



# Alfio Borzi

## Professor of Mathematics

### Experience

- 2011 - Now **Full Professor (Chair Mathematik IX)** [University of Würzburg, Germany](#)  
Starting March 1st, 2011, till now, Full Professor (W3) and Chair of Mathematik IX 'Scientific Computing' at the Institute for Mathematics, University of Würzburg. I have built up this new chair to its present status including W1 and W2 professorships and, in few years, I could make this chair internationally visible to different scientific communities.  
(In 2011, I also got a call for the full professorship 'Algorithmic Optimization' at the Humboldt Universität zu Berlin, but I declined this offer. )
- 2008 - 2011 **Associate Professor** [Università degli Studi del Sannio, Italy](#)  
In the period 2008-2010, I was Associate Professor at the Università degli Studi del Sannio in the Engineering School. During this period, I contributed to the LIGO project and collaborated on the development of algorithms for image restoration applied to SAR interferograms.
- 2003 - 2008 **Associate Professor** [University of Graz, Austria](#)  
In the period 2003-2007, I was Associate Professor at Institute for Mathematics and Scientific Computing, Karl-Franzens-University Graz. During this period I was leading a FWF project on quantum control problems and a SFB sub-project on non-linear reaction-diffusion (monodomain) models for medical application.
- 1998 - 2003 **Assistant Professor** [University of Graz, Austria](#)  
In 1998 - 2003, I was Assistant Professor at Institute for Mathematics and Scientific Computing Karl-Franzens-University Graz. My research focused on multigrid methods and optimal control problems.
- 1996 - 1997 **Research Engineer** [AVL List GmbH, Graz, Austria.](#)  
During the period 1996 - 1997, I was Research Engineer in the internationally renowned company AVL List GmbH, Graz, Austria. I worked on CFD and gas dynamics problems in engine simulation, multigrid solvers, and finite-volume schemes. I have continued this activity as private contractor till 2008.
- 1993 - 1995 **Research Officer** [University of Oxford, UK](#)  
In 1993 - 1995, I was Research Officer at the Oxford University, Oxford, UK, in the group of Professor Bill Morton. I worked on the analysis of finite-volume schemes and their solution by multigrid methods.
- 1991 - 1992 **Lieutenant** [CNMCA, Roma, Italy](#)  
During the period 1991 - 1992, I was an Italian Air Force Officer (Lieutenant) serving at the Centro Nazionale di Meteorologia e Climatologia, CNMCA, Roma, Italy. I worked on data analysis, Kalman filters, and numerical weather prediction.

### Address

Universität Würzburg  
Institut für Mathematik  
Chair Scientific  
Computing  
Campus Hubland Nord  
Emil-Fischer-Str. 30  
97074 Würzburg  
Germany

### Tel & Skype

+49 162 3741389  
alfio.borzi.lt

### Mail

alfio.borzi@  
uni-wuerzburg.de

### Web

Alfio Borzi  
Chair of Scientific  
Computing

### Personal Data

(prev. Alfio E. Borzi)  
Birth: 01.03.1965,  
Catania, Italy  
Citizenship: Italian

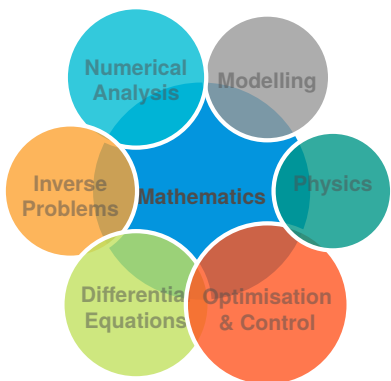
### Personal Skills



## Languages

Italian ★★★★★  
English ★★★★★  
German ★★★★★  
French ★★★★★

## Scientific Knowledge



## Professional metrics

Scopus h-index : 24;  
Google h-index : 32;  
i10-index : 86;  
Total citations : Scopus 2151; Google 4336.

## OS & Coding

GNU/Linux ★★★★★  
MacOS ★★★★★  
Fortran ★★★★★  
MATLAB ★★★★★  
Python ★★★★★  
C++ ★★★★★

## Places Lived

Benevento  
Cambridge  
Catania  
Firenze  
Graz  
Oxford  
Roma  
Salzburg  
Würzburg

## Education

- 1998 - 2003 **Habilitation** [Karl-Franzens-University Graz](#)  
Habilitation at Karl-Franzens-University Graz, Austria.
- 1991 - 1993 **Dottore di ricerca in Matematica** [SISSA/ISAS, Italy](#)  
Doctor Philosophy (Ph.D.) in Mathematical Physics, SISSA/ISAS-International School for Advanced Studies, Trieste, Italy.
- 1988 - 1990 **Magister Philosophiae (M.Ph.) in Mathematical Physics** [SISSA/ISAS, Italy](#)  
1988 - 1990 Master Philosophy (M.Ph.) in Mathematics, SISSA/ISAS-International School for Advanced Studies, Trieste, Italy.
- 1983 - 1988 **Laurea in Fisica** [Università degli Studi di Catania, Italy](#)  
1983 - 1988 Laurea in Physics (MSc), University of Catania, Italy.

## Additional education

- 1997 **Entrepreneur Qualification (Unternehmer Prüfung)** [WIFI Graz, Austria](#)  
Academy of Management, WIFI Graz (A).
- 1996 **Unix and Database Administrator** [HP and Informix, Austria and Germany](#)  
Administration of UNIX systems, Hewlett-Packard, Boeblingen (D), Vienna (A). Development and administration of databases, Informix, Ismaning (D).
- 1991 **Lieutenant** [Italian Air Force, Italy](#)  
Meteorology and numerical weather prediction, National Center of Meteorology and Climatology (CNMCA), Roma (I).

## Main research and teaching topics

1) Numerical solution of PDE optimization problems. 2) Development and analysis of multigrid methods. 3) Analysis of discretization schemes for partial differential equations. 4) Uncertainty quantification in simulation and optimization. 5) Simulation and control of quantum systems. 6) Modelling and numerical solution of gas dynamics problems. 7) Modelling and simulation of bio-chemical processes. 8) Imaging analysis and inverse problems. 9) Multi-agent differential systems. 10) Stochastic models and related control problems. 11) Fokker-Planck models and related control problems. 12) Ensemble optimal control of kinetic models. 13) Machine learning. 14) Analysis and numerical solution of differential games.

## Research Work - Main Contributions

Trained in Mathematics and Physics, my main field of expertise consists in developing and combining analytical and numerical methods in view of modelling and solving fundamental application problems that are often related to modelling, simulation, optimal control and optimisation. I am among the early initiators and/or contributor to the following research fields

1. Multigrid methods for solving optimality systems

## Reviewer

### For Agencies:

DFG, ANVUR, The Royal Society of London, The Russian Science Foundation

### For Journals:

SISC, SICON, SINUM, SIOPT, MMS, COAP, JCAM, JCOMP, JDCS, OMS, IJVC, NM:TMA, etc.

2. Modelling and numerical solution of quantum control problems
3. Fokker-Planck approach to stochastic control problems
4. Ensemble optimal control problems with kinetic models
5. PMP-based SQH method for solving optimal control problems

**Among my achievements, I also would like to mention the modelling of leadership-based control of multi-agent systems and opinion-formation models, the development of new schemes for solving medical imaging problems, advances in the modelling of wine fermentation and its efficient control, and various theoretical and numerical analysis results with linear and nonlinear PDE models.**

**Present research topics also include Monte Carlo methods to solve ensemble optimal control problems governed by kinetic models, methods for solving differential games, superresolution microscopy, and preconditioned iterative methods for machine learning.**

## Scopus & ORCID

Scopus Author ID:  
6603632708

ORCID ID:  
0000-0002-8050-1336

## Teaching

Analysis I and II, Linear Algebra I and II, Optimization I and II, Operations Research, Complex Analysis, Functional Analysis, Applied Analysis, Nonlinear Analysis, Theory of Ordinary Differential Equations, Programming in C++, Numerical Analysis I and II, Theory of Partial Differential Equations, Optimal Control Theory, Numerical Linear Algebra, Multigrid Methods, Multilevel Methods in Optimization with PDE models, Numerical Analysis of Partial Differential Equations and Optimality Systems, Modelling and Scientific Computing, Simulation and Optimal Control of Quantum and Stochastic Systems, Analysis and Implementation of Neural Networks, Kinetic Theory and Transport Problems.

I have been responsible to design and deliver series of PhD lectures on multilevel methods, optimization and control, and numerical analysis of PDEs for PhD schools in the Philippines (Diliman), The Netherlands (Woudschoten-Zeist), Italy (Catania), Austria (Graz), Spain (Zaragoza), and Germany (Schloss Thurnau and Trier), Italy (Catania and Cosenza).

## Memberships and fellowships

- Member of GiP - Gesellschaft für Inverse Probleme e.V.
- Member of the Research Council of the Hugo Steinhaus Center, Wrocław (Breslau). [http://prac.im.pwr.wroc.pl/~hugo/HSC/hsc\\_ang.html](http://prac.im.pwr.wroc.pl/~hugo/HSC/hsc_ang.html).
- Profesor Invitado of the PHD Program in Applied Mathematics at Escuela Politécnica Nacional de Ecuador. <http://www.math.epn.edu.ec/doctorado/index.php/profesores>.
- Past member of EMS and SIAM.
- Tinsley Oden Fellow, Institute for Computational Engineering and Sciences, University of Texas at Austin, USA.

## Professional responsibilities

- Member of the Internationalisation Committee, Universität Würzburg. Past Member of the Commission for Research and Technology Transfer of the University of Würzburg. Past member of the Research in Sciences Committee, Universität Würzburg.
- Administration of the Chair and co-administration of the Institute for Mathematics at JMU Würzburg.

## Editor Duty

Associate Editor:

SIAM Journal on Scientific Computing (SISC) - until 2020 -

SIAM Review, Books section

Guest Editor of CVS, NLAA, NM:TMA, and Journal of Franklin Institute.

## Supervision of PhD Thesis

- **J. Körner**, *Theoretical and numerical analysis of Fokker-Planck optimal control problems by first- and second-order optimality conditions*, PhD Math. Thesis, Univ. Würzburg, 2024.
- **J. Bartsch**, *Theoretical and numerical investigation of optimal control problems governed by kinetic models*, PhD Math. Thesis, Univ. Würzburg, 2021.
- **F. Calà Campana**, *Numerical methods for solving open-loop non zero-sum differential Nash games*, PhD Math. Thesis, Univ. Würzburg, 2021.
- **T. Breitenbach**, *A sequential quadratic Hamiltonian scheme for solving optimal control problems with non-smooth cost functionals*, PhD Math. Thesis, Univ. Würzburg, 2019.
- **D. Kioi Gathungu**, *On multigrid and H-matrix methods for partial integro-differential equations*. PhD Math. Thesis, Univ. Würzburg, 2017.
- **M. Sprengel**, *A theoretical and numerical analysis of a Kohn-Sham equation and related control problems*, PhD Math. Thesis, Univ. Würzburg, 2017.
- **B. Gaviraghi**, *Theoretical and numerical analysis of Fokker-Planck optimal control problems for jump-diffusion processes*. PhD Math. Thesis, Univ. Würzburg, 2017.
- **A. Schindele**, *Proximal methods in medical image reconstruction and in nonsmooth optimal control of partial differential equations*. PhD Math. Thesis, Univ. Würzburg, 2016.
- **J. Merger**, *Optimal control and function identification in biological processes*. PhD Math. Thesis, Univ. Würzburg, 2016.
- **S. Wongkaew**, *On the control through leadership of multi-agent systems*. PhD Math. Thesis, Univ. Würzburg, 2015.
- **G. Ciaramella**, *Optimal control of quantum spin systems*. PhD Math. Thesis, Univ. Würzburg, 2015.
- **M. Mohammadi**, *Discretization of the Fokker-Planck equation and related control systems*. PhD Math. Thesis, Univ. Würzburg, 2015.
- **M. Munir Butt**, *Formulation and multigrid solution of Cauchy-Riemann optimal control problems*, PhD Math. Thesis, Univ. Graz, 2011.
- **M. Vallejos**, *Multigrid optimization methods for elliptic optimal control problems*. PhD Math. Thesis, Univ. Graz, 2008.

Ongoing:

- **Nadja Vater**, *Random preconditioned iterative schemes and multilevel techniques in machine learning*, PhD Math. Thesis, ongoing.
- **Sebastian Hofmann**, *Optimal control and uncertainty quantification techniques in residual neural networks*, PhD Math. Thesis, ongoing.

## Supervision of Master Thesis (selection)

- **Emanuel Pfarr**, *Multigrid methods for least squares problems in tomographic image reconstruction*, MSc Math. Thesis, Univ. Würzburg, 2023.
- **Jonas Doré**, *A recurrent neural network to approximate Koopman operators with application to oscillatory systems*, MSc Math. Thesis, Univ. Würzburg, 2023.
- **Katja Lauer**, *Bildrekonstruktionseigenschaften bei modell- und datengetriebener Regularisierung zur Lösung schlecht gestellter inverser Probleme in der Magnetresonanztomographie*, MSc Math. Thesis, Univ. Würzburg, 2022.
- **Anna Rauch**, *Segmentation by weighted aggregation*, MSc Math. Thesis, Univ. Würzburg, 2021.
- **Kristina Meth**, *Parameter optimization with differential evolution of neural networks for image analysis*, MSc Math. Thesis, Univ. Würzburg, 2021.
- **Melissa Finster**, *Synchronization of Kuramoto and FitzHugh-Nagumo Networks*, MSc Math. Thesis, Univ. Würzburg, 2021.
- **Hannah Weinmann**, *Ecosystem models and social balance from a synchronization perspective*, MSc Math. Thesis, Univ. Würzburg, 2021.
- **Sarah Winkelmann**, *Optimal design with Liouville equation for optical systems*, MSc Math. Thesis, Univ. Würzburg, 2021.
- **Sebastian Hofmann**, *Sequential quadratic Hamiltonian schemes for training Runge-Kutta structured neural networks*, MSc Math. Thesis, Univ. Würzburg, 2021.
- **Max Steinlein**, *The Pontryagin maximum principle for solving Liouville optimal control problems*, MSc Math. Thesis, Univ. Würzburg, 2020.
- **Jonas Kleisel**, *Continuous models of pulse-coupled neural networks for image segmentation*, MSc Math. Thesis, Univ. Würzburg, 2020.
- **Nico Nees**, *A FEM-SQH framework for solving elliptic optimization problems*, MSc Math. Thesis, Univ. Würzburg, 2020.
- **Andreas Seufert**, *On the SSN and SQH methods for solving non-smooth optimal control problems*, MSc Math. Thesis, Univ. Würzburg, 2020.
- **Nadja Henning (now Vater)**, *Nested iteration for approximation with neural networks*, MSc Math. Thesis, Univ. Würzburg, 2019.
- **Jan Bartsch**, *Optimal control problems governed by Liouville models - Mathematical analysis and implementation*, MSc Math. Thesis, Univ. Würzburg, 2018.
- **Melina-Loren Kienle Garrido**, *On the optimal control of a new cancer therapy model*, MSc Math. Thesis, Univ. Würzburg, 2017. (with publication in Journal)
- **Lisa Schäfer**, *A mathematical investigation of a new Lorentz-covariant heat conduction model*, MSc Math. Thesis, Univ. Würzburg, 2017.
- **Andrea Thomann**, *Stability and accuracy of a pseudospectral scheme for the Wigner function equation*, MSc Math. Thesis, Univ. Würzburg, 2015. (with publication in Journal)
- **Veronika Thalhofer**, *Formulation and investigation of a new stochastic hybrid system for subtilin production and the corresponding Fokker-Planck equation*, MSc Math. Thesis, Univ. Würzburg, 2015. (with publication in Journal)
- **Roberta Mancini**, *An adjoint-based optimization scheme for solving time-domain electromagnetic inverse scattering problems*, MSc Math. Thesis, Univ. Sannio, 2009.

- **Elisabeth Decker**, *Spectral methods for the Schrödinger equation*. MSc Math. Thesis, Univ. Graz, 2005. (with publication in Journal)

## Main Research Grants

- BMBF-Verbundprojekt **iDeLIVER - Intelligent MR Diagnosis of the Liver by Linking Model and Data-Driven Processes** (Project Leader, 3 years; ongoing), supported by BMBF, Germany.
- BFHZ Project **Multi-Agent Fokker-Planck Nash Games** (Project Leader, 1 year; start 2018). Supported by BFHZ, Germany.
- BMBF-Verbundprojekt **ROENOBIO - Robust Energy Optimization of Fermentation Processes for the Production of Biogas and Wine** (Project Leader, 4 years; start 2013), supported by BMBF, Germany.
- EU Marie-Curie **Multi-ITN STRIKE - Novel Methods in Computational Finance** (Project Leader, 3 years; start 2013). Supported by EU.
- IZKF-Project **Parallel Multigrid Imaging and Compressed Sensing for Dynamic 3D Magnetic Resonance Imaging** (Project Leader, 3 years; start 2013). Supported by IZKF Universität Würzburg, Germany.
- DFG Project **COCIQ, Controllability and Optimal Control of Interacting Quantum Dynamical Systems** (Project Leader, 3 years; start 2012). Supported by DFG, Germany.
- FWF-Project, MGINV-MOBIS, SFB Mathematical Optimization with Applications to Biomedical Sciences (while on leave in U. Benevento), **Fast Multigrid Methods for Inverse Problems** (Project Leader, 2 years; start 2008). Supported by FWF, Austria.
- FWF-Project, **Quantum Optimal Control of Semiconductor Nanostructures** (Project Leader, 3.5 years; start 2005). Supported by FWF, Austria.

## Industrial Projects

- Towards the optimal control of Boltzmann models of ionized gases (with SPARC Industries SARL Luxemburg.)
- CFD Optimal shape design (with AVL List GmbH).
- PARALLEL AMG: Investigation and Development (with AVL List GmbH).
- Boundary Conditions Calculation in gas-dynamics package BOOST (with AVL List GmbH).
- The Simulation of the Gas Dynamics with Perforated Pipes in Plenum or in Pipes with BOOST (with AVL List GmbH).
- Comparison of Multigrid and SOR for the Solution of the Reynolds Equation in EXCITE (with AVL List GmbH).

## Organization of Workshops/Conferences

- Organizer and Chair of the European Multigrid Conference EMG2010, Isola d'Ischia, Italy, 2010.

- European Science Foundation OPTPDE Workshop Fast solvers for simulation, inversion, and control of wave propagation problems, 26 - 28 September 2011, University of Würzburg, Germany. (ESF Grant 22.000 Eur)
- Weizmann Workshop 2013 on Multilevel Computational Methods and Optimization, The Weizmann Institute of Science, April 30 - May 02, 2013, Rehovot, Israel.
- European Science Foundation OPTPDE Workshop ESF OPTPDE Workshop InterDyn2013, 10 - 12 September 2013, Université Paris-Dauphine, Paris, France. (ESF Grant 26.000 Eur)
- Multi-ITN STRIKE and WWCSC Mini-Workshop in Stochastic Computing and Optimization, Würzburg, Germany, September 30 - October 2, 2014
- 27th IFIP TC7 Conference 2015 on System Modelling and Optimization, Sophia Antipolis, France, 29.6. - 3.7.2015: Two Minisymposia: 1) Quantum optimal control; 2) Sparse reconstruction and medical imaging.
- FGS'2019 French-German-Swiss Conference on Optimization, Nice, Valrose campus, France, 17.9. - 20.9.2019: Minisymposium: Game theory approaches in Inverse Problems and Control.
- SIAM Conference on Optimization (OP21), Spokane, Washington, U.S., 22.07. - 23.7.2021: Minisymposium: The Passage from Optimal Control to Differential Game Problems - Part I and II.
- QuantMOCOTE - Modelling, Optimization and Control of Quantum systems in Technology and Education, Würzburg, Germany, 6-8 March 2023.
- MLSciComp - Machine Learning and Scientific Computing with Applications in Life Sciences and Engineering, Würzburg, Germany, 26-28 June 2023.

## Some Invited Talks

- Numerical Analysis of a General Kinetic Fokker-Planck Equation with Specular Reflection Boundary Conditions, March 2024, Department of Mathematics and Informatics, Università di Firenze, Italy.
- A new approach to high contrast and resolution reconstruction in quantitative photoacoustic tomography, February 2024, MOX, Department of Mathematics, Politecnico di Milano, Italy.
- A Monte Carlo approach to control and stabilization of a linear kinetic model, Nov.-Dec. 2023, Workshop on Applied Mathematics: Quantum and Classical Models (WAMQCM2023), Department of Mathematics and Informatics, Università di Firenze, Italy.
- The Sequential Quadratic Hamiltonian Method, European Conference on Computational Optimization (EUCCO), September 2023, Heidelberg, Germany.
- Formulation and Monte Carlo Solution of Linear Kinetic Optimal Control Problems, September 2023, Department of Mathematics, University of Roma II Tor Vergata, Italy.
- Open and Closed-Loop Linear Kinetic Optimal Control Problems, September 2023, Department of Mathematics and Informatics, University of Catania, Italy.
- Quantum models and optimal control problems, May 2023, Simula Research Laboratory, Oslo, Norway (Online).
- Some multilevel, preconditioning, and optimal control techniques in machine learning, March 2023, International School for Advanced Studies (SISSA), Trieste, Italy.

- On multilevel, preconditioning, and optimal control techniques in machine learning, Workshop on Mathematical Data Science, Control and Optimization, Sept.-Oct. 2022, University of Graz, Austria.
- Ensemble optimal control problems governed by kinetic models, Sept. 2022, Università della Calabria, Cosenza, Italy.
- Exploring multilevel, preconditioning, and optimal control techniques for training neural networks, Aug. 2022, International Multigrid Conference 2022 (IMG 2022), Lugano, Switzerland.
- A journey through quantum control problems, July 2022, Centre National de la Recherche Scientifique, Institut de Physique et Chimie des Matériaux de Strasbourg, France.
- The Pontryagin maximum principle and the training of Runge-Kutta neural networks, Jan. 2022, Department of Mathematics and Physics, University of Caserta, Italy.
- The Pontryagin maximum principle and the training of Runge-Kutta neural networks, Jan. 2022, MOX Seminars Series, Department of Mathematics, Politecnico di Milano, Italy.
- The Pontryagin maximum principle and the training of Runge-Kutta neural networks, Dec. 2021, Department of Mathematics and Informatics, University of Catania, Italy.
- Super-resolution fluorescence microscopy and a mean-field Fokker-Planck equation for the reconstruction of a cell membrane potential, Nov. 2021, Facoltà di scienze informatiche, Università della Svizzera italiana, Lugano, Switzerland.
- Super-resolution fluorescence microscopy and a mean-field Fokker-Planck equation for the reconstruction of a cell membrane potential, Nov. 2021, Department of Mathematics and Informatics, University of Firenze, Italy.
- On ensemble optimal control problems with deterministic and stochastic kinetic models, SIMAI 2020+2021 Congress, Aug.-Sept. 2021, Parma, Italy.
- A new method to compute optimal relaxed controls, Minisymposium Nonsmoothness in PDE constrained optimization and variational inequalities, part of the 29th IFIP TC7 Conference on System Modelling and Optimization, Quito, Ecuador (Online)
- Super-resolution microscopy and mean-field Fokker-Planck equations for the reconstruction of cell membrane potentials, Department of Mathematics and Informatics, University of Catania, 30.07.2021, Catania, Italy.
- On solving dynamical Nash games using the Pontryagin maximum principle, SIAM Conference on Optimization (OP21), July 2021, Spokane, Washington, U.S. (Online)
- Continuity equations and super-resolution microscopy for the reconstruction of a cell membrane potential, Lomonosov State University and the Institute of Numerical Mathematics (INM) at the Steklov Institute of Mathematics, April 2021, Moscow, Russia. (Online)
- The sequential quadratic Hamiltonian scheme solving challenging optimal control problems, MODEMAT, Escuela Politécnica Nacional, October 2020, Quito, Ecuador. (Online)
- The Liouville equation, its extensions, and related optimal control problems, October 2020, Universität Basel, Switzerland. (Online)
- On ensemble optimal control problems governed by Liouville, Fokker-Planck and linear Boltzmann equations - A workshop to celebrate the 50th anniversary of applied mathematics at the FAU Erlangen Nürnberg, March 2020, Germany.
- A sequential quadratic Hamiltonian scheme for solving optimal control problems with non-smooth cost functionals, Workshop "New trends in PDE constrained optimization", October 2019, RICAM, Linz, Austria.



- Optimal control problems with random and stochastic models, Autumn School 2019, DFG Research Training Group 2126 - Algorithmic Optimization -, University of Trier, October 2019, Trier, Germany.
- Optimal control of the Keilson-Storer master equation, Department of Mathematics and Informatics, University of Catania, 02.09.2019, Catania, Italy.
- On differential games with bilinear structure - a general framework for modelling pedestrians' motion -, Minisymposium "Novel Concepts in Model-driven Optimization and Control of Agent-based Systems", ICIAM 2019, 15.07-19.07.2019, Universidad de Valencia, Spain.
- Zufall und Spiele beim Spaziergehen, Kinderuni Weil der Stadt, 16.05.2019, Weil der Stadt, Germany.
- On the modelling of particle and pedestrian motion with Fokker-Planck equations, MOX Seminars Series, Department of Mathematics, Politecnico di Milano, April 2019, Milano, Italy.
- On the modelling of particle and pedestrian motion with Fokker-Planck equations, Department of Mathematics, Imperial College London, February 2019, London, UK.
- On the optimal control of a Kohn-Sham quantum model, Workshop PRACQSYS 2018: Principles and Applications of Control in Quantum Systems, Henri Poincaré Institute, July 2018, Paris, France.
- From Brownian to pedestrian motion and Fokker-Planck Nash games, Lothar-Collatz-Kolloquium für Angewandte Mathematik, Fachbereich Mathematik, Universität Hamburg, June 2018, Hamburg, Germany.
- From Brownian to pedestrian motion and Fokker-Planck Nash games, Lomonosov State University, April 2018, Moscow, Russia.
- From Brownian motion to pedestrian avoidance, Mathematisches und Mathematikdidaktisches Kolloquium, Universität Oldenburg, November 2017, Oldenburg, Germany.
- On the solution of some PDE control problems in the framework of the Pontryagin's maximum principle, Workshop INDAM 'Numerical methods for optimal control problems: algorithms, analysis and applications', June 2017, Rome, Italy.
- On a Fokker-Planck Nash game to model pedestrian motion, Schwerpunktskolloquium, University of Konstanz, October 2017, Germany.
- Fast iterative schemes for solving PDE control problems with the Pontryagin maximum principle, Institute of Numerical Mathematics (INM) at the Steklov Institute of Mathematics, February 2017, Moscow, Russia.
- Analysis of a pseudospectral scheme for the Wigner function equation, Workshop Mathematical Models for Quantum and Classical Mechanics, SEMODAY 2016, Nov. 17-18, 2016, Florence, Italy.
- Optimal control and function identification in the wine fermentation process, Kolloquium der Mathematik, Fakultät fuer Mathematik, Physik und Informatik der Universität Bayreuth, Oct. 2016, Germany.
- On a time-dependent Kohn-Sham equation and related optimal control problems, CECAM Workshop Numerical methods for optimal control of open quantum systems, Sept. 26-28, 2016, FU Berlin, Berlin, Germany.
- Advances in the numerical solution of quantum control problems, Workshop Quantum Cybernetics & Control 2015 (QCC2015), Jan. 19-23, 2015, Nottingham, UK.
- A Fokker-Planck strategy to control stochastic processes, Marian Smoluchowski Symposium on Statistical Physics, Sept. 22-26, 2014, Zakopane, Poland.

- A Fokker-Planck Strategy to Control Stochastic Processes, Kolloquium, 2014 April, Johann Radon Institute for Computational and Applied Mathematics (RICAM), Austrian Academy of Sciences, Linz, Austria.
- Fast and accurate computational methods for quantum control problems, 536th W.E. Heraeus Seminar on Optimal Control of Quantum Systems June 16th to 19th 2013, Physikzentrum Bad Honnef, Germany.
- A Fokker-Planck-Kolmogorov control framework for stochastic processes, Workshop Numerical Methods for Uncertainty Quantification, May 13-17, 2013, Hausdorff Center for Mathematics, Bonn, Germany.
- An Optimal Control Strategy for Probability Density Functions of Stochastic Processes and Piecewise Deterministic Processes, Mathematisches Kolloquium, Univ. Bayreuth, Jan. 2013, Germany.

## Scientific Outreach

### Interviews in national newspapers

- Süddeutsche Zeitung, Section 'Panorama', 11. Oktober 2017, Nr. 234: **Alfio Borzi, der ein mathematisches Modell gegen Zusammenstöße entwickelt hat**; see also <http://www.sueddeutsche.de/panorama/ein-anruf-bei-alfio-borzi-1.3702529>
- Main Post, Section 'Wissen', 7. Oktober 2017, Nr. 231: **Formeln für Fußgänger**; see also <http://www.mainpost.de/regional/wuerzburg/Mathematiker-Mathematische-Modell-art735,9761234>

### Interviews in University newspapers

- einBlick, das Online-Magazin der Universität Würzburg: 1) 22. September 2017: **Mit der Spieltheorie auf Kollisionskurs**; see also <http://www.presse.uni-wuerzburg.de/aktuell/einblick/single/news/mit-der-spieltheorie-auf-kollisionskurs-1/>; 2) 16. Juli 2013: **Die Formel für mehr Aroma und Ertrag**; see also [https://opus.bibliothek.uni-wuerzburg.de/opus4-wuerzburg/frontdoor/deliver/index/docId/6736/file/einBlick\\_201328.pdf](https://opus.bibliothek.uni-wuerzburg.de/opus4-wuerzburg/frontdoor/deliver/index/docId/6736/file/einBlick_201328.pdf); 3) 9. Juli 2013: **Workshop für einen Pionier**; see also <http://www.presse.uni-wuerzburg.de/aktuell/einblick/single/news/workshop-f->; 4) 30. Oktober 2012: **Mathematik gegen die Krise**; see also <http://www.presse.uni-wuerzburg.de/fileadmin/uniwue/Presse/EinBLICK/Archiv/2012/ar201239.pdf>; 5) 8. Februar 2011: **Die dritte Säule des Erkenntniserwerbs**; see also <http://www.presse.uni-wuerzburg.de/fileadmin/uniwue/Presse/EinBLICK/Archiv/2011/ar201105.pdf>

### Interviews in TV and Radio

- Bayerische Rundfunk Fernsehen, Frankenschau aktuell Das Wichtigste aus Franken, 14. März 2018: **Pi-Tag**; see also <https://www.br.de/mediathek/video/frankenschau-aktuell-5a71a5a08e1343001858eb4c> and <https://youtu.be/6B6R9SUPgIA>
- SWR1 'Leute', 12.07.2018. <https://www.swr.de/swr1/bw/programm/leute/borzi-prof/-/id=1895042/did=21937368/nid=1895042/o1p3rc/index.html>

### Youtube Videos

- **Alfio's Math** : [https://www.youtube.com/watch?v=ju6rG\\_7Z\\_5I](https://www.youtube.com/watch?v=ju6rG_7Z_5I)
- **Quantenmechanik - Von Democritus bis Schrödinger** : [https://www.youtube.com/watch?v=BTiPcnT\\_QKc](https://www.youtube.com/watch?v=BTiPcnT_QKc)
- **Quantenkontrolle - Die Zukunft der Wissenschaft!** : <https://www.youtube.com/watch?v=00KMy90zXuM>

- **Malthus & Verhulst, die Bevölkerungsentwicklung und die Weingärung** : <https://www.youtube.com/watch?v=NtLnp1cUPmc>
- **Einstein & Co. und die Revolution des Aktienhandels** : <https://www.youtube.com/watch?v=Qb4obyF7c9I>
- **On the optimal control of a Kohn-Sham quantum model - Workshop PRACQSYS 2018 at IHP Paris** : <https://www.youtube.com/watch?v=6chQr02uInY&index=53&list=PL9kd4mpdvWcAMYt4Fhw0dgBPF24bQmDGz>

#### **Popularising Lectures and Books**

- **Wissenschaftliches Rechnen am Beispiel der Weingärungs**, Marktbreit, 08.10.2014. (A lecture for the Winemakers Community on the modelling and efficient control of wine fermentation.)
- **Wissenschaftliches Rechnen in Würzburg**, Würzburg, 2015. (A lecture presenting scientific computing in Würzburg.) [https://www.mathematik.uni-wuerzburg.de/fileadmin/10040900/2019/ab\\_WiReMIX.pdf](https://www.mathematik.uni-wuerzburg.de/fileadmin/10040900/2019/ab_WiReMIX.pdf)
- **New Trends in Mathematics**, Staats- und Universitätsbibliothek der Universität Göttingen, 16.10.2015. (A lecture for Teachers on present research developments and trends in applied mathematics.)
- **Zufall und Spiele beim Spaziergehen**, Kinderuni Weil der Stadt, 16.05.2019, Weil der Stadt. (A lecture for children about random processes and games.) <https://www.mathematik.uni-wuerzburg.de/scientificcomputing/nachrichten/single/news/vortrag-an-der-kinderuni-weil-der-stadt/>
- **Falling Into A Well While Gazing At The Stars - A Very Short History of Mathematics** -. (A children book giving a short account of the early history of mathematics.)

# Alfio Borzi 's Publications

## Books

- A. Borzi, **The Sequential Quadratic Hamiltonian Method: Solving Optimal Control Problems**, CRC/Chapman and Hall, 2023 (ISBN 9780367715526). <https://www.routledge.com/The-Sequential-Quadratic-Hamiltonian-Method-Solving-Optimal-Control-Problems/Borzi/p/book/9780367715526>
- A. Borzi, **Modelling with Ordinary Differential Equations: A Comprehensive Approach**, CRC/Chapman and Hall, 2020 (ISBN 9780815392613).
- A. Borzi, G. Ciaramella and M. Sprengel, **Formulation and Numerical Solution of Quantum Control Problems**, SIAM, Philadelphia, 2017 (ISBN 978-1-611974-83-6).
- A. Borzi and V. Schulz, **Computational Optimization of Systems Governed by Partial Differential Equations**, SIAM, Philadelphia, 2012 (ISBN 978-1-611972-04-7).
- A. Borzi and M. Wogrin, **Equazioni Differenziali Ordinarie**, Hevelius Edizioni, Benevento, 2009 (ISBN 978-88-86977-63-0).
- A. Borzi, **Falling Into A Well While Gazing At The Stars - A Very Short History of Mathematics** -, epubli, Berlin, 2021 (ISBN 978-3-7541-4618-7). (Also in German (2017) and Russian (2019).)

## Special Issues

- A. Borzi, D. Dong, G. Zhang, and I. R. Petersen, Control, Estimation & Machine Learning in a Quantum Framework, Journal of Franklin Institute, 2023. <https://www.sciencedirect.com/journal/journal-of-the-franklin-institute/special-issue/105FDSM4FZ0>
- A. Borzi, J. Brannick, F. Gaspar and I. Yavneh, Special Issue - Weizmann Workshop 2013, Numerical Mathematics: Theory, Methods and Applications, 8 (2015).
- A. Borzi and C. W. Oosterlee, Special Issue - OPTPDE 2011, ESF OPTPDE Workshop, 2011, Numerical Linear Algebra with Applications, 20 (2013), 539-711
- A. Borzi and C. W. Oosterlee, Special Issue in Numerical Mathematics: Theory, Methods and Applications (NM-TMA), European Multigrid Conference, EMG 2010, Numerical Mathematics: Theory, Methods and Applications, 5 (2012).
- A. Borzi and C. W. Oosterlee, Special Issue in Computing and Visualization in Science (CVS), European Multigrid Conference, EMG 2010, Computing and Visualization in Science, 14 (2011).

## Algorithms

- **MOCOKI**: A Monte Carlo approach for optimal control in the force of a linear kinetic model (2021); in Computer Physics Communications, CPC Program Library.
- **COKOSNUT**: A code for the control of the time-dependent Kohn-Sham model (2017); in Computer Physics Communications, CPC Program Library.

- **LONE**: A code for the sparse control of quantum systems (2016); in Computer Physics Communications, CPC Program Library.
- **SKRYN**: A fast semismooth-Krylov-Newton method for controlling Ising spin systems (2015); in Computer Physics Communications, CPC Program Library.
- **QUCON**: A fast Krylov-Newton code for dipole quantum control problems (2010); in Computer Physics Communications, CPC Program Library.
- **CNMS**: a cascadic monotonic time-discretized algorithm for finite-level quantum control computation (2008); in Computer Physics Communications, CPC Program Library.
- **SANTAFE**: a space-time multigrid method for open-loop (and receding-horizon) optimal control of time-dependent reaction-diffusion systems (2005). In MGNet Home Page, <http://www.mgnet.org>.
- **CONTROLLA**: a full multigrid method for the solution of an optimality system arising from a singular optimal control problem (2001). In MGNet Home Page, <http://www.mgnet.org>.
- **INTEGRA**: a multigrid code for the solution of systems of nonlinear integral equations (1998). In MGNet Home Page, <http://www.mgnet.org>.
- **TBA**: a multigrid code for the solution of the thermodynamic Bethe Ansatz equations (1993); in Computer Physics Communications, CPC Program Library.

## Nine Selected Publications

- S. Hofmann and A. Borzì, **A sequential quadratic hamiltonian algorithm for training explicit RK neural networks**, Journal of Computational and Applied Mathematics, 405 (2022), 113943.
- M. Annunziato, and A. Borzì, **A Fokker-Planck approach to the reconstruction of a cell membrane potential**, SIAM Journal on Scientific Computing, 43 (2021), B623 - B649.
- S. Roy and A. Borzì, **A new optimisation approach to sparse reconstruction of log-conductivity in acousto-electric tomography**, SIAM Journal on Imaging Sciences, 11 (2018), 1759-1784.
- V. Thalhofer, M. Annunziato, and A. Borzì, **Stochastic modelling and control of antibiotic subtilin production**, Journal of Mathematical Biology, 73 (2016), 727-749.
- S. Wongkaew, M. Caponigro, A. Borzì, **On the control through leadership of the Hegselmann-Krause opinion formation model**, Mathematical Models and Methods in Applied Sciences (M3AS), 25 (2015), 565-585.
- D. Calebiro, F. Rieken, J. Wagner, T. Sungkaworn, U. Zabel, A. Borzì, E. Cocucci, A. Zuern, M. J. Lohse, **Single-molecule analysis of fluorescently labeled GPCRs reveals receptor-specific complexes with distinct dynamics and organization**, Proceedings of the National Academy of Sciences (PNAS), 110 (2013), 743-748.
- A. Borzì and V. Schulz, **Multigrid methods for PDE optimization**, SIAM Review, 51 (2009), 361-395.
- A. Borzì and G. Borzì, **Algebraic multigrid methods for solving generalized eigenvalue problems**, International Journal for Numerical Methods in Engineering, 65(8) (2006), 1186-1196.
- A. Borzì and G. Propst, **Numerical investigation of the Liebau phenomenon**, Zeitschrift für angewandte Mathematik und Physik (ZAMP), 54 (2003), 1050 - 1072.

## Articles (peer-reviewed)

149. N. Vater and A. Borzi, A split preconditioning scheme for nonlinear underdetermined least squares problems, *Numerical Linear Algebra with Applications*, 2024. <https://doi.org/10.1002/nla.2558>
148. S. Hofmann and A. Borzi, Pointwise error estimates of numerical solutions to linear quadratic optimal control problems, *Journal of Scientific Computing*, 99 (2024), 21, pp. 1-44. <https://doi.org/10.1007/s10915-024-02484-7>
147. S. Roy and A. Borzi, Numerical approximation of kinetic Fokker–Planck equations with specular reflection boundary conditions, *Journal of Computational Physics*, 503 (2024) 112841. <https://doi.org/10.1016/j.jcp.2024.112841>
146. J. Bartsch and A. Borzi, On the stabilization of a kinetic model by feedback-like control fields in a Monte Carlo framework, *Kinetic and Related Models*. <https://doi.org/10.3934/krm2024005>
145. G. Nastasi, A. Borzi, V. Romano, Optimal control of a semiclassical Boltzmann equation for charge transport in graphene, *Communications in Nonlinear Science and Numerical Simulation*, 2024, <https://doi.org/10.1016/j.cnsns.2024.107933>
144. O. Morandi, N. Rotundo, A. Borzi, L. Barletti, An optimal control problem for the Wigner equation, *SIAM Journal on Applied Mathematics*, , 84 (2024), pp. 387-411. <https://doi.org/10.1137/22M1515033>
143. M. Annunziato and A. Borzi, Fokker–Planck analysis of superresolution microscopy images, *Math. Comput. Appl.*, 2023, 28(6), 113; <https://doi.org/10.3390/mca28060113>
142. J. Bartsch, A. Borzi, C. Schenk, D. Schmidt, J. Müller, V. Schulz, K. Velten, An extended model of wine fermentation including aromas and acids, in Jochen Wittmann, Kurt Chudej (Eds.) *Simulation in den Umwelt- und Geowissenschaften, Workshop Bayreuth 2023, Berichte aus der Umweltinformatik*, Shaker Verlag, Düren, pp. 125-136, 2023.
141. A. Borzi, K. Kułakowski, Social balance in oscillatory ecosystems, in Jochen Wittmann, Kurt Chudej (Eds.) *Simulation in den Umwelt- und Geowissenschaften, Workshop Bayreuth 2023, Berichte aus der Umweltinformatik*, Shaker Verlag, Düren, pp. 149-156, 2023.
140. J. Kleineisel, K. Lauer, A. Borzi, T. A. Bley, H. Köstler, T. Wech, Assessment of resolution and noise in magnetic resonance images reconstructed by data driven approaches, *Zeitschrift für Medizinische Physik*, 2023. <https://doi.org/10.1016/j.zemedi.2023.08.007>
139. Hao Chen and A. Borzi, Positivity preserving exponential integrators for differential Riccati equations, *Journal of Scientific Computing*, 96 (2023), 50. <https://doi.org/10.1007/s10915-023-02275-6>
138. J. Körner and A. Borzi, Accuracy estimates for bilinear optimal control problems governed by ordinary differential equations, *Numerical Functional Analysis and Optimization*, 44 (2023), 564-602. <https://doi.org/10.1080/01630563.2023.2192776>
137. J. Körner and A. Borzi, Second–order analysis of Fokker–Planck ensemble optimal control problems, *ESAIM: Control, Optimisation and Calculus of Variations*, 28 (2022), 77. <https://doi.org/10.1051/cocv/2022066>
136. P. Gawroński<sup>1</sup>, A. Borzi, and K. Kułakowski, Instability of oscillations in the Rosenzweig–MacArthur model of one consumer and two resources, *Chaos*, 32, 093121 (2022). <https://doi.org/10.1063/5.0105340>
135. N. Vater and A. Borzi, Preconditioned gradient method for data approximation with shallow neural networks, *The 8th International Online & Onsite Conference on Machine*

Learning, Optimization, and Data Science – Sept. 18 - 22, 2022 - Certosa di Pontignano, Siena – Tuscany, Italy . LOD 2022 Springer LNCS Conference Proceedings, LNCS 13811, pp. 357-372, 2023.

[https://doi.org/10.1007/978-3-031-25891-6\\_27](https://doi.org/10.1007/978-3-031-25891-6_27)

134. H. Weinmann, K. Kułakowski, and A. Borzì, Ecosystem models and social balance from a synchronization perspective, *International Journal of Modern Physics C*, 33 (2022), 2250064.  
<https://doi.org/10.1142/S0129183122500644>
133. S. Hofmann and A. Borzì, A sequential quadratic hamiltonian algorithm for training explicit RK neural networks, *Journal of Computational and Applied Mathematics*, 405 (2022), 113943.  
<https://doi.org/10.1016/j.cam.2021.113943>
132. N. Vater and A. Borzì, Training artificial neural networks with gradient and coarse-level correction schemes, *The 7th International Conference on Machine Learning, Optimization, and Data Science*, Grasmere, Lake District, UK, October 4-8, 2021. LOD 2021 Springer LNCS Conference Proceedings, LNCS 13163, pp. 473-487, 2022.  
<https://link.springer.com/book/9783030954666>  
[https://doi.org/10.1007/978-3-030-95467-3\\_34](https://doi.org/10.1007/978-3-030-95467-3_34)
131. D. Gathungu, M. Bebendorf and A. Borzì, Hierarchical-matrix method for a class of diffusion-dominated partial integro-differential equations, *Numerical Linear Algebra with Applications*, 29 (2022), e2410.  
<https://doi.org/10.1002/nla.2410>
130. J. Bartsch, A. Borzì, F. Fanelli, S. Roy, A numerical investigation of Brockett's ensemble optimal control problems, *Numerische Mathematik*, 149 (2021), 1-42.  
<https://doi.org/10.1007/s00211-021-01223-6>
129. F. Calà Campana and A. Borzì, On the SQH method for solving differential Nash games, *Journal of Dynamical and Control Systems*, 28 (2022), 739-755.  
<https://doi.org/10.1007/s10883-021-09546-1>
128. J. Bartsch and A. Borzì, MOCOKI: A Monte Carlo approach for optimal control in the force of a linear kinetic model, *Computer Physics Communications*, 266 (2021), 108030.  
<https://doi.org/10.1016/j.cpc.2021.108030>
127. M. Annunziato, and A. Borzì, A sequential quadratic Hamiltonian scheme to compute optimal relaxed controls, *ESAIM: Control, Optimisation and Calculus of Variations*, 27 (2021), 49.  
<https://doi.org/10.1051/cocv/2021041>
126. M. Annunziato, and A. Borzì, A Fokker-Planck approach to the reconstruction of a cell membrane potential, *SIAM Journal on Scientific Computing*, 43 (2021), B623 - B649.  
<https://doi.org/10.1137/20M131504X>
125. F. Calà Campana, A. De Marchi, A. Borzì and M. Gerdt, On the numerical solution of a free end-time homicidal chauffeur game, *FGS'2019, ESAIM: Proceedings and Surveys*, 71 (2021), 33-42.  
<https://doi.org/10.1051/proc/202171104>
124. J. Bartsch, G. Nastasi, and A. Borzì, Optimal control of the Keilson-Storer master equation in a Monte Carlo framework, *Journal of Computational and Theoretical Transport*, 50 (2021), 454-482.  
<https://doi.org/10.1080/23324309.2021.1896552>
123. A. Borzì and L. Grüne, Towards a solution of mean-field control problems using model predictive control, *IFAC-PapersOnLine*, 53 (2020), 4973-4978.

<https://doi.org/10.1016/j.ifacol.2020.12.1086>

122. A. Borzi, The Fokker-Planck framework in the modeling of pedestrians' motion, Chapter 6 in: L. Gibelli (ed.), *Crowd Dynamics, Volume 2, Modeling and Simulation in Science, Engineering and Technology*, Birkhäuser, Cham, Switzerland, 2020.  
[https://doi.org/10.1007/978-3-030-50450-2\\_6](https://doi.org/10.1007/978-3-030-50450-2_6)
121. T. Breitenbach, A. Borzi, The Pontryagin maximum principle for solving Fokker-Planck optimal control problems, *Computational Optimization and Applied Mathematics*, 76 (2020), 499-533.
120. F. Calà Campana, G. Ciaramella, A. Borzi, Nash equilibria and bargaining solutions of differential bilinear games, *Dynamic Games and Applications*, 11 (2021), 1-28.
119. T. Breitenbach, A. Borzi, A sequential quadratic Hamiltonian scheme for solving non-smooth quantum control problems with sparsity, *Journal of Computational and Applied Mathematics*, 369 (2020), 112583.
118. J. Bartsch, A. Borzi, F. Fanelli, S. Roy, A theoretical investigation of Brockett's ensemble optimal control problems, *Calculus of Variations and Partial Differential Equations*, 58 (2019).  
<https://doi.org/10.1007/s00526-019-1604-2>
117. T. Breitenbach, A. Borzi, On the SQH scheme to solve non-smooth PDE optimal control problems, *Numerical Functional Analysis and Optimization*, 40 (2019), 1489-1531.
116. T. Breitenbach and A. Borzi, A sequential quadratic Hamiltonian method for solving parabolic optimal control problems with discontinuous cost functionals, *Journal of Dynamical and Control Systems*, 25 (2019), 403-435.
115. M.-L. Kienle Garrido, T. Breitenbach, K. Chudej, and A. Borzi, Modeling and Numerical Solution of a Cancer Therapy Optimal Control Problem, *Applied Mathematics*, 9 (2018), 985-1004.
114. S. Roy and A. Borzi, A new optimisation approach to sparse reconstruction of log-conductivity in acousto-electric tomography, *SIAM Journal on Imaging Sciences*, 11 (2018), 1759-1784.
113. M. Annunziato and A. Borzi, A Fokker-Planck control framework for stochastic systems, *EMS Surveys in Mathematical Sciences*, 5 (2018), 65-98.  
<https://doi.org/10.4171/EMSS/27>
112. M. Sprengel, G. Ciaramella and A. Borzi, Investigation of optimal control problems governed by a time-dependent Kohn-Sham model, *Journal of Dynamical and Control Systems*, 24 (2018), 657-679.
111. D.K. Gathungu and A. Borzi, A multigrid scheme for solving convection-diffusion-integral optimal control problems, *Computing and Visualization in Science*, 22 (2019), 43-55.
110. K. Kułakowski, P. Gronek, and A. Borzi, Paradox of integration - mean field approach, *International Journal of Modern Physics C*, 28 (2017), 1750133.
109. S. Roy, A. Borzi, and A. Habbal, Pedestrian motion modelled by Fokker - Planck Nash games, *Royal Society open science*, 4: 170648, 2017.
108. S. Roy, A. Annunziato, A. Borzi, and C. Klingenberg, A Fokker-Planck approach to control collective motion, *Computational Optimization and Applications*, 69 (2018), 423-459.
107. T. Breitenbach, M. Annunziato and A. Borzi, On the optimal control of a random walk with jumps and barriers, *Methodology and Computing in Applied Probability*, 20



(2018), 435-462.

106. B. Gaviraghi, M. Annunziato, and A. Borzì, Chapter 22: Splitting Methods for Fokker-Planck Equations Related to Jump-Diffusion Processes, pp. 409-422; Chapter 23: A Fokker-Planck Based Approach to Control Jump Processes, pp. 423-439. *Novel Methods in Computational Finance*, Springer, 2017. Edited by Matthias Ehrhardt, Michael Guenther, E. Jan W. ter Maten.
105. D.K. Gathungu and A. Borzì, Multigrid Solution of an Elliptic Fredholm Partial Integro-Differential Equation with a Hilbert-Schmidt Integral Operator, *Applied Mathematics*, 8 (2017), 967-986.
104. G. Ciaramella, M. Sprengel and A. Borzì, A theoretical investigation of time-dependent Kohn-Sham equations: new proofs, *Applicable Analysis*, 2019. <https://doi.org/10.1080/00036811.2019.1679792>
103. M. Sprengel, G. Ciaramella, and A. Borzì, A theoretical investigation of time-dependent Kohn-Sham equations, *SIAM Journal on Mathematical Analysis*, 49 (2017), 1681-1704.  
Erratum: *SIAM J. Math. Anal.*, 52 (2020), 1006-1008.
102. S. Roy and A. Borzì, Numerical Investigation of a Class of Liouville Control Problems, *Journal of Scientific Computing*, 73 (2017), 178-202.
101. M. Sprengel, G. Ciaramella and A. Borzì, A COKOSNUT code for the control of the time-dependent Kohn-Sham model, *Computer Physics Communications*, 214 (2017), 231-238.
100. T. Breitenbach, M. Annunziato and A. Borzì, On the optimal control of random walks, *IFAC-PapersOnLine*, 49 (2016), 248-253.
99. A. Schindele and A. Borzì, Proximal schemes for parabolic optimal control problems with sparsity promoting cost functionals, *International Journal of Control*, 90 (2016), 2349-2367.
98. B. Gaviraghi, M. Annunziato, A. Borzì, Analysis of splitting methods for solving a partial-integro differential Fokker-Planck equation, *Applied Mathematics and Computation*, 294 (2016), 1-17.
97. B. Gaviraghi, A. Schindele, M. Annunziato, A. Borzì, On optimal sparse-control problems governed by jump-diffusion processes, *Applied Mathematics*, 7 (2016), 1978-2004.
96. A. Schindele and A. Borzì, Proximal Methods for Elliptic Optimal Control Problems with Sparsity Cost Functional, *Applied Mathematics*, 7 (2016), 967-992.
95. J. Merger and A. Borzì, A Lie Algebraic and Numerical Investigation of the Black-Scholes Equation with Heston Volatility Model, *J Generalized Lie Theory Appl* (2016).
94. A. Borzì and M. Caponigro, Comment: A control theoretical approach to crowd management: Comment on 'Human behaviours in evacuation crowd dynamics: From modelling to big data toward crisis management' by Nicola Bellomo et al., *Physics of Life Reviews*, 18 (2016), 27-28.
93. V. Ratz, T. Wech, A. Schindele, A. Dierks, A. Sauer, J. Reibetanz, A. Borzì, T. Bley, H. Koestler, Dynamic 3D MR-Defecography, *Fortschr. Roentgenstr*, 188(09)(2016), 859-863.
92. S. Roy, M. Annunziato, and A. Borzì, A Fokker-Planck feedback control-constrained approach for modelling crowd motion, *Journal of Computational and Theoretical Transport*, 45 (2016), 442-458.

91. A. Thomann and A. Borzi, Stability and accuracy of a pseudospectral scheme for the Wigner function equation, *Numerical Methods for Partial Differential Equations*, 33 (2017), 62-87.
90. G. Ciaramella and A. Borzi, Quantum Optimal Control Problems with a Sparsity Cost Functional, *Numerical Functional Analysis and Optimization*, 37 (2016), 938-965.
89. J. Merger and A. Borzi, Dynamics identification in evolution models using radial basis functions, *Journal of Dynamical and Control Systems*, 23 (2017), 317-335.
88. J. Merger, A. Borzi, and R. Herzog, Optimal Control of a System of Reaction-Diffusion Equations Modeling the Wine Fermentation Process, *Optimal Control, Applications and Methods*, 38 (2017), 112-132.
87. V. Thalhofer, M. Annunziato, and A. Borzi, Stochastic modelling and control of antibiotic subtilin production, *Journal of Mathematical Biology*, 73 (2016), 727-749.
86. M. Mohammadi and A. Borzi, Hermite approximation of a hyperbolic Fokker-Planck optimality system to control a piecewise-deterministic process, *International Journal of Control*, 89 (2016), 1382-1395.
85. G. Ciaramella and A. Borzi, A LONE code for the sparse control of quantum systems, *Computer Physics Communications*, 200 (2016), 312-323.
84. T. Wech, N. Seiberlich, A. Schindele, V. Grau, L. Diffley, M. L. Gyngell, A. Borzi, H. Koestler, and J. E. Schneider, Development of Real-time Magnetic Resonance Imaging of Mouse Hearts at 9.4 Tesla – Simulations and First Application, *IEEE TRANSACTIONS ON MEDICAL IMAGING*, 35(3) (2016), 912-20.
83. S. Wongkaew, M. Caponigro, K. Kułakowski, A. Borzi, On the control of the Heider balance model, *European Physical Journal - Special Topics*, 224 (2015), 3325-3342.
82. A. Borzi, E.-J. Park, M. Vallejos Lass, Multigrid Optimization Methods for the Optimal Control of Convection – Diffusion Problems with Bilinear Control, *Journal of Optimization Theory and Applications*, 168 (2016), 510-533.
81. M. Annunziato, A. Borzi, M. Magdziarz, A. Weron, A fractional Fokker-Planck control framework for subdiffusion processes, *Optimal Control, Applications and Methods*, 37 (2016), 290-304
80. G. Ciaramella and A. Borzi, SKRYN: A fast semismooth-Krylov-Newton method for controlling Ising spin systems, *Computer Physics Communications*, 190 (2015), 213-223.
79. G. Ciaramella, A. Borzi, G. Dirr, D. Wachsmuth, Newton methods for the optimal control of closed quantum spin systems, *SIAM Journal on Scientific Computing*, 37 (2015), A319-A346.
78. G. Ciaramella, J. Salomon, A. Borzi, A method for solving exact-controllability problems governed by closed quantum spin systems, *International Journal of Control (IJC)*, 88 (2015), 682-702.
77. M. Mohammadi and A. Borzi, A Hermite spectral method for a Fokker-Planck optimal control problem in an unbounded domain, *International Journal for Uncertainty Quantification (IJUQ)*, 5 (2015), 233-254.
76. M. Tanvir Rahman and A. Borzi, A FEM-multigrid scheme for elliptic Nash-equilibrium multiobjective optimal control problems, *Numerical Mathematics: Theory, Methods and Applications (NMTMA)*, 8 (2015) 253-282.
75. S. Wongkaew, M. Caponigro, A. Borzi, On the control through leadership of the Hegselmann-Krause opinion formation model, *Mathematical Models and Methods in Applied Sciences (M3AS)*, 25 (2015), 565-585.

74. S. Wongkaew and A. Borzi, Modeling and control through leadership of a refined flocking system, *Mathematical Models and Methods in Applied Sciences (M3AS)*, 25 (2015), 255-282.
73. M. Annunziato, A. Borzi, F. Nobile, and R. Tempone, On the connection between the Hamilton-Jacobi-Bellman and the Fokker-Planck control frameworks, *Applied Mathematics*, 5 (2014), 2476-2484.
72. S. Gonzalez Andrade and A. Borzi, Second-order approximation and fast multigrid solution of parabolic bilinear optimization problems, *Advances in Computational Mathematics*, 41 (2015), 457-488
71. M. Mohammadi and A. Borzi, Analysis of the Chang-Cooper Discretization Scheme for a Class of Fokker-Planck Equations, *Journal of Numerical Mathematics*, 23 (2015), 271-288.
70. A. Borzi, D. di Serafino, and V. De Simone, Parallel algebraic multilevel Schwarz preconditioners for a class of elliptic PDE systems, *Computing and Visualization in Science*, 16 (2013), 1-14.
69. M. Annunziato and A. Borzi, Optimal control of a class of piecewise deterministic processes , *European Journal of Applied Mathematics*, 25 (2014), 1-25.
68. P.F. Antonietti, A. Borzi, and M. Verani, Multigrid shape optimization governed by elliptic PDEs, *SIAM J. Control Optim.*, 51 (2013), 1417-1440.
67. A. Borzi, Quantum optimal control using the adjoint method, *Nanoscale Systems: Mathematical Modeling, Theory and Applications*, 1 (2012), 93-111.
66. D. Calebiro, F. Rieken, J. Wagner, T. Sungkaworn, U. Zabel, A. Borzi, E. Cocucci, A. Zuern, M. J. Lohse, Single-molecule analysis of fluorescently labeled GPCRs reveals receptor-specific complexes with distinct dynamics and organization, *Proceedings of the National Academy of Sciences (PNAS)*, 110 (2013), 743-748.
65. M. Annunziato and A. Borzi, Fokker-Planck-based control of a two-level open quantum system, *Mathematical Models and Methods in Applied Sciences (M3AS)*, 23 (2013), 2039-2064
64. A. Borzi and C. Kanzow, Formulation and numerical solution of Nash equilibrium multiobjective elliptic control problems, *SIAM J. Control Optim.*, 51(2013), 718-744.
63. M. Annunziato and A. Borzi, A Fokker-Planck control framework for multidimensional stochastic processes, *Journal of Computational and Applied Mathematics*, 237 (2013), 487-507.
62. A. Borzi and M. Borzi, A MPC Scheme with Guaranteed Stability for the Control of Bloch Systems, *Proceedings MATHMOD 2012*, I. Troch, F. Breitenecker, eds.
61. M. M. Butt and A. Borzi, A full multigrid solution of control-constrained Cauchy-Riemann optimal control problems , *Journal of Numerical Mathematics*, 19 (2011), 189-214.
60. A. Borzi and G. von Winckel, A POD framework to determine robust controls in PDE optimization, *Computing and Visualization in Science*, 14 (2011), 91-103.
59. M. M. Butt and A. Borzi, Formulation and multigrid solution of Cauchy-Riemann optimal control problems, *Computing and Visualization in Science*, 14 (2011), 79-90.
58. S. Gonzalez Andrade and A. Borzi, Multigrid solution of a Lavrentiev-regularized state-constrained parabolic control problem, *Numerical Mathematics: Theory, Methods and Applications*, 5 (2012), 1-18.
57. M. Annunziato and A. Borzi, Optimal control of probability density functions of stochastic processes, *Mathematical Modelling and Analysis*, 15 (2010), 393-407.

56. S. Gonzalez Andrade and A. Borzi, Multigrid second-order accurate solution of parabolic control-constrained problems, *Computational Optimization and Applications*, 51 (2012), 835-866.
55. G. von Winckel and A. Borzi, QUCON: A fast Krylov-Newton code for dipole quantum control problems, *Computer Physics Communications*, 181 (2010), 2158-2163.
54. A. Borzi, V. Schulz, C. Schillings, and G. von Winckel, On the treatment of distributed uncertainties in PDE constrained optimization, *GAMM Mitteilungen*, 33 (2010), 230-246.
53. A. Borzi, Multigrid and sparse-grid schemes for elliptic control problems with random coefficients, *Computing and Visualization in Science*, 13 (2010), 153-160.
52. M. Annunziato and A. Borzi, Fast solvers of Fredholm optimal control problems, *Numerical Mathematics: Theory, Methods and Applications*, 3 (2010), 431-448.
51. A. Borzi, M. di Bisceglie, C. Galdi, L. Pallotta, S.L. Ullo, Phase retrieval in SAR interferograms using diffusion and inpainting, *Proceedings IEEE International Geoscience & Remote Sensing Symposium*, 2010, Honolulu, HI, USA.
50. A. Borzi, M. di Bisceglie, C. Galdi, G. Giangregorio, Robust registration of satellite images with local distortions, *Proceedings IEEE International Geoscience & Remote Sensing Symposium*, 2009, Cape Town, South Africa.
49. G. von Winckel, A. Borzi, and S. Volkwein, A globalized Newton method for the accurate solution of a dipole quantum control problem, *SIAM J. Sci. Comp.*, 31 (2009), 4176-4203.
48. A. Borzi and G. von Winckel, Multigrid methods and sparse-grid collocation techniques for parabolic optimal control problems with random coefficients, *SIAM J. Sci. Comp.*, 31 (2009), 2172-2192.
47. A. Borzi and V. Schulz, Multigrid methods for PDE optimization, *SIAM Review*, 51 (2009), 361-395.
46. O. Lass, M. Vallejos, A. Borzi, and C.C. Douglas, Implementation and analysis of multigrid schemes with finite elements for elliptic optimal control problems, *Computing*, 84 (2009), 27-48
45. M. Vallejos and A. Borzi, Multigrid optimization methods for linear and bilinear elliptic optimal control problems, *Computing*, 82 (2008), 31-52
44. M. Vallejos and A. Borzi, Multigrid methods for linear elliptic optimal control problems, *Numerical Mathematics and Advanced Applications*, Springer (2008)
43. G. von Winckel and A. Borzi, Computational techniques for a quantum control problem with H1-cost, *Inverse Problems*, 24 (2008) 034007.
42. A. Borzi and U. Hohenester, Multigrid optimization schemes for solving Bose–Einstein condensates control problems, *SIAM J. Sci. Comp.*, 30 (2008), 441-462.
41. P. Ditz and A. Borzi, A cascadic monotonic time-discretized algorithm for finite-level quantum control computation, *Computer Physics Communications*, 178 (2008), 393-399.
40. A. Borzi, J. Salomon, and S. Volkwein, Formulation and numerical solution of finite-level quantum optimal control problems, *Journal of Computational and Applied Mathematics*, 216 (2008), 170-197
39. U. Hohenester, P.K. Rekdal, A. Borzi, J. Schmiedmayer, Optimal quantum control of Bose-Einstein condensates in magnetic microtraps, *Phys. Rev. A* 75, 023602 (2007)

38. A. Borzi, Smoothers for control- and state-constrained optimal control problems, *Computing and Visualization in Science*, 11 (2008), 59-66.
37. A. Borzi, On the convergence of the MG/OPT method, *PAMM*, 5(1) (2005), 735-736
36. A. Borzi, High-order discretization and multigrid solution of elliptic nonlinear constrained optimal control problems, *Journal of Computational and Applied Mathematics*, 200 (2007), 67-85.
35. A. Borzi and R. Griesse, Distributed optimal control of lambda-omega systems, *Journal of Numerical Mathematics*, 14 (2006), 17-40.
34. A. Borzi, Space-time multigrid methods for solving unsteady optimal control problems, (Chapter 5) in L.T. Biegler, O. Ghattas, M. Heinkenschloss, D. Keyes and B. van Bloemen Waanders (Eds.), *Real-Time PDE-Constrained Optimization*, Computational Science and Engineering, Vol. 3, SIAM, Philadelphia, 2007.
33. A. Borzi and G. Borzi, Algebraic multigrid methods for solving generalized eigenvalue problems, *International Journal for Numerical Methods in Engineering*, 65(8) (2006), 1186-1196.
32. A. Borzi and E. Decker, Analysis of a leap-frog pseudospectral scheme for the Schroedinger equation, *Journal of Computational and Applied Mathematics*, 193(1) (2006), 65-88.
31. A. Borzi and K. Kunisch, A globalization strategy for the multigrid solution of elliptic optimal control problems, *Optimization Methods and Software*, 21(3) (2006), 445-459
30. A. Borzi, H. Grossauer, and O. Scherzer, Analysis of Iterative Methods for Solving a Ginzburg-Landau Equation, *Int. Journal of Computer Vision*, 64 (2005), 203-219.
29. A. Borzi and R. Griesse, Experiences with a space-time multigrid method for the optimal control of a chemical turbulence model, *Int. J. Numer. Meth. Fluids.*, 47 (2005), 879-885.
28. A. Borzi, Solution of lambda-omega systems: Theta-schemes and multigrid methods, *Numerische Mathematik*, 98(4) (2004), 581-606.
27. A. Borzi and K. Kunisch, A multigrid scheme for elliptic constrained optimal control problems, *Computational Optimization and Applications*, 31 (2005), 309-333.
26. A. Borzi and G. Borzi, An efficient algebraic multigrid method for solving optimality systems, *Computing and Visualization in Science*, 7(3/4) (2004), 183-188.
25. A. Borzi and G. Borzi, An algebraic multigrid method for a class of elliptic differential systems, *SIAM J. Sci. Comp.*, 25(1) (2003), 302-323.
24. A. Borzi, Multigrid methods for parabolic distributed optimal control problems, *J. Comp. Appl. Math*, 157 (2003), 365-382.
23. P. Bartsch and A. Borzi, On the Modeling and Simulation of Boundary Flow Through Partially Open Pipe Ends, *ZAMP*, 55 (2004), 946-961.
22. A. Borzi, G. Stadler, and U. Hohenester, Optimal quantum control in nanostructures: Theory and application to a generic three-level system , *Phys. Rev. A* 66, 053811 (2002).
21. A. Borzi, Fast multigrid methods for parabolic optimal control problems, *Proceedings of 18-th GAMM Seminar Leipzig 2002*.
20. A. Borzi and G. Propst, Numerical Investigation of the Liebau Phenomenon, *ZAMP*, 54 (2003), 1050 - 1072.
19. G. Propst and A. Borzi, Numerical Investigation of periodically excited valveless pumping, in *Simplicity behind Complexity*, W. Klonowski (Ed.), *Proceedings of Euroattractor 2002*, Warsaw, Pabst science publishers, pp. 192-200.

18. A. Borzi, K. Kunisch, and Do Y. Kwak, Accuracy and Convergence Properties of the Finite Difference Multigrid Solution of an Optimal Control Optimality System, *SIAM J. Control Opt.*, 41(5) (2003), 1477-1497.
17. A. Borzi, K. Ito, and K. Kunisch, Optimal Control Formulation for Determining Optical Flow, *SIAM J. Sci. Comput.*, 24(3) (2002), 818-847.
16. A. Borzi, K. Ito, and K. Kunisch, An Optimal Control Approach to Optical Flow Computation, *Int. J. Numer. Meth. Fluids.*, 40 (2002), 231-240.
15. A. Borzi and K. Kunisch, The Numerical Solution of the Steady State Solid Fuel Ignition Model and Its Optimal Control, *SIAM J. Sci. Comp.*, 22(1) (2000), 263-284.
14. A. Borzi, K.W. Morton, E. Suli and M. Vanmaele, Multilevel Solution of Cell Vertex Cauchy-Riemann Equations, *SIAM J. Sci. Comp.*, 18(2) (1997), 441-459.
13. M. Vanmaele, K.W. Morton, E. Suli and A. Borzi, Analysis of the Cell Vertex Finite Volume Method for the Cauchy-Riemann Equations, *SIAM J. Num. Anal.*, 34(5) (1997), 2043-2062.
12. A. Borzi and A. Koubek, A multi-grid method for the resolution of thermodynamic Bethe ansatz equations, *Comp. Phys. Commun.*, 75 (1993), 118-126.
11. A. Borzi and G. Fonte, On Variational principles for Nonlinear Partial Differential Equations in Complex Spaces, *Nuovo Cimento*, B107 (1992), 189-201.
10. A. Borzi, K. Ito and K. Kunisch An Optimal Control Approach to Optical Flow Computation, In M J Baines, editor, *Numerical Methods for Fluid Dynamics VII*, ICFD, Oxford University Computing Laboratory, 2001.
9. P. Bartsch, B. Bachner, A. Borzi, and H.A. Schuemie, Simulation of a Concentric-Tube Resonator, in *International Symposium on Experimental and Computational Aerothermodynamics of Internal Flows 5th ISAIF*, 4 - 7 September 2001 Gdansk.
8. A. Borzi and K. Kunisch, A Multigrid Method for the Optimal Control of Time-Dependent Reaction Diffusion Processes, in K.H. Hoffmann, R. Hoppe, and V. Schulz (Eds.), „Fast solution of discretized optimization problems“, *International Series on Numerical Mathematics*, Vol. 138, Birkhäuser, 2001.
7. A. Borzi and G. Borzi, Algebraic Multigrid and Conjugate Gradient Methods for the Solution of FEM Equations for 3D Static Problems, 9th IGTE Symposium on Numerical Field Calculation in Electrical Engineering, Graz (Austria), 11-14 settembre, 2000.
6. P. Bartsch and A. Borzi, A New Reconstruction Technique for the Euler Equations of Gas Dynamics with Source Terms, in E. Toro (Ed.), „Godunov Methods: Theory and Applications“, Kluwer Academic/Plenum Publishers, 2001.
5. A. Borzi, K. Kunisch, and M. Vanmaele, A Multi-Grid Approach to the Optimal Control of Solid Fuel Ignition Problems, in E. Dick, K. Riemsdagh and J. Vierendeels (Eds.), *Lecture Notes in Computer Science and Engineering*, 14, European Multigrid Meeting 1999, Springer 2000.
4. A. Borzi, K.W. Morton, E. Suli and M. Vanmaele, A full multi-grid method for the solution of the cell vertex Cauchy-Riemann equations, in “Seventh Copper Mountain Conference on Multigrid Methods”, ed. by N.D. Melson, T.A. Manteuffel, S.F. McCormick and C.C. Douglas, 73-86, NASA, Hampton, (1996).
3. A. Borzi, Burgers Equation and Multi-Grid Techniques, in “Contributions to Multigrid” ed. by P.W. Hemker and P. Wesseling, CWI, Amsterdam, (1994).
2. A. Borzi, On the Extension of the Twolevel Method for Operator Equations in Hilbert Space, in “Contributions to Multigrid” ed. by P.W. Hemker and P. Wesseling, CWI, Amsterdam, (1994).

1. A. Borzi and A. Koubek, On a multi-grid algorithm for the TBA equations, in "Multigrid Methods IV", ed. by P.W. Hemker and P. Wesseling, Birkhaeuser Verlag, Basel, (1994).