former PhD students

- Antonio Cicone, Dottorato in Matematica - Università di L'Aquila, 2007–2010 (advisor). (Now at Georgia Institute of Technology, Atlanta, USA).
- Manuela Manetta, Dottorato in Matematica - Università di L'Aquila, 2009–2012. (advisor) (Now at Georgia Institute of Technology, Atlanta, USA).
- Linda Laglia, Dottorato in Matematica - Università di L'Aquila, 2010–2013. (advisor).

Current PhD students

- Mutti Ur Rehman, PhD in Mathematics - Gran Sasso Institute L'Aquila, 2014–

Main visits at foreign institutions

1996 4–6 June: IBM T.J Watson Research Center, Yorktown-Heights (NY) (invited by Dr. Albert Ruehli)

1997 1–25 June: IBM T.J Watson Research Center, Yorktown-Heights (NY) (invited by Dr. Albert Ruehli)

1998 13–23 May: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer)

1999 6 November–4 December: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer)

2000 27 February–1 April, 11 June–1 July, 23 September–7 October: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer)

2002 30 June–5 July: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer)

2002 8 July–20 July: Department of Mathematics, Universität Bremen (invited by Professor Fabian Wirth)

2003 7 January–12 January: Department of Mathematics, Universität Tübingen (invited by Professor Christian Lubich)

2003 23 November–20 December: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer)

2004 11 January–20 March: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer)

2004 12 September–24 September: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer)

2004 6 December–21 December: Bolyai Institut of University of Szeged, Hungary (invited by Professor Laszlo Hatvani)

2005 18 April–23 April: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer)

2007 7 September–22 September: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer)

2008 15 May–18 May: Department of Mathematics, Michigan State University (invited by Professor P. Bates).

2008 21 May–23 May: School of Mathematics, Emory University (invited by Professor M. Benzi).

2009 15 January–12 March: Courant Institute, New York University (invited by Professor Michael Overton).

2009 12 March–10 April: Department of Mathematics, Mc Gill University (invited by Professor T. Humphries).

2009 1 May–30 June: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer).

2009 15 August–15 December: School of Mathematics, Georgia Tech (invited by Professor Luca Dieci as visiting professor teaching a class).

2010 3 May–8 May: Department of Mathematics, Universität Tübingen (invited by Professor Christian Lubich)

2010 30 Jume–12 July: ETH Zürich (invited by Professor Daniel Kressner)

2010 4 September–1 October: Courant Institute, New York University (invited by Professor Michael Overton).

2011 7 February–9 March: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer).

2011 16 May–20 May: Department of Mathematics, Universität Tübingen (invited by Professor Christian Lubich).

2011 26 October–29 October: Department of Mathematics, Technische Universität Berlin (invited by Professor Volker Mehrmann).

2012 29 October–4 November: Department of Computer Science, University K.U. Leuven (invited by Professor Wim Michiels).

2012 16 January–3 February: Mathematisches Forschungsinstitut Oberwolfach, Research in pairs program with Daniel Kressner (EPFL, Lausanne) and Christian Lubich (Universität Tübingen).

2012 19 March–30 April: Section de Mathématiques, Université de Genève (invited by Professor Ernst Hairer).

2012 24 September–28 September: EPFL Lausanne (invited by Professor John Maddocks).

2013 15 September–15 December: Institute of Mathematics, University of Zürich (invited by Professor Stefan Sauter as visiting professor teaching a class).

Seminars and Conference Presentations

Plenary Lectures

P1) **Novel results of numerical stability for delay differential equations**. Lecture for the conferring of the New Talent Award presented at the International Conference "SciCADE99", (Fraser Island, Australia, 9–13 August 1999).

P2) **Automatic detection of breaking points in delay differential equations**.
"2nd International Workshop on the Technological Aspects of Mathematics", (Montecatini, Italy, 1–3 April 2004).

P3) **Numerical delay differential equations**.
"Joint AARMS-CRM Workshop: Recent Advances in Functional and Delay Differential Equations", (Halifax, Canada, 1–5 November 2007).

P4) **Joint spectral radius: theory, applications and computation**.
"Congress of the Gruppo Nazionale di Calcolo Scientifico 2007", (Montecatini, Italy, 4–6 February 2008).

P5) **On singular perturbations of neutral delay differential equations**.
"Conference on Scientific Computing and Differential Equations celebrating Ernst Hairer's 60th birthday" (Geneva, June 17-20, 2009).

P6) **Asymptotic expansions for regularized state dependent neutral delay differential equations**. "Workshop on delay differential equations" (Bristol, 7 – 9 September 2009).

P7) **Regularization of discontinuous ODEs with application to neutral delay differential equations**. 12th Seminar "NUMDIFF" on Numerical Solution of Differential and Differential-Algebraic Equations (Halle, 14 - 18 September 2009).

P8) **Regularization approaches for discontinuous differential equations** 'Structural dynamical systems: Computational Aspects SDS2010" (Capitolo, 8 - 11 June 2010).

P9) **Regularization of neutral delay di.erential equations with several delays**. "Structural dynamical systems: Computational Aspects SDS2012" (Capitolo, Italy, 12-15 June 2012).

P10) **Computing the upper and the lower Lyapunov exponent of a switched linear system**. "Structural dynamical systems: Computational Aspects SDS2012" (Capitolo, Italy, 12-15 June 2012).

P11) **A novel method to approximate structured stability radii**. "ICNAAM 2013" (Rodos, Greece, 21-27 September 2013).

Invited Lectures

C1) **Metodi Numerici per l'Analisi Stazionaria di Circuiti Analogici Nonlineari** (in Italian).
Presented at the Congress "Convegno Nazionale di Analisi Numerica", (Montecatini, Italy, 27–29 April 1994).

C2) **Numerical Methods for the Simulation of Nonlinear Circuits in the Frequency Domain**.
Presented at the International Congress "SIMAI'94", (Capri, Italy, 30 May–3 June 1994).

C3) **Stability properties of Numerical Methods for Delay Differential Equations**.
Presented at the International Congress "ODE to NODE", (Geiranger, Norway, 19–22 June 1995).

C4) **On the Stability Properties of Runge–Kutta Methods for Delay Differential Equations**.
Presented at the International Congress "Volterra Centennial", (Tempe, Arizona (USA), 27–30 May 1996).

C5) **Contractivity and asymptotic stability of linear delay differential systems of the neutral type**.
Presented at the International Congress "SciCADE97", (Grado, Italy, 15–19 September 1997).

C6) **Contractivity and stability of numerical methods for systems of neutral delay differential equations**.
Presented at the International Congress "NMDE98", (Coimbra, Portugal, 25–27 February 1998).

C7) **Sulla contrattività e la stabilità dei metodi numerici per sistemi di equazioni differenziali neutrali**.
Presented at the Congress "Convegno Nazionale di Analisi Numerica", (Montecatini, Italy, 15 April 1998).

C8) **On the Stability Properties of Runge–Kutta Methods for Delay Differential Equations**.
Presented at the Section de Mathématiques, Université de Genève, (Geneva, Switzerland, 19 May 1998).

C9) **Contractivity and stability of numerical methods for systems of neutral delay differential equations**.
Presented at the International Congress "SIMAI-1998", (Taormina, Italy, 1–5 June 1998).

C10) **Sulla stabilità dei metodi Runge-Kutta nella soluzione di equazioni con ritardo**.
Presented at the Congress "Workshop Metodi numerici per ODEs", (Bari, Italy, 9–10 June 1998).

C11) **The joint spectral radius of families of matrices with applications to stability theory**.
Short course of 3 lectures presented (jointly M. Zennaro) at International Congress "ANODE-99", (Auckland, New Zealand, 16–20 August 1999).

C12) **Sulla stabilità dei metodi numerici per equazioni differenziali con ritardo**.
Selected communication at the Congress "UMI-99", (Napoli, Italy, 13–18 September 1999).

C13) **Families of matrices and polytope norms with applications to stability analysis of numerical ODE methods**.
Presented at the International Congress "Workshop on stability", (Frostavallen, Sweden, 11–15 October 1999).

C14) **On the instabilities of Runge-Kutta methods when applied to retarded differential equations**.
Presented at the International Congress "British Applied Mathematics Conference at the Millennium, 2000", (Manchester, England, 25–28 April 2000).

C15) **The numerical solution of stiff delay differential equations**.
Presented at the International Congress "WCNNA 2000", (Catania, Italy, 17–26 July 2000).

C16) **Polytope norms for families of matrices with application to stability of numerical methods for ODEs**.
Presented at the International Congress "BIT Anniversary Conference", (Lund, Sweden, 9–12 August 2000).

C17) **Developing a code for stiff delay differential equations**.
Presented at the International Congress "IFAC conference on Time Delay Systems", (Ancona, Italy, 11–13 September 2000).

C18) **Sviluppo di un codice per equazioni con ritardo di tipo stiff**.
Presented at the Congress "Convegno GNIM", (Bertinoro, Italy, 11–13 December 2000).

C19) **Implementation issues in the numerical solution of stiff delay differential equations**.
Presented at the International Congress "SciCADE 2001", (Vancouver, Canada, 29 July–3 August 2001).

C20) **Radau IIA methods for the numerical integration of stiff delay differential equations**.
Presented at the International Congress "Numerical methods for ODEs", (Peschici, Italy, 17–20 September 2001).

C21) **A software tool for the numerical integration of stiff retarded differential equations**.
Presented at the International Congress "SIMAI 2002", (Chia Laguna, Italy, 27–31 May 2002).

C22) **On the limit products of a family of matrices**.
Presented at the International Congress "Conference on Scientific Computation celebrating Gerhard Wanner's 60th birthday", (Geneva, Switzerland, 26–29 June 2002).

C23) **Polytope norms of families of matrices with application to numerical stability analysis**.
"Numerical Analysis Seminar, University of Hamburg", (Hamburg, Germany, 11 July 2002).

C24) **Open issues in devising software for the numerical solution of implicit delay differential equations**.
"International Workshop on the Technological Aspects of Mathematics", (Bari, Italy, 18-20 December 2002).

C25) **Stability of Θ-methods for the variable coefficient pantograph equation**.
"Numerical Analysis Seminar, University of Tübingen", (Tübingen, Germany, 9 January 2003).

C26) **Sulla stabilità dei Θ-metodi per equazioni con ritardo proporzionale**.
Presented at the Congress "Due giorni di algebra lineare numerica 2003", (Pisa, Italy, 6–7 March 2003).

C27) **Sull'integrazione numerica di un modello con memoria dell'interazione antigene-anticorpo**.
Presented at the Congress "Convegno dell'Unione Matematica Italiana 2003", (Milano, Italy, 8-13 September 2003).

C28) **On stepsize control in the numerical integration of implicit delay differential equations**.
Presented at the International Congress "Tenth Numdiff Conference", (Halle, Germany, 8-11 September 2003).

C29) **Asymptotic stability of numerical methods for a class of linear variable coefficient delay equations**.
Presented at the Section de Mathématiques, Université de Genève, (Geneva, Switzerland, 4 and 11 December 2003).

C30) **Complex polytope extremality results for families of matrices**.
Presented at the Section de Mathématiques, Université de Genève, (Geneva, Switzerland, 30 January 2004).

C31) **Studio numerico della dinamica gradiente per funzionali non convessi**.
Presented at the International Congress "Convegno GNCS", (Montecatini, Italy, 9–11 February 2003).

C32) **Computing breaking points of implicit delay differential equations**.
Presented at the International Congress "Fifth IFAC Workshop on Time-Delay Systems ", (Leuven, Belgium, 8-10 September 2004).

C33) **Asymptotic stability of numerical methods for a class of variable coefficient delay equations**.
Presented at the Eotvos Lorand University of Budapest, (Budapest, Hungary, 13 December 2004).

C34) **Complex polytope extremality results for families of matrices**.
Presented at the Bolyai Institut of the University of Szeged, (Szeged, Hungary, 16 December 2004).

C35) **Numerical experiments and conjectures on the dynamics of some singularly perturbed non-convex functionals**.
Presented at Centro De Giorgi – Scuola Normale Superiore (Pisa, Italy, 2 May 2005).

C36) **Numerical periodic orbits of neutral delay differential equations**.
Presented at the International Congress "SciCADE 2005", (Nagoya, Japan, 23-27 May 2005).

C37) **Automatic computation of breaking points in implicit delay differential equations by the code Radar5**.
Presented at the International Congress "SciCADE 2005", (Nagoya, Japan, 23-27 May 2005).

C38) **A model of antigen antibody dynamics based on delay differential equations with state dependent delays**.
Presented at the International Congress "The Fourth China-Italy Conference on Mathematical Models in Life Science: Theory and Simulation", (Peking, China, 31 May-2 June 2005).

C39) **Numerical periodic orbits of neutral delay differential equations**.
Presented at the International Congress "Structural dynamical systems: Computational Aspects SDS2005 ", (Capitolo, Italy, 26-29 June 2005).

C40) **Solving delay differential equations by the code Radar5**.
Presented at the International Congress "Workshop: Computational Life Sciences ", (Innsbruck, Austria, 12-15 October 2005)

C41) **Polytope norms and related algorithms for the computation of the joint spectral radius**.
Presented at the International Congress "44th IEEE Conference on Decision and Control and European Control Conference 2005 ", (Seville, Spain, 12-15 December 2005).

C42) **Algorithms for the computation of the joint spectral radius**.
Presented at the International Congress "Structural dynamical systems: Computational Aspects SDS2006 ", (Capitolo, Italy, 12-16 June 2006).

C43) **On the numerical integration of neutral state dependent delay equations**.
Presented at the International Congress "Workshop: Innovative integrators for differential and delay equations ", (Innsbruck, Austria, 10-15 September 2006).

C44) **Multiple scales in the dynamics of forward-backward parabolic equations**.
Presented at the International Congress "Joint International Meeting UMI - DMV", (Perugia, Italy, 18-22 June 2007).

C45) **Numerical integration of state dependent neutral delay equations**.
"8th Colloquium on the Qualitative Theory of Differential Equations", (Szeged, Hungary, 25-28 June 2007).

C46) **Computation of the joint spectral radius of real matrices**.
Presented at the Section de Mathématiques, Université de Genève, (Geneva, Switzerland, 19 September 2007).

C47) **Computing the joint spectral radius of a family of matrices**.
Presented at the Workshop "Gene Golub Day in Pisa", (Pisa, Italy, 29 February 2008).

C48) **A regularization for discontinuous differential equations with application to state-dependent delay differential equations**.
Presented at the "7th AIMS Conference on Dynamical Systems and Differential Equations", (University of Texas at Arlington, Texas, USA, 18-21 May 2008).

C49) **On finiteness properties of sets of matrices**.
Presented at the International Conference "Structured Numerical Linear Algebra Problems: Analysis, Algorithms, and Applications", (Cortona, Italy, 15-19 September 2008).

C50) **The joint spectral radius of a matrix family: computation and applications (part 2)**.
Presented at the International Conference "3rd Workshop Stability and Discretization Issues in Differential Equations", (University of Technology, Vienna, 17-20 September 2008).

C51) **Fast algorithms for approximating the pseudospectral abscissa and radius**.
Presented at the "SIAM Conference on Applied Linear Algebra 2009" (Monterey (USA), 26–30 October 2009).

C52) **Robust stability of linear dynamical systems by pseudospectral analysis**
Presented at the Universität Tübingen, (Tübingen, 6 May 2010).

C53) **Computing the joint spectral radius in some subdivison schemes**,
Presented at the International Conference "16th Conference of the International Linear Algebra Society (ILAS)" (21–25 June 2010)

C54) **Fast algorithms for approximating the pseudospectral abscissa and pseudospectral radius**, Presented at the Courant Institute, New York University, (New York, 17 September 2010).

C55) **Una regolarizzazione di equazioni differenziali discontinue**, Seminario di Modellistica differenziale numerica, Dipartimento di Matematica, Università di Roma La Sapienza, (Roma 25 January 2011).

C56) **Computing joint spectral characteristics of sets of nonnegative matrices**.
Presented at the Section de Mathématiques, Université de Genève (Geneva, Switzerland, 22 February 2011).

C57) **Fast computation of extremal points of the pseudospectrum and the distance to instability of a stable matrix**.
Presented at EPFL de Lausannee, (Lausanne, Switzerland, 2 March 2011).

C59) **Regularization and asymptotic expansions for neutral DDEs**.
Presented at the International Conference "Delay Differential Equations in Applications: Common Themes and Methods" (Vancouver, Canada, 14-16 July 2011).

C59) **Differential equations leading to the pseudospectral abscissa and radius**.
Presented at the International Conference "ICIAM 2011" (Vancouver, Canada, 18-22 July 2011).

C60) **Regularization of neutral state dependent delay differential equations**.
Presented at the International Conference "ICIAM 2011" (Vancouver, Canada, 18-22 July 2011).

C61) **Computation of the Lower Spectral Radius of a Set of Nonnegative Matrices**. Courant Institute, New York University, (New York, 23 Settembre 2011).

C62) **Novel methods to compute the distance to instability of a stable matrix and the H-infinity norm of a linear system.**.
Presented at TU Berlin (Berlin, Germany, 27 October 2011).

C63) **Numerical integration of implicit delay differential equations and accurate computation of breaking points**.
Presented at the Conference"SFB 910 Symposium Differential equations and numerical methods" (Berlin, Germany, 28 October 2011).

C64) **Low rank dynamics for computing extremal points of real and complex pseudospectra**.
Presented at the "SIAM Conference on Applied Linear Algebra 2012" (Valencia (Spain), 18-22 June 2012).

C65) **Differential Equations for the Approximation of the Closest Defective Matrix**.
Presented at the "Workshop on Numerical Linear Algebra and Optimization" (Vancouver (Canada), 8-10 August 2013).

C66) **Computing the distance to defectivity**.
Presented at the "ENUMATH 2013" (Lausanne (Switzerland), 26-30 August 2013).

C67) **Polytope joint Lyapunov functions for positive LSS**.
Presented at the 52th CDC Conference on Decision and Control 2013" (Firenze (Italy), 10-13 December 2013).

C68) **Approximation of Lyapunov exponents of linear switched systems of odes**.
Presented at EPFL de Lausannee, (Lausanne, Switzerland, 26 February 2014).

List of publications - Research papers

PhD) N. Guglielmi: **Sulla stabilità dei metodi a un passo per la soluzione numerica di equazioni differenziali con ritardo, (On the stability of one-step methods for delay differential equations)** Tesi di Dottorato (PhD Dissertation), February 1996 (available at the National Bibliotheques of Roma and Firenze).

Articles published in international journals

1) N. Guglielmi, R. Guerrieri, G. Baccarani: **Highly-Constrained Neural Networks for Industrial Quality Control,** "IEEE Transactions on Neural Networks", vol. 7, no. 1, pp. 206–213, 1996.

2) N. Guglielmi: **Inexact Newton methods for the steady-state analysis of nonlinear circuits,** "Mathematical Models and Methods in Applied Sciences", vol. 6, no. 1, pp. 43–57, 1996.

3) A. Montanari, N. Guglielmi: **Gli indici di proiezione nella projection pursuit,** "Statistica", anno LVI, no. 1, pp. 63–86, 1996.

4) N. Guglielmi: **On the asymptotic stability properties of Runge-Kutta methods for delay differential equations,** "Numerische Mathematik", vol. 77, no. 4, pp. 467–485, 1997.

5) A. Bellen, N. Guglielmi and L. Torelli: **Asymptotic stability properties of Θ-methods for the pantograph equation,** "Applied Numerical Mathematics", vol. 24, no. 2–3, pp. 279–293, 1997.

6) N. Guglielmi: **Delay dependent stability regions of Theta-methods for delay differential equations,** "IMA Journal of Numerical Analysis", vol. 18, pp. 399–418, 1998.

7) A. Bellen, N. Guglielmi and M. Zennaro: **On the contractivity and asymptotic stability of systems of delay differential equations of neutral type,** "BIT", vol. 39, pp. 1–24, 1999.

8) A. Bellen, N. Guglielmi and A. Ruehli: **Methods for linear systems of circuit delay differential equations of neutral type,** "IEEE Transactions on Circuits and Systems-I: Fundamental theory and applications", vol. 46, no. 1, pp. 212–216, 1999.

9) N. Guglielmi and E. Hairer: **Order stars and stability for delay differential equations,** "Numerische Mathematik", vol. 83, no. 3, pp. 371–383, 1999.

10) N. Guglielmi: **An analytic proof of numerical stability of Gaussian collocation for delay differential equations,** "Boll. UMI Sez. B.", vol. 1-B, pp.95–116, 2000.

11) N. Guglielmi and E. Hairer: **Geometric proofs of numerical stability for delay equations,** "IMA Journal of Numerical Analysis", vol. 21, no. 1, pp. 439–450, 2001.

12) N. Guglielmi and M. Zennaro: **On the zero-stability of variable stepsize multistep methods: the spectral radius approach,** "Numerische Mathematik", vol. 88, no. 3, pp. 445–458, 2001.

13) N. Guglielmi: **On the qualitative behaviour of numerical methods for delay differential equations of neutral type. A case study: Θ-methods,** "Recent Trends in Numerical Analysis", edited by L. Brugnano and D. Trigiante.

14) N. Guglielmi and M. Zennaro: **On the asymptotic properties of a family of matrices,** "Linear Algebra and its Applications", vol. 322, no. 1–3, pp. 169–192, 2001.

15) A. Bellen, N. Guglielmi and M. Zennaro: **Numerical stability of nonlinear delay differential equations of neutral type,** "Journal of Computational and Applied Mathematics", vol. 125, no. 1–2, pp. 251–263, 2001.

16) N. Guglielmi and E. Hairer: **Implementing Radau IIA methods for stiff delay differential equations,** "Computing", vol. 67, no. 1, pp. 1–12, 2001.

17) N. Guglielmi: **Asymptotic stability barriers for natural Runge–Kutta processes for delay equations,** "SIAM Journal on Numerical Analysis", vol. 39, no. 3, pp. 763–783, 2002.

18) N. Guglielmi and M. Zennaro, **On the limit products of a family of matrices,** "Linear Algebra and its Applications", vol. 362, pp. 11–27, 2003.

19) N. Guglielmi and M. Zennaro: **Stability of one-leg Θ-methods for the variable coefficient pantograph equation,** "IMA Journal on Numerical Analysis", vol. 23, pp 421–438, 2003.

20) N. Guglielmi: **Open issues in devising software for the numerical solution of implicit delay differential equations,** "Journal of Computational and Applied Mathematics", vol. 185, pp. 261-277, 2006.

21) N. Guglielmi: **On the Newton iteration in the application of collocation methods to implicit delay equations,** "Applied Numerical Mathematics", vol. 53, pp. 281–297, 2005.

22) N. Guglielmi and C. Lubich: **Numerical periodic orbits of neutral delay differential equations,** "Discrete and Continuous Dynamical Systems - Series A (DCDS-A)", vol. 13, pp. 1057–1067, 2005.

23) N. Guglielmi: **Short proofs and a counterexample for analytical and numerical stability of delay equations with infinite memory,** "IMA Journal on Numerical Analysis", vol. 26, pp. 60–77, 2006.

24) N. Guglielmi, F. Wirth and M. Zennaro: **Complex polytope extremality results for families of matrices,** "SIAM Journal on Matrix Analysis and Applications", vol. 27, pp 721–743, 2005.

25) G. Bellettini, G. Fusco and N. Guglielmi: **A concept of solution and numerical experiments for forward-backward diffusion equations,** "Discrete and Continuous Dynamical Systems - Series A (DCDS-A)", vol. 16, pp. 783–842, 2006.

26) A. Bellen, N. Guglielmi and S. Maset: **Numerical methods for delay models in biomathematics,** in Integration of Complex Systems in Biomedicine, A. Quarteroni (editor), Springer Verlag pp 148–185, 2006.

27) N. Guglielmi e M. Zennaro: **Balanced complex polytopes and related vector and matrix norms,** "Journal of Convex Analysis", vol. 14, pp. 729–766, 2007.

28) Y. Muroya, E. Ishiwata and N. Guglielmi: **Global stability for nonlinear difference equations with variable coefficients,** "Journal of Mathematical Analysis and its Applications", vol. 334, pp. 232–247, 2007.

29) N. Guglielmi and E. Hairer: **Computing breaking points in implicit delay differential equations,** "Advances in Computational Mathematics", vol. 29, pp. 229–247, 2008.

30) N. Guglielmi and M. Zennaro: **An algorithm for finding extremal polytope norms of matrix families.** "Linear Algebra and its Applications", vol. 428, pp. 2265–2282, 2008.

31) N. Guglielmi and L. Hatvani: **On small oscillations of dynamical systems with time-dependent kinetic and potential energy,** "Discrete and Continuous Dynamical Systems - Series A (DCDS-A)", vol. 20, pp. 911–926 , 2008.

32) A. Bellen and N. Guglielmi: **Solving neutral delay differential equations with state-dependent delays,** "Journal of Computational and Applied Mathematics", vol. 229, pp. 350–362 , 2009.

33) A. Bellen, N. Guglielmi, S. Maset and M. Zennaro **Recent trends in the numerical solution of retarded functional differential equations,** "Acta Numerica 2009", pp 1–110, 2009.

34) N. Guglielmi and M. Zennaro, **Finding extremal complex polytope norms for families of real matrices,** "SIAM Journal on Matrix Analysis and Applications", vol. 31, pp. 602–620, 2009.

35) A. Cicone, N. Guglielmi, S. Serra and M. Zennaro: **Finiteness properties of 2×2 sign-matrices via real polytope extremal norms,** "Linear Algebra and its Applications", vol. 432, pp. 796–816, 2010.

36) J. De Luca, N. Guglielmi, T. Humphries and A. Politi: **Electromagnetic two-body problem: recurrent dynamics in the presence of state-dependent delay,** "Journal of Physics A: Mathematical and Theoretical", vol. 43, 2010.

37) N. Guglielmi, C. Manni and D. Vitale, **Convergence analysis of C^2 Hermite interpolatory subdivision schemes by explicit joint spectral radius formulas,** "Linear Algebra and its Applications", vol. 434, pp. 884–902, 2011.

38) G. Fusco and N. Guglielmi: **A regularization for discontinuous differential equations with application to state-dependent delay differential equations,** "Journal of Differential Equations", vol. 250, pp. 3230–3279, 2011.

39) N. Guglielmi and C. Lubich: **Differential equations for roaming pseudospectra: paths to extremal points and boundary tracking,** "SIAM Journal on Numerical Analysis", vol. 49, pp. 1194–1209, 2011.

40) N. Guglielmi and M. Overton: **Fast algorithms for the approximation of the pseudospectral abscissa and pseudospectral radius of a matrix,** "SIAM Journal on Matrix Analysis and Applications" vol. 32, pp. 1166–1192, 2011.

41) N. Guglielmi and M. Zennaro: **On the asymptotic regularity of a family of matrices,** "Linear Algebra and its Applications", vol. 436, pp. 2093–2104, 2012.

42) N. Guglielmi and C. Lubich: **Erratum/Addendum: Differential Equations for Roaming Pseudospectra: Paths to Extremal Points and Boundary Tracking,** 'SIAM Journal on Numerical Analysis", vol. 50, pp. 977–981, 2012.

43) N. Guglielmi and E. Hairer: **Numerical approaches for state-dependent neutral delay equations with discontinuities,** "Mathematics and Computers in Simulation", (published online, 9 December 2011, available at address http://www.sciencedirect.com/science/article/pii/S0378475411002667).

44) N. Guglielmi and E. Hairer: **Asymptotic expansions for regularized state-dependent neutral delay equations,** "SIAM Journal on Mathematical Analysis" vol. 44, pp. 2428–2458, 2012.

45) W. Michiels and N. Guglielmi: **An iterative method for computing the pseudospectral abscissa for a class of nonlinear eigenvalue problems,** "SIAM Journal on Scientific Computing", vol. 34, pp. 2366–2393, 2012.

46) N. Guglielmi: *Delay differential equations,* Encyclopedia of Applied and Computational Mathematics, delivered January 2012.

47) P. Buttà, N. Guglielmi, S. Noschese: **Computing the structured pseudospectrum of a Toeplitz matrix and its extremal points,** "SIAM Journal on Matrix Analysis and Applications", vol. 33 pp. 1300–1319, 2012.

48) N. Guglielmi and C. Lubich: **Low-rank dynamics for computing extremal points of real pseudospectra,** "SIAM Journal on Matrix Analysis and Applications", vol. 34, pp. 40–66, 2013.

49) L. Dieci and N. Guglielmi: **Regularizing piecewise smooth differential systems: co-dimension** 2 **discontinuity surface,** "Journal of Dynamics and Differential Equations", vol. 25, pp. 7194, 2013

50) N. Guglielmi and V.Yu. Protasov, **Exact computation of joint spectral characteristics of linear operators,** "Foundations of Computational Mathematics", vol. 25, pp. 71–94, 2013.

51) N. Guglielmi and E. Hairer: **Regularization of neutral delay differential equations with several delays.** "Journal of Dynamics and Differential Equations", vol. 25, pp. 173–192, 2013.

52) N. Guglielmi, M. Gurbuzbalaban and M. Overton: **Fast approximation of the H_∞ norm via optimization over spectralvalue sets.** "SIAM Journal on Matrix Analysis and Applications", vol. 34, pp. 709–737, 2013.

53) N. Guglielmi and M. Zennaro: **Stability of linear problems: joint spectral radius of sets of matrices,** Springer CIME Lecture Notes, 2013.

54) A. Cicone, N. Guglielmi and R. Jungers: **Lifted polytope methods for the computation of joint spectral characteristics,** "SIAM Journal on Matrix Analysis and Applications", vol. 35, pp. 391–410., 2014.

55) N. Guglielmi, D. Kressner and Ch. Lubich: **Low rank differential equations for Hamiltonian matrix nearness problems,** "Numerische Mathematik", in press, 2014.

56) N. Guglielmi and M. Manetta, **Approximating real stability radii,** "IMA Journal on Numerical Analysis", in press, 2014.

Submitted papers

57) N. Guglielmi, D. Kressner and Ch. Lubich: **Computing extremal points of symplectic pseudospectra and solving symplectic matrix nearness problems,** pp 1–21, 2013.

58) N. Guglielmi, M.L. Overton and G.W. Stewart: **An efficient algorithm for computing the generalized null space decomposition,** pp 1–15, 2014.

59) P. Buttà, N. Guglielmi, M. Manetta and S. Noschese: **Differential equations for real-structured (and unstructured) defectivity measures,** pp 1–29, 2014.

60) N. Guglielmi, L. Laglia and V.Yu. Protasov: **Polytope Lyapunov functions for stable and for stabilizable LSS,** pp 1–52, 2014.

61) N. Guglielmi and M. Zennaro: **Canonical construction of Barabanov polytope norms and antinorms for sets of matrices,** pp 1–19, 2014.

Articles published on the Internet

1i) N. Guglielmi and E. Hairer: **Stiff delay equations,** "Scholarpedia article", "http://www.scholarpedia.org/article/Stiff_Delay_Equations", 2007.

Articles in preparation

p1) N. Guglielmi and C. Lubich: **Sweeping all unstable eigenvalues of a matrix,** 2014.

p2) M. Charina, C. Conti, N. Guglielmi and V.Yu. Protasov: **Non-stationary multivariate subdivision: joint spectral radius and asymptotic similarity,** 2104.

p3) N. Guglielmi, M. Gürbüzbalaban, M.L. Overton and T. Mitchell: **Approximating the real structured stability radius with Frobenius-bounded perturbations via spectral value sets,** 2014.

p4) N. Guglielmi and E. Hairer: **Weak solutions and their regularization,** 2014.

Articles published in Conference Proceedings and Technical reports

1c) N. Guglielmi, R. Guerrieri, M. Mastretta, L. De Vena: **Highly-Constrained Neural Networks with Application to Visual Inspection of Machined Parts,** Proceedings of "1993 International Conference on Acoustics, Speech and Signal Processing", Minneapolis, USA, 27-30 April 1993, Vol. I, pp. 629-632.

2c) N. Guglielmi, R. Guerrieri: **An experimental comparison of Software Methodologies for Image Based Quality Control,** Proceedings of "1994 International Conference on Industrial Electronics, Control and Instrumentation", Bologna, Italy, 5-9 September 1994, Vol. III, pp. 1942-1945.

3c) A. Montanari, N. Guglielmi: **Exploratory Projection Pursuit maximizing departure from Unimodality,** Proceedings of "$XXXVII$ Riunione Scientifica della Società Italiana di Statistica", San Remo, Italy, 6-8 April 1994.

4c) A. Benedetti, N. Guglielmi: **Tracing characteristics of smooth nonlinear resistive circuits by interval analysis,** Proceedings of "ISCAS-96", Atlanta, USA, 12–15 May 1996, Vol. 3, pp. 272–275.

5c) N. Guglielmi: **A software tool for the numerical integration of stiff retarded differential equations,** Proceedings of "VI Congresso della Societa' Italiana di Matematica Applicata e Industriale, SIMAI 2002", Chia Laguna, Italy, 27–31 May 2002, pp. 1–15.

6c) N. Guglielmi, E. Hairer: **Computing breaking points of implicit delay differential equations,** Proceedings of "Fifth IFAC workshop on time delay systems", Leuven, Belgium, 8–10 September 2004.

7c) N. Guglielmi, M. Zennaro: **Polytope norms and related algorithms for the computation of the joint spectral radius,** Proceedings of "44th IEEE Conference on Decision and Control and European Control Conference 2005 ", Seville, Spain, 12-15 December 2005, pp. 3007–3012.

8c) N. Guglielmi, L. Laglia, V. Protasov: **Polytope joint Lyapunov functions for positive LSS,** Proceedings of "52th IEEE Conference on Decision and Control and European Control Conference 2013 ", Firenze, Italy, 10-13 December 2013, pp. 3007–3012.

1t) A. Bellen, N. Guglielmi and A. Ruehli: **On a class of stable methods for linear systems of delay differential equations of neutral type,** IBM Research Report, no. RC21253(94633), pp 1–26, 1998.

Contributions to books and collections

L1) N. Guglielmi, R. Guerrieri and G. Baccarani: **Neural networks techniques for the optical inspection of machined parts,** Computer-Aided Design, Engineering and Manufacturing (CADEM) Systems Techniques and Applications, C. T. Leondes (editor), Gordon & Breach, 2003.

L2) A. Bellen, N.Guglielmi and S.Maset: **Numerical methods for delay models in biomathematics,** in Integration of Complex Systems in Biomedicine, A. Quarteroni (editor), Springer Verlag, 2005.

Software Codes

S1) N. Guglielmi and E. Hairer: **RADAR5:** a Fortran–90 code for the numerical integration of stiff and implicit systems of delay differential equations; the software is available at the internet web-site:

"http//www.unige.ch/math/folks/hairer".

Summary of main research interests and achievements

Synthesis.

My main research topics are in the general area of scientific computing, particularly numerical analysis of ordinary and delay differential equations, stability analysis of (discretized) dynamical systems - including variable coefficient and switched systems - and ode methods in matrix perturbation theory and control, for high-dimensional problems.

I am interested in stiff and singularly perturbed problems (in particular in the framework of delay differential equations), in the stability analysis of numerical integrators for ordinary and delay differential equations, in the computation of the joint spectral characteristics of a set of matrices, with application to contractivity analysis of time dependent systems of difference equations, and in ode-based pseudospectral computations for both unstructured and structured problems.

I am also interested in software development for general classes of implicit delay differential equations (I have co-authored the code RADAR5 with Ernst Hairer) and - recently - for non-smooth differential equations with focus on the computation of weak solutions.

Scientific achievements

My work to date has mainly included:

(i) The stability analysis of numerical methods for delay differential equations, giving emphasis to the delay dependence of analytical and numerical stability, a subject which has been unexplored for a long time in the literature.

Main results: the delay dependent analysis of Runge-Kutta processes for delay differential equations which has put in evidence the significant difference with respect to delay independent results. The classification of high order methods has been pursued by geometric proofs which make use of order stars theory. For these contributions I received the New Talent award at SciCADE-99 conference.

The most relevant articles are:

- N. Guglielmi: *On the asymptotic stability properties of Runge-Kutta methods for delay differential equations,* Numerische Mathematik, vol. 77, pp. 467–485, 1997.
- N. Guglielmi: *Delay dependent stability regions of Theta-methods for delay differential equations,* IMA Journal of Numerical Analysis, vol. 18, pp. 399–418, 1998.
- N. Guglielmi and E. Hairer: *Order stars and stability for delay differential equations,* Numerische Mathematik, vol. 83, pp. 371–383, 1999.
- N. Guglielmi and E. Hairer: *Geometric proofs of numerical stability for delay equations,* IMA Journal of Numerical Analysis, vol. 21, pp. 439–450, 2001.
- N. Guglielmi: *Asymptotic stability barriers for natural Runge–Kutta processes for delay equations,* SIAM Journal on Numerical Analysis, vol. 39, pp. 763–783, 2002.

(ii) The theoretical and computational analysis of methods to compute joint spectral characteristics of sets of matrices with applications to stability of numerical methods for differential equations, to convergence analysis of refinement and subdivision schemes, and control theory.

Main results: consist in a new class of exact algorithms able in many cases to calculate the joint and the lower spectral radius of a finite set of linear operators (a problem which is known to be NP-hard), by computing optimal norms. On the application side, new results on the stability of BDF methods for ordinary differential equations and of numerical methods for delay differential equations have been obtained. As well as new convergence results for a class of Hermite subdivision schems.

For the analysis and computation of the joint spectral radius the most significant articles are:

- N. Guglielmi, F. Wirth and M. Zennaro: *Complex polytope extremality results for families of matrices,* SIAM Journal on Matrix Analysis and Applications, vol. 27, pp 721–743, 2005.
- N. Guglielmi and M. Zennaro: *An algorithm for finding extremal polytope norms of matrix families.* Linear Algebra and its Applications, vol. 428, pp. 2265–2282, 2008.
- N. Guglielmi and M. Zennaro, *Finding extremal complex polytope norms for families of real matrices,* SIAM Journal on Matrix Analysis and Applications, vol. 31, pp. 602–620, 2009.
- N. Guglielmi and V.Yu. Protasov, *Exact computation of joint spectral characteristics of linear operators,* Foundations of Computational Mathematics, vol. 13, pp. 37–97, 2013.

For the applications the most significant articles are:

- N. Guglielmi and M. Zennaro: *On the zero-stability of variable stepsize multistep methods: the spectral radius approach,* Numerische Mathematik, vol. 88, pp. 445–458, 2001.
- N. Guglielmi and M. Zennaro: *Stability of one-leg Θ-methods for the variable coefficient pantograph equation,* IMA Journal on Numerical Analysis, vol. 23, pp 421–438, 2003.
- N. Guglielmi: *Short proofs and a counterexample for analytical and numerical stability of delay equations with infinite memory,* IMA Journal on Numerical Analysis, vol. 26, pp. 60–77, 2006.
- N. Guglielmi, C. Manni and D. Vitale, *Convergence analysis of C^2 Hermite interpolatory subdivision schemes by explicit joint spectral radius formulas,* Linear Algebra and its Applications, vol. 434, pp. 884–902, 2011.

(iii) The development (jointly with E. Hairer) of a general purpose software - Radar5 - for stiff and implicit systems of delay differential equations.

To our knowledge this is the only available code for a ganeral class of stiff and implicit problems with state dependent - possibly vanishing - delays.

The most significant relevant publications are:

- N. Guglielmi and E. Hairer: *Implementing Radau IIA methods for stiff delay differential equations,* Computing, vol. 67, pp. 1–12, 2001.

- N. Guglielmi: *On the Newton iteration in the application of collocation methods to implicit delay equations,* Applied Numerical Mathematics, vol. 53, pp. 281–297, 2005.
- N. Guglielmi and E. Hairer: *Computing breaking points in implicit delay differential equations,* Advances in Computational Mathematics, vol. 29, pp. 229–247, 2008.

(iv) The theoretical and numerical analysis of non-smooth odes and of neutral and implicit delay differential equations with state dependent delays (with general non-smooth behaviour) and their regularization based on singular perturbations.

Main results: a rigorous analysis of a some new proposed regularizations has been achieved in order to compare generalized solutions of both ordinary and delay differential equations to the solutions of the associated singularly perturbed problems. This has been done by considering new types of asymptotic expansions with respect to singularly perturbed (smooth) odes.

The most relevant publications are:

- A. Bellen, N. Guglielmi, S. Maset and M. Zennaro *Recent trends in the numerical solution of retarded functional differential equations,* Acta Numerica 2009, pp 1–110, 2009.
- G. Fusco and N. Guglielmi: *A regularization for discontinuous differential equations with application to state-dependent delay differential equations,* Journal of Differential Equations, vol. 250, pp. 3230–3279, 2011.
- N. Guglielmi and E. Hairer: *Numerical approaches for state-dependent neutral delay equations with discontinuities,* Mathematics and Computers in Simulation, published online, 9 December 2011.
- N. Guglielmi and E. Hairer: *Asymptotic expansions for regularized state-dependent neutral delay equations,* SIAM Journal on Mathematical Analysis vol. 44, pp. 2428–2458, 2012.
- L. Dieci and N. Guglielmi: *Regularizing piecewise smooth differential systems: co-dimension* 2 *discontinuity surface,* vol. 25, pp. 71–94, 2013.
- N. Guglielmi and E. Hairer: *Regularization of neutral delay differential equations with several delays,* J. Dynam. Differential Equations, vol. 25, pp. 173–192, 2013.

(v) The development of a new class of algorithms, based on low rank (continuous and discrete) dynamical systems, for computing pseudospectral measures of a matrix and its distance to instability, and their restrictions to structured perturbations. A new algorithm for computing the H-infinity norm of a large linear dynamical system has also been proposed and analyzed.

Main results: the available codes (e.g. The Matlab control toolbox) present severe restrictions for the dimension of the matrices (already in the unstructured case) and often do not treat the structured case. Based on a low rank property, new ideas have lead to algorithms and novel codes which are very well suited to large sparse matrices and can also efficiently deal with structured problems. The application to different related fields appear promising.

The most relevant publications are:

– N. Guglielmi and M. Overton: *Fast algorithms for the approximation of the pseudospectral abscissa and pseudospectral radius of a matrix,* SIAM Journal on Matrix Analysis and Applications vol. 32, pp. 1166–1192, 2011.

– N. Guglielmi and C. Lubich: *Differential equations for roaming pseudospectra: paths to extremal points and boundary tracking,* SIAM Journal on Numerical Analysis, vol. 49, pp. 1194–1209, 2011.

– W. Michiels and N. Guglielmi: *An iterative method for computing the pseudospectral abscissa for a class of nonlinear eigenvalue problems,* SIAM Journal on Scientific Computing, vol. 34, pp. 2366–2393, 2012.

– N. Guglielmi and C. Lubich: *Low-rank dynamics for computing extremal points of real pseudospectra,* SIAM J. Matrix Anal. Appl., vol. 34, pp. 40–66, 2013.

– P. Buttà, N. Guglielmi and S. Noschese: *Computing the structured pseudospectrum of a Toeplitz matrix and its extremal points,* SIAM Journal on Matrix Analysis and Applications, vol. 33 pp. 1300–1319, 2012.

– N. Guglielmi, M. Gurbuzbalaban and M. Overton: *Fast approximation of the H_∞ norm via optimization over spectralvalue sets.* SIAM Journal on Matrix Analysis and Applications, vol. 34, pp. 709–737, 2013.

All papers are made available on my homepage, http://univaq.it/∼guglielm/.

30 April 2014,

Nicola Guglielmi