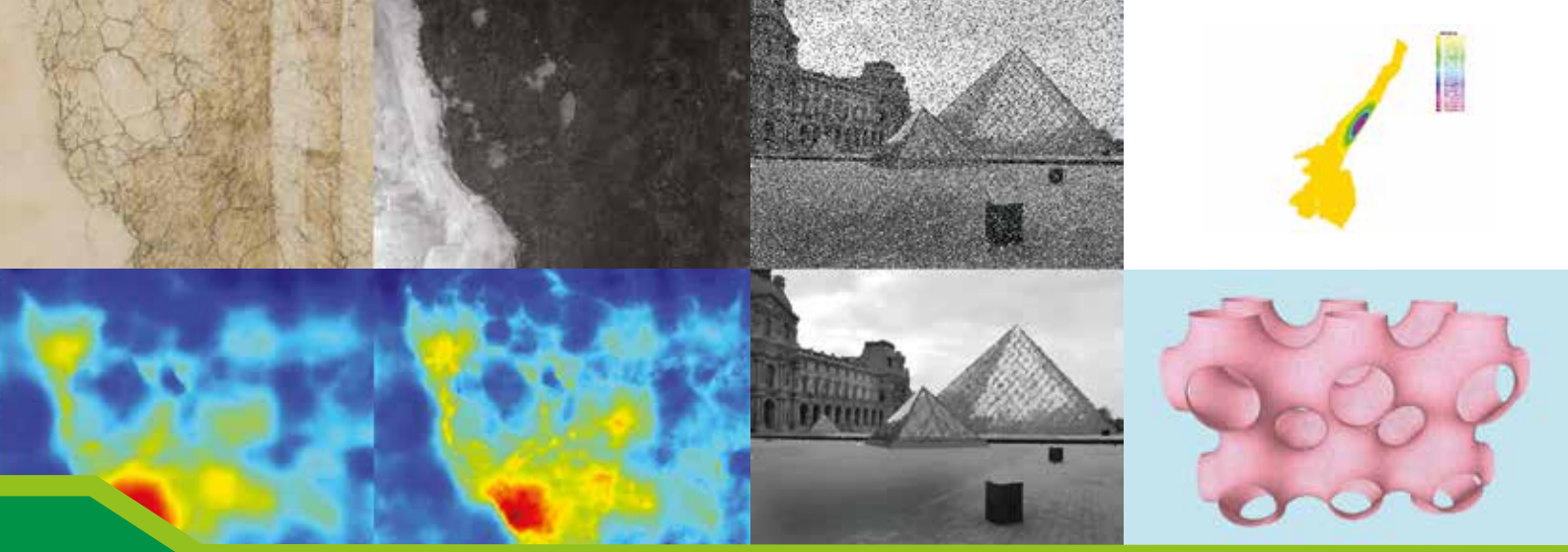

MATHEMATICS - APPLICATIONS AND MODELLING

DESCRIPTION

Applied mathematics is concerned with mathematical methods and models that are used in science, engineering, business and industry. The research in this area is involved in the mathematical treatment and modeling, both from a theoretical and numerical point of view, of a variety of phenomena described through partial differential equations (PDE) or optimization of suitable energy costs, arising for instance in quantum and classical fluid dynamics (nonlinear Schrödinger equations, advection-diffusion-reaction equations and Navier-Stokes equations), electromagnetism (Maxwell equations), superconductivity (Ginzburg-Landau equations), image processing tasks, with applications to cultural heritage, such as segmentation, denoising, restoration, inpainting (total variation energy based methods), optimal control (Hamilton-Jacobi equations), evolution of interfaces in physics and biology (minimal surface equations, motion by mean curvature, string theory), finance (stochastic differential equations, Black-Scholes equations, Lévy processes, stochastic control). Different aspects of the above problems require a sophisticated integration of multidisciplinary skills in Analysis of nonlinear PDEs, Optimal Control, Optimization, Numerical methods for PDEs, Multivariate data approximation, Scientific Computing, Stochastic Analysis, Mathematical Physics and Differential Geometry.

The research is carried out through several collaborations, partnerships, networks, and research projects both at national and international level.

PROJECTS (2012-2016)

- Set-valued analysis and optimal transportation methods for modeling of financial markets with transition costs from a deterministic and stochastic viewpoint, INdAM-GNAMPA national project (Istituto Nazionale di Alta Matematica-Gruppo Nazionale per l'Analisi Matematica, la Probabilità e le loro Applicazioni).
- EU-H2020-MSCA-IF-2016 CuMin (Currents and Minimizing networks), Marie Curie action devoted to problems in optimal transport on networks arising in economy, biology, and data science.
- Stochastic Partial Differential Equations and Stochastic Optimal Control with Applications to Mathematical Finance, INdAM-GNAMPA national project (Istituto Nazionale di Alta Matematica-Gruppo Nazionale per l'Analisi Matematica, la Probabilità e le loro Applicazioni).
- CIRM-FBK (Centro Internazionale per la Ricerca in Matematica, Fondazione Bruno Kessler, Trento) funded project on the stochastic analysis of neuronal systems of FitzHugh-Nagumo type with emphasis on noise control.
- Meshfree exponential integrators, Tiroler Wissenschaftsfonds Project (Austria), devoted to the analysis and implementation of new efficient solvers for nonlinear PDEs with solutions travelling in time.

SELECTED PUBLICATIONS (2012-2016)

- P. Cannarsa, A. Marigonda, and K.T. Nguyen. Optimality conditions and regularity results for time optimal control problems with differential inclusions, J. Math. Anal. Appl. Vol 427, n. 1, pp. 202-228, 2015.
- A. Marigonda, S. Rigo. Controllability of some nonlinear systems with drift via generalized curvature properties, SIAM J. Contol Opt. Vol. 53, n. 1, pp. 434-474, 2015.
- S. Baldo, R. L. Jerrard, G. Orlandi, H.M. Soner. Vortex density models for Superconductivity and Superfluidity, Comm. Math. Phys. Vol. 318, n. 1, pp. 131-171, 2013.
- M. Caliari, A. Ostermann, S. Rainer. Meshfree exponential integrators, SIAM J. Sci. Comput. Vol. 35, n. 1, pp. A431-A452, 2013.
- G. Albi, L. Pareschi, Binary interaction algorithms for the simulation of flocking and swarming dynamics, SIAM Multiscale Model. Simul., 11(1), pp. 1-29, 2013.
- C. Marinelli, L. Di Persio, G. Ziglio. Approximation and convergence of solutions to semilinear stochastic evolution equations with jumps, J. Funct. Anal. Vol. 264, pp. 2784-2816, 2013.
- S. Baldo, R. Jerrard, G. Orlandi, H. M. Soner. Convergence of Ginzburg-Landau functionals in 3-d superconductivity, Arch. Rat. Mec. Analysis. Vol. 205, n. 3, pp. 699-752, 2012.
- L. Bos, S. De Marchi, K. Hormann, G. Klein. On the Lebesgue constant of barycentric rational interpolation at equidistant nodes, Numer. Math. Vol. 121, pp. 461-471, 2012.
- G. Albi, M. Bongini, E. Cristiani, D. Kalise, Invisible control of self-organizing agents leaving unknown environments, SIAM J. Appl. Math., 76(4), 1683-1710, 2016.

PEOPLE (2017)

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