Curriculum of Scientific and Didactic Activity
by
Maria Letizia BERTOTTI

Current position

Full Professor in the disciplinary scientific sector (SSD)
MATH-04/A - Mathematical Physics
at the Faculty of Engineering of the **Free University of Bozen-Bolzano**.

Previous Academic positions

- 1/11/2008 - 28/2/2023: **Full Professor**
  disciplinary scientific sector: **Mathematical Physics**,
  Faculty of Science and Technology, Free University of Bozen-Bolzano.
- **1/11/2000** - 31/10/2008: **Full Professor**
  disciplinary scientific sector: **Mathematical Physics**,
  Faculty of Engineering, University of Palermo.
- 1/11/1998 - 31/10/2000: **Associate Professor**
  scientific sector: **Mathematical Analysis**,
  Faculty of Engineering, University of Palermo.
- 18/6/1986 - 31/10/1998: **Assistant Professor**
  scientific sector: **Mathematical Physics**,
  Faculty of Science, University of Trento.

Education

- "Magister Philosophiae in Mathematical Physics" (30/30 cum Laude), International School for Advanced Studies (SISSA), Trieste, (1985); (fellowship from November 1984 on, attended 8 courses and passed exams, 6 of which with 30/30 cum Laude, 2 with 30/30);

- Attended 6 courses organized by Istituto Nazionale di Alta Matematica "F. Severi" at the University of Bologna, supported by a INdAM fellowship (1/11/1982–31/10/1983) and passed the final examination.
- "Laurea in Mathematics" (110/110 cum Laude), University of Trento (1982);
- "Diploma di maturità classica", July 1977, Liceo Classico G. Carducci, Bolzano.

Language skills

- **Italian** - mother tongue;
- level of **English** language knowledge: C1
  (Cambridge Assesment English).
- level of **German** language knowledge: C1
  (Goethe Zertifikat).

1. Scientific activity

1.1 Research areas in short

Complex systems, Complex networks, Mathematical models from micro to macro of interest in the socio-economic arena, Ordinary differential equations, Dynamical systems, Hamiltonian systems, Nonlinear analysis.

1.2 Short description of main research topics

During several years my research dealt with dynamics of systems of nonlinear differential equations arising in classical and celestial mechanics. I investigated various questions concerning Hamilton and Lagrange equations, both in the autonomous and in the time dependent case (e.g., but not only, with quasi-periodic or almost periodic time dependence). The techniques and tools I have been using to face the various problems (search for periodic solutions, for homoclinics, for heteroclinics, ...) encompass different methods of nonlinear analysis (among which, developments of Morse and Lyusternick and Schnirelmann theories).

Since more or less the beginning of the new millennium my interest was captured by a different, very intriguing and fascinating field. I started and

was involved in methodological aspects of modelling of complex systems. In particular, I have developed a discretisation of a class of nonlinear integro-differential equations of Boltzmann kind, which turns out to be a natural tool to model the evolution of a distribution probability of the microscopic characterisation of systems composed by a high number of interacting elements/individuals/particles. The ordinary differential equations (a system composed by many equations) to which such a discretisation leads can be used to analyse and explain, on the basis of knowledge of the interactions taking place at the "microscopic" level, aggregate and collective phenomena (in physics, economics, biology, social sciences, ...) which are observable at a "macroscopic" level. Within this approach I have dealt both with general analytical questions (such as well-posedness of certain problems, ...) and with the development of specific models in applied sciences. For example, I have worked on problems of opinion formation, developing and investigating various mathematical models for it. Subsequently, I have developed a model (involving a multiplicity of interactions and exchanges of economic nature) for the study of the emergence of the income distribution, and economic inequality in response to different taxation and welfare systems. Through joint work with other researchers we formulated a version of the model which also includes stochastic terms to account for uncertainty.

For some years now I have been studying and considering complex networks. It is now evident that the underlying connections that exist between the elements of a complex system (e.g., individuals in a society or firms in a country) play a crucial role in the formation and evolution of collective phenomena, that can be observed at a macroscopic level. I began to study dynamical problems on networks, incorporating by means of an heterogeneous mean field theory the network topology in the systems of evolution equations. I applied this approach to the study of innovation diffusion processes, thus obtaining a generalisation of the famous Bass model. Finally, another research topic I have been working on concerns the dynamics and oscillations of a cable car, especially as it passes over a support. The treatment of this topic involves mechanical aspects and minimisation techniques.

1.2 Publication list

1.2.1 International refereed journals

- M. L. Bertotti, M. Menale,
  Opinion dynamics models describing the emergence of polarization phenomena,

Journal of Computational Social Science,
vol. 7(3), pp. 2591-2612 (2024).

- M. L. Bertotti,
A mathematical model for the dynamics of income distribution in the presence of production,
Complexity,
vol. 2024, Article ID 3190620, 10 pages (2024).

- U. Asma, M. L. Bertotti, S. Zamai, M. Arnold, R. Amorati, M. Scampicchio,
A kinetic approach to Oxigen Radical Absorbing Capacity (ORAC): restoring order to the antioxidant activity of hydroxycinnamic acids and fruits juices,
Antioxidants,
vol. 2024, 13: 222 (2024).

- M. L. Bertotti, B. Carbonaro, M. Menale,
Modelling a market society with stochastically varying money exchange frequencies,
Symmetry,
vol. 15, 9, 1751, (2023).

- S. Leitner, M. L. Bertotti,
Solutions of a countable set of non-elementary integrals by means of simple algebra,
International Mathematical Forum,
vol. 17, 2: pp. 51-55 (2022).

- M. L. Bertotti,
A mathematical model of universal basic income and its numerical simulations,
Algorithms,
vol. 2021, 14 (no. 11): 331 (2021).

- M. L. Bertotti, G. Modanese,
Diagonal degree correlations vs. epidemic thresholds in scale-free networks,
Complexity,
vol. 2021, Article ID 7704586, 11 pages (2021).

- M. L. Bertotti, A. K. Chattopadhyay, G. Modanese,
Stochastic models with multiplicative noise for economic inequality and

mobility,
International Journal of Nonlinear Sciences and Numerical Simulation,
vol. 22, pp. 287-301 (2021).

- M. Wenin, S. Ladurner, D. Reiterer, M. L. Bertotti, G. Modanese,
Validation of the velocity optimization for a ropeway passing over a support,
Sustainability,
vol. 13, 5, 2986, (2021).

- M. L. Bertotti, G. Modanese,
Comparison of simulations with a mean-field approach vs. synthetic correlated networks,
Symmetry,
vol. 13, 1, 141, (2021).

- M. L. Bertotti - G. Modanese,
Network rewiring in the r-K plane,
Entropy,
vol. 22, 6, 653, (2020).

- M. L. Bertotti - G. Modanese,
On the evaluation of the takeoff time and of the peak time for innovation diffusion on assortative networks,
Mathematical and Computer Modelling of Dynamical Systems,
vol. 25, 5 pp. 482-498, (2019).

- M. L. Bertotti - G. Modanese,
The configuration model for Barabasi-Albert networks,
Applied Network Science,
vol. (2019) 4:32 (2019).

- M. L. Bertotti - G. Modanese,
The Bass diffusion model on finite Barabasi-Albert networks,
Complexity,
vol. 2019, Article ID 6352657, 12 pages (2019).

- M. Wenin - A. Windisch - S. Ladurner - M. L. Bertotti - G. Modanese,
Optimal velocity profile for a cable car passing over a support,
European Journal of Mechanics/A Solids,
vol. 73, pp. 366-372, (2019).

- M. L. Bertotti - A. K. Chattopadhyay - G. Modanese,
Statistics of correlations and fluctuations in a stochastic model of wealth exchange,
Entropy,
vol. 20, 3, 166, (2018).

- M. L. Bertotti - A. K. Chattopadhyay - G. Modanese,
Uncertainty dynamics in a model of economic inequality,
International Journal of Design & Nature and Ecodynamics,
vol. 13, 1, pp. 16-22, (2018).

- M. L. Bertotti - G. Modanese,
Mathematical models describing the effects of different tax evasion behaviors,
Journal of Economic Interaction and Coordination,
vol. 13 (2), pp. 351-363, (2018).

- M. L. Bertotti - G. Modanese,
Statistics of binary exchange of energy or money,
Entropy,
vol. 19, 9, 465, (2017).

- M. L. Bertotti - A. K. Chattopadhyay - G. Modanese,
Correlation between Gini index and mobility in a stochastic kinetic model of economic exchange,
Results in Physics,
vol. 7, pp. 2081-2084, (2017).

- M. L. Bertotti - A. K. Chattopadhyay - G. Modanese,
Stochastic effects in a discretized kinetic model of economic exchange,
Physica A,
vol. 471, pp. 724-732, (2017).

- M. L. Bertotti - G. Modanese,
Economic inequality and mobility in kinetic models for social sciences,
European Physical Journal Special Topics,
vol. 225, 10, pp. 1945-1958, (2016).

- M. L. Bertotti - G. Modanese,
Discretized kinetic theory on scale-free networks,
European Physical Journal Special Topics,
vol. 225, 10, pp. 1879-1891, (2016).

- M. L. Bertotti - G. Modanese,
Exchange models for the emergence of income distribution and economic inequality,
International Journal of Design & Nature and Ecodynamics,
vol. 11, 4, pp. 620-627, (2016).

- M. L. Bertotti - G. Modanese,
Microscopic models for the study of taxpayer audit effects,
International Journal of Modern Physics C,
vol. 27, 9, 1650100 (15 pages), (2016).

- M. L. Bertotti - J. Brunner - G. Modanese,
Innovation diffusion equations on correlated scale-free networks,
Physics Letters A,
vol. 380, pp. 2475-2479, (2016).

- M. L. Bertotti - J. Brunner - G. Modanese,
The Bass diffusion equation on networks with correlations and inhomogeneous advertising,
Chaos, Solitons & Fractals,
vol. 90, pp. 55-63, (2016).

- M. L. Bertotti - G. Modanese,
Microscopic models for welfare measures addressing a reduction of economic inequality,
Complexity,
vol. 21, nr. 6, pp. 89-98, (2016).

- M. L. Bertotti - G. Modanese,
Micro to macro models for income distribution in the absence and in the presence of tax evasion,
Applied Mathematics and Computation,
vol. 244, pp. 836-846, (2014).

- M. L. Bertotti - G. Modanese,
Exploiting the flexibility of a family of models for taxation and redistribution,
European Physical Journal B,
vol. 85, nr. 8, 261, (2012).

- M. L. Bertotti - G. Modanese,
From microscopic taxation and redistribution models to macroscopic

income distributions,
Physica A,
vol. 390, pp. 3782-3793, (2011).

- M. L. Bertotti,
From individual interactions to collective patterns. A mathematical approach,
Advances and Applications in Statistical Sciences,
vol. 6, nr. 6, pp. 507-524, (2011).

- M. L. Bertotti,
Modelling taxation and redistribution: a discrete active particle kinetic approach,
Applied Mathematics and Computation,
vol. 217, pp. 752-762, (2010).

- M. L. Bertotti,
On a class of dynamical systems with emerging cluster structure,
Journal of Differential Equations,
vol. 249, pp. 2757-2770, (2010).

- M. L. Bertotti - M. Delitala,
Cluster formation in opinion dynamics: a qualitative analysis,
Zeitschrift für Angewandte Mathematik und Physik (ZAMP),
vol. 61, nr. 4, pp. 583-602, (2010);

- M. L. Bertotti - M. Delitala,
On the existence of limit cycles in opinion formation processes under time periodic influence of persuaders,
Mathematical Models & Methods in Applied Sciences,
vol. 18, nr. 6, pp. 913-934, (2008).

- M. L. Bertotti - M. Delitala,
On a discrete generalized kinetic approach for modelling persuaders influence in opinion formation processes,
Mathematical and Computer Modelling,
vol. 48, pp. 1107-1121, (2008).

- M. L. Bertotti - M. Delitala,
Conservation Laws and Asymptotic Behavior of a Model of Social Dynamics,
Nonlinear Analysis: Real World Applications,
vol. 9, nr. 1, pp. 183-196, (2008).

- N. Bellomo - M. L. Bertotti - M. Delitala,
From the kinetic theory of active particles to the modelling of social behaviors and politics,
Quality and Quantity,
vol. 41, nr. 4, pp. 545-555, (2007).

- M. L. Bertotti - M. Delitala,
On the Qualitative Analysis of the Solutions of a Mathematical Model of Social Dynamics,
Applied Mathematics Letters,
vol. 19, pp. 1107-1112, (2006).

- M. L. Bertotti - M. Delitala,
From Discrete Kinetic and Stochastic Game Theory to Modelling Complex Systems in Applied Sciences,
Mathematical Models & Methods in Applied Sciences,
vol. 14, nr. 7, pp. 1061-1084, (2004).

- M. L. Bertotti - N. Bellomo,
Boundary value steady solutions of a class of hydrodynamic models for vehicular traffic flow,
Mathematical and Computer Modelling,
vol. 38, pp. 367-384, (2003).

- M. L. Bertotti - S. V. Bolotin,
Chaotic trajectories for natural systems on a torus,
Discrete and Continuous Dynamical Systems, Series A,
vol. 9, nr. 5, pp. 1343-1357, (2003).

- M. L. Bertotti - S. V. Bolotin,
On the influence of the kinetic energy on the stability of equilibria of natural Lagrangian systems,
Archive for Rational Mechanics and Analysis,
vol. 152, pp. 65-79, (2000).

- F. Alessio - M. L. Bertotti - P. Montecchiari,
Multibump solutions to possibly degenerate equilibria of almost periodic Lagrangian systems,
Zeitschrift für Angewandte Mathematik und Physik (ZAMP),
vol. 50, n. 6, pp. 860-891, (1999).

- M. L. Bertotti - P. Montecchiari,
  Connecting orbits for some classes of almost periodic Lagrangian systems,
  Journal of Differential Equations,
  vol. 145, pp. 453-468, (1998).

- M. L. Bertotti - S. V. Bolotin,
  Doubly asymptotic trajectories of Lagrangian systems in homogeneous force fields,
  Annali di Matematica Pura ed Applicata,
  (IV), vol. CLXXIV, pp. 253-275, (1998);

- M. L. Bertotti - S. V. Bolotin,
  Doubly asymptotic trajectories of Lagrangian systems and a problem by Kirchhoff,
  Rendiconti Lincei: Matematica e Applicazioni,
  serie IX, vol. VIII, pp. 93-100, (1997).

- M. L. Bertotti - L. Jeanjean,
  Multiplicity of homoclinic solutions for singular second order conservative systems,
  Proceedings of the Royal Society of Edinburgh,
  vol. 126A, pp. 1169-1180, (1996).

- M. L. Bertotti - S. V. Bolotin,
  A variational approach for homoclinics in almost periodic Hamiltonian systems,
  Communications on Applied Nonlinear Analysis,
  vol. 2, pp. 43-57, (1995).

- M. L. Bertotti - S. V. Bolotin,
  Homoclinic solutions of quasiperiodic Lagrangian systems,
  Differential and Integral Equations,
  vol. 8, pp. 1733-1760, (1995).

- M. L. Bertotti,
  Homoclinics for Lagrangian systems on Riemannian manifolds,
  Dynamic Systems and Applications,
  vol. 1, pp. 341-368, (1992).

- M. L. Bertotti,
  Forced oscillations for singular dynamical systems with an application

to the restricted three body problem,
Journal of Differential Equations,
vol. 93, pp. 102-141, (1991).

- M. L. Bertotti,
Multiplicity of kT-periodic solutions near a given T-periodic solution for nonlinear Hamiltonian systems,
Differential and Integral Equations,
vol. 2, pp. 193-202, (1989).

- M. L. Bertotti,
Multiplicity of subharmonic solutions of forced Hamiltonain systems near an equilibrium,
Manuscripta Mathematica,
vol. 64, pp. 389-402, (1989).

- M. L. Bertotti,
Forced oscillations of asymptotically linear Hamiltonian systems,
Bollettino Unione Matematica Italiana,
vol. 7 (1B), pp. 729-740, (1987).

- M. L. Bertotti,
Localization of closed orbits of nonlinear Hamiltonian systems with 1:-2 resonance near an equilibrium,
Bollettino Unione Matematica Italiana,
vol. 7 (1B), pp. 965-978, (1987).

- M. L. Bertotti - V. Moauro,
Bifurcation and total stability,
Rendiconti del Seminario Matematico dell'Università di Padova,
vol. 71, pp. 131-139, (1984).

1.2.2 Refereed chapters in books

- M. Wenin, M. L. Bertotti, G. Modanese,
Quasi-static ropeway simulation using parallel computing,
Engineering Design Applications IV,
edito da A. Öchsner, H. Altenbach,
Springer Research Monograph in the Advanced Structured Materials Series,
vol. 172, pp. 103-111, (2022).

- M. L. Bertotti,
  Taxation and redistribution against inequality: a mathematical model,
  Macroeconomics,
  edito da Musa Jega Ibrahim,
  IntechOpen, London. 10.5772/intechopen.100939 (2021).

- S. Ladurner - M. Wenin - D. Reiterer - M. L. Bertotti - G. Modanese,
  Experimental investigation of the dynamics of a ropeway passing over a support,
  Engineering Design Applications III,
  edito da A. Öchsner, H. Altenbach,
  Springer Research Monograph in the Advanced Structured Materials Series,
  vol. 124, pp. 61-69, (2020).

- M. Wenin - A. Windisch - S. Ladurner - M. L. Bertotti - G. Modanese,
  Optimization of the head geometry for a cable car passing over a support,
  Engineering Design Applications II,
  edito da A. Öchsner, H. Altenbach,
  Springer Research Monograph in the Advanced Structured Materials Series,
  vol. 113, pp. 231-241, (2020).

- M. Wenin - M. Irschara - S. Obexer - M. L. Bertotti - G. Modanese,
  Cable railway simulation: a two-span oscillator model,
  Engineering Design Applications,
  edito da A. Öchsner, H. Altenbach,
  Springer Research Monograph in the Advanced Structured Materials Series,
  vol. 92, pp. 65-79, (2019) (disponibile online dal 2018).

- H. Thaler - M. Wenin - J. Brunner - D. Reiterer - M. L. Bertotti - G. Modanese - E. Oberhuber,
  Numerical optimization in ropeway planning,
  Properties and Characterization of Modern Materials,
  edito da A. Öchsner, H. Altenbach,
  Springer Research Monograph in the Advanced Structured Materials Series,
  vol. 33, pp. 113-124, (2016).

- M. L. Bertotti - G. Modanese,
  Mathematical Models for Socio-Economic Problems,
  Mathematical Models and Methods for Planet Earth,
  edito da A. Celletti, U. Locatelli, T. Ruggeri, E. Strickland,
  Springer INDAM Series,
  vol. 6, pp. 123-134, (2014).

- N. Bellomo - M. L. Bertotti - S. Motta,
  Cancer Immune System Competition: Modelling and Bifurcation Problems,
  Cancer Modelling and Simulation,
  edito da L. Preziosi, Chapman & Hall / CRC Press, pp. 299-332, (2003).

- M. L. Bertotti - S. V. Bolotin,
  Kinetic energy and Lyapunov stability of equilibria of natural Lagrangian systems,
  International Conference on Differential Equations - Equadiff 99, Berlin,
  edito da B. Fiedler, K. Gröger e J. Sprekels, World Scientific, pp. 1155-1157, (2000).

- M. L. Bertotti - S. V. Bolotin,
  Homoclinic solutions of almost periodic Hamiltonian systems,
  International Conference on Differential Equations - Equadiff 95, Lisbon,
  edito da L. Magalhaes, C. Rocha e L. Sanchez World Scientific, pp. 272-276, (1998).

- A. Ambrosetti - M. L. Bertotti,
  Homoclinics for second order conservative systems,
  Partial Differential Equations and Related Subjects,
  volume in onore di Louis Niremberg, edito da M. Miranda, Pitman Research Notes in Mathematics, Longman Scientific & Technical, pp. 21-37, (1992).

- M. L. Bertotti,
  Periodic solutions for the elliptic planar restricted three body problem: a variational approach,
  Predictability, Stability and Chaos in N-Body Dynamical Systems,

edito da A.E. Roy, NATO-ASI Series, Plenum Press, pp. 467-473, (1991).

- M. L. Bertotti,
  A note on a Theorem of Conley and Zehnder,
  Recent Advances in Hamiltonian Systems,
  edito da G.F. Dell'Antonio e B.M. D'Onofrio, World Scientific, pp. 135-145, (1987).

- M. L. Bertotti - E. Zehnder,
  A Poincaré–Birkhoff type result in higher dimensions,
  Stochastic Processes in Classical and Quantum Systems,
  edito da S. Albeverio, G. Casati e D. Merlini, Lecture Notes in Physics 262, Springer Verlag, pp. 54-64, (1986).

1.2.3 Books

- M. L. Bertotti - F. Bigolin - B. Firmani,
  Geometria Vettoriale nel piano e nello spazio con esercizi svolti di Esami di Stato,
  Edizioni Scientifiche Italiane (2018).

- M. L. Bertotti - G. Modanese,
  Elementi di Meccanica Razionale. Una Prospettiva Dinamica,
  Edizioni Scientifiche Italiane (2015).

1.3 Other scientific activities

- Reviewer for Mathematical Reviews of the American Mathematical Society. I reviewed almost 300 papers and 6 books.

- Reviewer for various scientific international journals, including Algorithms, Annales Polonici Mathematici, Annali dell'Università di Ferrara, Annali di Matematica Pura ed Applicata, Applied Mathematics and Computation, Applied Mathematical Modelling, Chaos, Solitons & Fractals, Complexity, Communications in Nonlinear Science and Numerical Simulation Journal of Applied Mathematics and Computing, Energy Strategy Reviews, Entropy, European Physical Journal Special Topics, International Economic Journal, International Journal

of Information Technology & Decision Making, Journal of Combinatorial Optimization, Journal of Complex Networks, Journal of Computational Science, Journal of Differential Equations, Journal of Mathematical Analysis and Applications, Mathematical and Computational Applications, Mathematical Models and Methods in the Applied Sciences, Mathematics, NoDEA, Nonlinear Analysis TMA, Nuovo Cimento B, Physica A, Proceedings of the Edinburgh Mathematical Society, Resources Policy, Scandinavian Journal of Statistics, Symmetry, Scientific Reports, Socio-Economic Planning Sciences, Statistics and Computing, Structural Change and Economic Dynamics.

- Member and/or president (during the years) of several Commissions for the selection procedure of an assistant professor or a RTD, and Commissions for the confirmation of university assistant professors, of associate professors, and of full professors; member of Commission for the final examination of PhD.

- Expert evaluator assisted the European Commission within the FP7 framework both in the evaluation of European Projects and for the attribution of Marie Curie fellowships.

- Expert evaluator assisted the European Commission within the HORIZON 2020 framework in the evaluation of European Projects.

- Evaluator of research projects for INdAM, Istituto Nazionale di Alta Matematica, and for announcements SIR von MIUR (Ministero dell'Istruzione, dell'Università e della Ricerca).

- Referee for MIUR (Ministero dell'Istruzione, dell'Università e della Ricerca) in connection with the evaluation of projects announcements PRIN.

- Referee for national and international projects presented at Italian or foreign universities.

1.4 Seminars held

More than 50 seminars or communications held at scientific international workshops and in various Universities.

1.5 Participation to workshops and schools

Participated to more than 100 international and national workshops and schools.

2. Didactic activity

2.1 Didactic experience

Long and various experience (started in 1986), including courses of Analisi Matematica (I, II and Complementi), Meccanica Razionale, Istituzioni di Fisica Matematica, Fisica Matematica, Modelli Matematici, Matematica Applicata, Geometria, Advanced Statistics and lessons within Preparatory Course in Mathematics, for various undergraduate and specialist degree courses at the Faculty of Science and at the Faculty of Engineering of the University of Trento, at the Faculty of Engineering of the University of Palermo and at the Faculty of Science and Technology of the free University of Bozen-Bolzano.

2.2 Some didactic-administrative activities

- Member for various years of the didactic commission of the Faculty of Engineering, at the University of Palermo.
- Delegate by the Dean to represent the Faculty of Engineering, University of Palermo, since 2001 and till 2008 in the National Commission for the Admission Tests in the Engineering Faculties.
- Member of the national sub-commission preparing the tests of mathematics and logic for the Admission Tests in the Engineering Faculties.
- Delegated by the Dean for the Faculty of Engineering, University of Palermo, from November 2000 to December 2004, as the responsible for questions relating Advisory and Tutoring.
- Responsible for the Faculty of Engineering, University of Palermo (delegated by the Dean) for the years 2001/02, 2002/03, 2003/04 of the organization of the survey of didactic quality.
- Member of the Giunta di Presidenza di Facoltà (Faculty of Engineering, University of Palermo) from March 2005 to November 2007.

- Member of the Directive Board of C.I.S.I.A. (Centro Interuniversitario per l'Accesso alle Scuole di Ingegneria e Architettura) from 2005 to 2009.
- Vicedean of the Faculty of Science and Technology of the Free University of Bozen-Bolzano from November 2008 to October 2011.
- Director of the Bachelor in Logistik and Production Engineering and subsequently in Industrial Mechanical Engineering, Free University of Bozen-Bolzano, for some years.

2.3 Third mission activities

- Together with the colleaugues of mathematical area of the faculty I organised at the Free University of Bozen-Bolzano on March 14 (Pi-Day), in the years 2015, 2016, 2017 and 2019, an event devoted to high school students characterized by two popular seminars, one in italian and the other in german, about mathematics and its applications.
- She participated in the Mathematik - Modellierungswoche, which took place from 16.03.14 to21.03.14 at the Castle Rechtenthal (BZ), organized by the German speaking Sovrintendenza of Southtyrol province.
- In february 2013 she presented (in Italian) within the event MINT (Mathematik, Informatik, Naturwissenschaft, Technik) in Bolzano a seminar entitled "Can we live without mathematics?". Also, for three times in 2013, 2014, 2015 she participated to the round table "Mathematics, physics with ...", organised on the occasion of this event.
- I have been interviewed in several occasions (e.g. by the local media) in connection to mathematics and to my research.

Curriculum dell'attività scientifica e didattica
di
Maria Letizia BERTOTTI

Posizione attuale

Professore Ordinario nel settore scientifico disciplinare (SSD)
MATH-04/A - Fisica Matematica
presso la Facoltà di Ingegneria della **Libera Università di Bolzano**.

Posizioni accademiche precedentemente ricoperte

- Dall'1/11/2008 al 28/2/2023 **Professore di Prima Fascia**
  nel settore scientifico disciplinare **Fisica Matematica**,
  Facoltà di Scienze e Tecnologie della Libera Università di Bolzano.
- Dall'**1/11/2000** al 31/10/2008 **Professore di Prima Fascia**
  nel settore scientifico disciplinare **Fisica Matematica**,
  Facoltà di Ingegneria dell'Università degli Studi di Palermo.
- Dall'1/11/1998 al 31/10/2000 **Professore di Seconda Fascia**
  nel settore scientifico disciplinare **Analisi Matematica**,
  Facoltà di Ingegneria dell'Università degli Studi di Palermo.
- Dal 18/6/1986 al 31/10/1998 **Ricercatore Universitario**
  nel settore scientifico disciplinare **Fisica Matematica**,
  Facoltà di Scienze Matematiche, Fisiche, Naturali dell'Università di Trento.

Formazione e studi

- Diploma di Perfezionamento "Magister Philosophiae in Fisica Matematica" con 30/30 e Lode, Scuola Internazionale Superiore di Studi Avanzati, Trieste, (1985); (borsa di studio da novembre 1984 per frequenza di 8 corsi, dei quali 6 superati con 30/30 e Lode, 2 con 30/30);

- Frequenza e colloquio finale a sei corsi post-laurea organizzati dall'Istituto Nazionale di Alta Matematica "F. Severi", Bologna, con borsa di studio INdAM dall'11/1982 al 31/10/1983;
- Laurea in Matematica con 110/110 e Lode, Università degli Studi di Trento (1982);
- Diploma di maturità classica conseguito nel luglio 1977 presso il Liceo Classico G. Carducci di Bolzano.

Conoscenza lingue

- **italiano** - lingua madre;
- livello di conoscenza della lingua **inglese**: C1
  (Cambridge Assesment English).
- livello di conoscenza della lingua **tedesca**: C1
  (Goethe Zertifikat).

1. Attività scientifica

1.1 Aree di interesse in breve

Sistemi complessi, Reti complesse, Modelli matematici, Modelli dal micro al macro di interesse in ambito socio-economico, Equazioni differenziali ordinarie, Sistemi dinamici, Sistemi Hamiltoniani, Analisi nonlineare.

1.2 Descrizione sintetica degli argomenti delle ricerche svolte

Per molti anni la mia ricerca ha riguardato la dinamica di sistemi di equazioni differenziali nonlineari aventi origine in questioni di meccanica classica e meccanica celeste. Mi sono occupata di sistemi di equazioni di Hamilton e di Lagrange, autonomi, o dipendenti dal tempo ad esempio in modo periodico o quasi-periodico. Le tecniche e gli strumenti con cui ho affrontato i vari problemi (fra i quali la ricerca di soluzioni periodiche, omocline, eterocline, ...) comprendono diversi metodi di analisi nonlineare e, più specificamente, della teoria dei punti critici (fra cui, sviluppi delle teorie di Morse e di Lusternick e Schnirelmann).

A partire grosso modo dai primi anni del nuovo millennio la mia attenzione è andata spostandosi verso un diverso, affascinante campo. Ho iniziato ad

occuparmi di aspetti metodologici per la modellazione di sistemi complessi. In particolare, sono andata sviluppando una discretizzazione di una classe di equazioni integro-differenziali nonlineari di tipo Boltzmann, che si rivelano uno strumento naturale per modellare l'evoluzione della distribuzione di probabilità dello stato microscopico di un sistema composto da numerosi elementi/individui/particelle interagenti. Le equazioni differenziali ordinarie (un sistema di molte equazioni) in cui tale discretizzazione si traduce possono essere utilizzate per analizzare e spiegare, a partire dalla conoscenza delle interazioni "microscopiche", fenomeni osservabili (in fisica, economia, biologia, scienze sociali, ...) a livello "macroscopico". Con riferimento a questo approccio, ho sia affrontato questioni prettamente analitiche (di buona posizione, ...), sia sviluppato simulazioni numeriche. Ad esempio, mi sono occupata di formazione delle opinioni, formulando ed investigando diversi modelli matematici atti a descrivere tale formazione. Successivamente ho sviluppato un modello (che tiene conto di una molteplicità di interazioni e scambi di natura economica) per lo studio della emergenza della curva di distribuzione del reddito e della disuguaglianza economica in presenza a diversi sistemi di tassazione e di welfare. In collaborazione con altri ricercatori abbiamo poi formulato una versione del modello contenente anche termini stocastici di incertezza.

Da alcuni anni, avendo compreso come l'insieme delle connessioni fra le varie entità interagenti in sistemi complessi (ad esempio, gli individui di una società o le ditte di un paese in un problema di tipo economico) giochi un ruolo cruciale nel comporsi dei fenomeni collettivi osservati a livello macroscopico, ho iniziato ad interessarmi di networks complessi. Ho iniziato a studiare problemi di dinamica su networks, incorporando mediante un approccio eterogeneo di campo medio la topologia di networks diversi nei sistemi di equazioni di evoluzione. Ho applicato questo approccio allo studio della diffusione di innovazioni, ottenendo una generalizzazione del famoso modello di Bass degli anni sessanta. Un ulteriore ambito di ricerca di cui mi sono occupata, coinvolgente aspetti di meccanica e tecniche di minimizzazione, riguarda problemi connessi alla dinamica e alle oscillazioni di una funivia, segnatamente in prossimità del passaggio su supporto.

1.2 Elenco delle pubblicazioni

1.2.1 Articoli in riviste internazionali

- M. L. Bertotti, M. Menale,
  Opinion dynamics models describing the emergence of polarization

phenomena,
Journal of Computational Social Science,
vol. 7(3), pp. 2591-2612 (2024).

- M. L. Bertotti,
A mathematical model for the dynamics of income distribution in the presence of production,
Complexity,
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- U. Asma, M. L. Bertotti, S. Zamai, M. Arnold, R. Amorati, M. Scampicchio,
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- M. L. Bertotti, B. Carbonaro, M. Menale,
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- S. Leitner, M. L. Bertotti,
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- M. L. Bertotti,
A mathematical model of universal basic income and its numerical simulations,
Algorithms,
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- M. L. Bertotti, G. Modanese,
Diagonal degree correlations vs. epidemic thresholds in scale-free networks,
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- M. L. Bertotti, A. K. Chattopadhyay, G. Modanese,
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- M. Wenin, S. Ladurner, D. Reiterer, M. L. Bertotti, G. Modanese,
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- M. L. Bertotti, G. Modanese,
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- M. L. Bertotti - G. Modanese,
On the evaluation of the takeoff time and of the peak time for innovation diffusion on assortative networks,
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- M. L. Bertotti - G. Modanese,
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- M. L. Bertotti - G. Modanese,
The Bass diffusion model on finite Barabasi-Albert networks,
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vol. 2019, Article ID 6352657, 12 pages (2019).

- M. Wenin - A. Windisch - S. Ladurner - M. L. Bertotti - G. Modanese,
Optimal velocity profile for a cable car passing over a support,

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- M. L. Bertotti - A. K. Chattopadhyay - G. Modanese,
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- M. L. Bertotti - A. K. Chattopadhyay - G. Modanese,
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- M. L. Bertotti - G. Modanese,
Mathematical models describing the effects of different tax evasion behaviors,
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- M. L. Bertotti - G. Modanese,
Statistics of binary exchange of energy or money,
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- M. L. Bertotti - A. K. Chattopadhyay - G. Modanese,
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- M. L. Bertotti - A. K. Chattopadhyay - G. Modanese,
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- M. L. Bertotti - G. Modanese,
Economic inequality and mobility in kinetic models for social sciences,
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- M. L. Bertotti - G. Modanese,
Discretized kinetic theory on scale-free networks,

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vol. 225, 10, pp. 1879-1891, (2016).

- M. L. Bertotti - G. Modanese,
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Chaos, Solitons & Fractals,
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- M. L. Bertotti,
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- M. L. Bertotti - M. Delitala,
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- M. L. Bertotti - M. Delitala,
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- N. Bellomo - M. L. Bertotti - M. Delitala,
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- M. L. Bertotti - M. Delitala,
On the Qualitative Analysis of the Solutions of a Mathematical Model of Social Dynamics,
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- M. L. Bertotti - M. Delitala,
From Discrete Kinetic and Stochastic Game Theory to Modelling Complex Systems in Applied Sciences,
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- M. L. Bertotti - N. Bellomo,
Boundary value steady solutions of a class of hydrodynamic models for vehicular traffic flow,
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- F. Alessio - M. L. Bertotti - P. Montecchiari,
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- M. L. Bertotti - S. V. Bolotin,
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  Annali di Matematica Pura ed Applicata,
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- M. L. Bertotti - S. V. Bolotin,
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- M. L. Bertotti - L. Jeanjean,
  Multiplicity of homoclinic solutions for singular second order conservative systems,
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- M. L. Bertotti - S. V. Bolotin,
  A variational approach for homoclinics in almost periodic Hamiltonian systems,
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- M. L. Bertotti - S. V. Bolotin,
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  Differential and Integral Equations,
  vol. 8, pp. 1733-1760, (1995).

- M. L. Bertotti,
  Homoclinics for Lagrangian systems on Riemannian manifolds,
  Dynamic Systems and Applications,
  vol. 1, pp. 341-368, (1992).

- M. L. Bertotti,
  Forced oscillations for singular dynamical systems with an application

to the restricted three body problem,
Journal of Differential Equations,
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- M. L. Bertotti,
Multiplicity of kT-periodic solutions near a given T-periodic solution for nonlinear Hamiltonian systems,
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- M. L. Bertotti,
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- M. L. Bertotti,
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- M. L. Bertotti,
Localization of closed orbits of nonlinear Hamiltonian systems with 1:-2 resonance near an equilibrium,
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- M. L. Bertotti - V. Moauro,
Bifurcation and total stability,
Rendiconti del Seminario Matematico dell'Università di Padova,
vol. 71, pp. 131-139, (1984).

1.2.2 Articoli in capitoli di libri (con referee)

- M. Wenin, M. L. Bertotti, G. Modanese,
Quasi-static ropeway simulation using parallel computing,
Engineering Design Applications IV,
edito da A. Öchsner, H. Altenbach,
Springer Research Monograph in the Advanced Structured Materials Series,
vol. 172, pp. 103-111, (2022).

- M. L. Bertotti,
  Taxation and redistribution against inequality: a mathematical model,
  Macroeconomics,
  edito da Musa Jega Ibrahim,
  IntechOpen, London. 10.5772/intechopen.100939 (2021).

- S. Ladurner - M. Wenin - D. Reiterer - M. L. Bertotti - G. Modanese,
  Experimental investigation of the dynamics of a ropeway passing over a support,
  Engineering Design Applications III,
  edito da A. Öchsner, H. Altenbach,
  Springer Research Monograph in the Advanced Structured Materials Series,
  vol. 124, pp. 61-69, (2020).

- M. Wenin - A. Windisch - S. Ladurner - M. L. Bertotti - G. Modanese,
  Optimization of the head geometry for a cable car passing over a support,
  Engineering Design Applications II,
  edito da A. Öchsner, H. Altenbach,
  Springer Research Monograph in the Advanced Structured Materials Series,
  vol. 113, pp. 231-241, (2020).

- M. Wenin - M. Irschara - S. Obexer - M. L. Bertotti - G. Modanese,
  Cable railway simulation: a two-span oscillator model,
  Engineering Design Applications,
  edito da A. Öchsner, H. Altenbach,
  Springer Research Monograph in the Advanced Structured Materials Series,
  vol. 92, pp. 65-79, (2019).

- H. Thaler - M. Wenin - J. Brunner - D. Reiterer - M. L. Bertotti - G. Modanese - E. Oberhuber,
  Numerical optimization in ropeway planning,
  Properties and Characterization of Modern Materials,
  edito da A. Öchsner, H. Altenbach,
  Springer Research Monograph in the Advanced Structured Materials Series,
  vol. 33, pp. 113-124, (2016).

- M. L. Bertotti - G. Modanese,
  Mathematical Models for Socio-Economic Problems,
  Mathematical Models and Methods for Planet Earth,
  edito da A. Celletti, U. Locatelli, T. Ruggeri, E. Strickland,
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  vol. 6, pp. 123-134, (2014).

- N. Bellomo - M. L. Bertotti - S. Motta,
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  Cancer Modelling and Simulation,
  edito da L. Preziosi, Chapman & Hall / CRC Press, pp. 299-332, (2003).

- M. L. Bertotti - S. V. Bolotin,
  Kinetic energy and Lyapunov stability of equilibria of natural Lagrangian systems,
  International Conference on Differential Equations - Equadiff 99, Berlin,
  edito da B. Fiedler, K. Gröger e J. Sprekels, World Scientific, pp. 1155-1157, (2000).

- M. L. Bertotti - S. V. Bolotin,
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  International Conference on Differential Equations - Equadiff 95, Lisbon,
  edito da L. Magalhaes, C. Rocha e L. Sanchez World Scientific, pp. 272-276, (1998).

- A. Ambrosetti - M. L. Bertotti,
  Homoclinics for second order conservative systems,
  Partial Differential Equations and Related Subjects,
  volume in onore di Louis Niremberg, edito da M. Miranda, Pitman Research Notes in Mathematics, Longman Scientific & Technical, pp. 21-37, (1992).

- M. L. Bertotti,
  Periodic solutions for the elliptic planar restricted three body problem: a variational approach,
  Predictability, Stability and Chaos in N-Body Dynamical Systems,

edito da A.E. Roy, NATO-ASI Series, Plenum Press, pp. 467-473, (1991).

- M. L. Bertotti,
  A note on a Theorem of Conley and Zehnder,
  Recent Advances in Hamiltonian Systems,
  edito da G.F. Dell'Antonio e B.M. D'Onofrio, World Scientific, pp. 135-145, (1987).

- M. L. Bertotti - E. Zehnder,
  A Poincaré–Birkhoff type result in higher dimensions,
  Stochastic Processes in Classical and Quantum Systems,
  edito da S. Albeverio, G. Casati e D. Merlini, Lecture Notes in Physics 262, Springer Verlag, pp. 54-64, (1986).

1.2.3 Libri

- M. L. Bertotti - F. Bigolin - B. Firmani,
  Geometria Vettoriale nel piano e nello spazio con esercizi svolti di Esami di Stato,
  Edizioni Scientifiche Italiane (2018).

- M. L. Bertotti - G. Modanese,
  Elementi di Meccanica Razionale. Una Prospettiva Dinamica,
  Edizioni Scientifiche Italiane (2015).

1.3 Altre attività scientifiche

- Reviewer per Mathematical Reviews dell'American Mathematical Society. Finora ha recensito circa 300 articoli e 6 libri.

- Svolge ed ha svolto attività in qualità di referee per diverse riviste scientifiche con comitato internazionale. Fra esse: Algorithms, Annales Polonici Mathematici, Annali dell'Università di Ferrara, Annali di Matematica Pura ed Applicata, Applied Mathematics and Computation, Applied Mathematical Modelling, Chaos, Solitons & Fractals, Complexity, Communications in Nonlinear Science and Numerical Simulation Journal of Applied Mathematics and Computing, Energy Strategy Reviews, Entropy, European Physical Journal Special Topics, International Economic Journal, International Journal of Information Technology & Decision Making, Journal of Combinatorial Op-

timization, Journal of Complex Networks, Journal of Computational Science, Journal of Differential Equations, Journal of Mathematical Analysis and Applications, Mathematical and Computational Applications, Mathematical Models and Methods in the Applied Sciences, Mathematics, NoDEA, Nonlinear Analysis TMA, Nuovo Cimento B, Physica A, Proceedings of the Edinburgh Mathematical Society, Resources Policy, Scandinavian Journal of Statistics, Symmetry, Scientific Reports, Socio-Economic Planning Sciences, Statistics and Computing, Structural Change and Economic Dynamics.

- Membro e/o presidente (negli anni) di parecchie Commissioni giudicatrici per posizioni di ricercatore universitario e di RTD, di Commissioni per la conferma di ricercatori universitari, di professore associato, e di professore ordinario; membro di Commissione per l'esame finale di Dottorato di ricerca.

- Esperto valutatore per la Commissione Europea nel Settimo Programma Quadro FP7, ha assistito la Commissione nella valutazione di Progetti Europei e di Progetti per Borse di Studio Marie Curie.

- Esperto valutatore per la Commissione Europea nel Programma Quadro HORIZON 2020, ha assistito la Commissione nella valutazione di Progetti Europei.

- Valutatore di progetti di ricerca per l'Istituto Nazionale di Alta Matematica, INdAM e nell'ambito di bandi SIR del MIUR (Ministero dell'Istruzione, dell'Università e della Ricerca).

- Referee per il MIUR (Ministero dell'Istruzione, dell'Università e della Ricerca) nella valutazione progetti Bando PRIN.

- Referee per progetti nazionali e internazionali presentati presso università italiane o straniere.

1.4 Comunicazioni e seminari tenuti

Ha tenuto oltre 50 fra seminari e comunicazioni in occasione di convegni internazionali ed in varie Università.

1.5 Partecipazione a scuole e convegni

Ha partecipato ad oltre 100 fra convegni internazionali, nazionali e scuole.

2. Attività didattica

2.1 Insegnamenti

Estesa e diversificata esperienza didattica (iniziata nel 1986), comprendente insegnamenti di Analisi Matematica (I, II e Complementi), Meccanica Razionale, Istituzioni di Fisica Matematica, Fisica Matematica, Modelli Matematici, Matematica Applicata, Geometria, Statistica Avanzata, e lezioni ai Precorsi di Matematica, presso diversi corsi di laurea della Facoltà di Scienze Matematiche, Fisiche e Naturali e della Facoltà di Ingegneria dellÕUniversità di Trento, della Facoltà di Ingegneria dellÕUniversità degli Studi di Palermo e della Facoltà di Scienze e Tecnologie della Libera Università di Bolzano.

2.2 Alcune attività di tipo didattico-organizzativo

- Membro per vari anni della Commissione Paritetica per la Didattica della Facoltà di Ingegneria dell'Università di Palermo.
- Referente delegato per la Facoltà di Ingegneria dell'Università degli Studi di Palermo dal 2001 al 2008 nella Commissione Nazionale Test che predispone i test d'ingesso per le facoltà di ingegneria consorziate.
- Membro per diversi anni della sottocommissione nazionale che prepara e predispone i quesiti di area matematica e della sottocommissione per i quesiti di area logica per detto test.
- Referente di Facoltà (delegato dal Preside), da novembre 2000 a dicembre 2004, per le questioni inerenti Orientamento e Tutorato.
- Responsabile per la Facoltà (delegato dal Preside) della organizzazione del lavoro di rilievo per la Valutazione della Qualità della Didattica negli anni 2001/02, 2002/03, 2003/04.
- Membro della Giunta di Presidenza di Facoltà nel periodo marzo 2005 - novembre 2007.
- Membro del Comitato Direttivo del C.I.S.I.A. (Centro Interuniversitario per l'Accesso alle Scuole di Ingegneria e Architettura) dal 2005 al 2009.
- Vicepreside della Facoltà di Scienze e Tecnologie della Libera Università di Bolzano da novembre 2008 ad ottobre 2011.

- Direttore del Consiglio di Corso di Studio in Ingegneria Logistica e della Produzione e successivamente in Ingegneria Industriale Meccanica, Libera Università di Bolzano, per alcuni anni.

2.3 Attività didattico-divulgative

- Assieme ai colleghi di facoltà di area matematica ha organizzato presso la Libera Università di Bolzano nel giorno di Pi Greco - Pi Day (14 marzo) nel 2015, nel 2016, nel 2017 e nel 2019 un evento per studenti delle scuole medie e superiori comprendente due seminari di carattere divulgativo su temi inerenti la matematica e le sue applicazioni, uno in lingua italiana ed uno in lingua tedesca.

- Ha partecipato alla Mathematik - Modellierungswoche, che si è svolta nella settimana dal 16.03.14 al 21.03.14 presso Castel Rechtenthal (BZ), organizzata dalla Sovrintendenza di lingua tedesca della Provincia di Bolzano, proponendo il progetto dal titolo "Werden Reiche immer reicher und Arme immer ärmer?".

- Nel febbraio 2013 ha tenuto nell'ambito della manifestazione MINT (Mathematik, Informatik, Naturwissenschaft, Technik) a Bolzano un seminario dal titolo "Si può vivere senza la matematica?" e per tre volte, nel 2013, 2014, 2015 ha partecipato alla tavola rotonda "Matematica, fisica con ..." organizzata in occasione di questa manifestazione.

- Sono stata intervistata in varie occasioni (ad esempio dai media locali) a proposito di temi relativi alla matematica e alla ricerca che svolgo.