SIMONE CACACE
Curriculum Vitae

per la destinazione "ai fini della pubblicazione in ottemperanza del D. Lgs. 33/2013"

Content Index

Part I - General Information

Full Name	Simone Cacace
Citizenship	Italian
Spoken Languages	Italian, English

Part II - Education

Type	Year	Institution	Notes
"Dottorato di Ricerca in Matematica, XVII ciclo"	2007	Dipartimento di Matematica Guido Castelnuovo, "Sapienza" Università di Roma	"Dottore di Ricerca in Matematica", with the thesis:"Gamma-convergenza di un modello di transizione di fase per le dislocazioni planari nei cristalli", defended on 16 January 2007, Supervisor: Prof. A. Garroni. Committee: G.Bellettini, G.Buttazzo e G.Dal Maso.
"Laurea Quadriennale in Matematica"	2001	Dipartimento di Matematica Guido Castelnuovo, "Sapienza" Università di Roma	"Dottore in Matematica", with the thesis: "Problemi di esistenza di soluzioni per equazioni ellittiche semilineari", defended on 21 September 2001, Supervisor: Prof. A. Tesei. Mark: 110/110 cum laude

Part III - Appointments

Academic Appointments

Start	End	Institution	Position
14/12/2018	current position	Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre	“Ricercatore a Tempo Determinato di tipologia A (RTDA), SSD MAT/08”
01/06/2017	13/12/2018	Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre	“Assegno di Ricerca”. Research topics: first and second order Hamilton-Jacobi equations, numerical methods and applications. Supervisor: Prof. R. Ferretti
01/02/2014	31/10/2016	Dipartimento di Matematica Guido Castelnuovo, “Sapienza” Università di Roma	“Assegno di Ricerca”. Research topics: efficient numerical methods for optimal control problems and differential games. Supervisor: Prof. M. Falcone
10/10/2013	06/01/2014	Istituto per le Applicazioni del Calcolo "Mauro Picone", Consiglio Nazionale delle Ricerche, Rome	“Assegno di Ricerca”. Research topics: analysis, numerical approximation and implementation of hybrid anti-diffusive numerical schemes for hyperbolic conservation laws. Supervisor: Prof. R. Natalini
01/09/2010	31/08/2013	Dipartimento di Matematica Guido Castelnuovo, “Sapienza” Università di Roma	“Assegno di Ricerca”. Research topics: numerical solution of Hamilton-Jacobi equations in high dimension for optimal control problems. Supervisor: Prof. M. Falcone
01/11/2009	30/04/2010	CMAP(Centre de Mathématiques Appliquées), École Polytechnique CNRS, Paris, France	“Contratto di Ricerca Postdoc”. Research topics: analysis, numerical approximation and implementation of 3D models for the computation of the effective surface tension of liquid drops on rough surfaces, via optimization of functionals of type perimeter. Supervisor: Prof. A. Chambolle
15/01/2009	31/10/2009	CERMICS (Centre d'Enseignement et de Recherche en Mathématiques et Calcul Scientifique), École des Ponts ParisTech, Paris, France	“Contratto di Ricerca Postdoc”. Research topics: analysis, numerical approximation and implementation of models for dislocation dynamics in crystals, described by non-local Hamilton-Jacobi equations. Supervisor: Prof. R. Monneau

Other Appointments

Start	End	Institution	Position
28/03/2008	27/03/2009	Cineca, ex CASPUR (Consorzio per le Applicazioni di Supercalcolo per Università e Ricerca), Rome	"Borsa di Studio". Study and Research topics: advanced programming in C++ language and OpenGL graphic libraries. Development of texture registration algorithms for digital images onto 3D scanned models in cultural heritage. Collaboration with "Coordinamento SIBA", University of Lecce. Supervisor: Dott. P. Lanucara
14/11/2007	14/12/2007	Dipartimento di Matematica Guido Castelnuovo, "Sapienza" Università di Roma	"Contratto di Ricerca". Research topics: numerical approximation of non-linear differential problems related to the study of dislocation dynamics in crystals. Supervisor: Prof. M. Falcone

Part IV - Teaching Experience

Academic Year	Institution	Lecture/Course
2021/2022	Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre	Teacher for the course *Matlab and Python Programming (Matlab Module)* - 3 CFU
2020/2021	Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre	Teacher for the course *Numerical Analysis II* - 9 CFU Teacher for the course *Matlab and Python Programming (Matlab Module) - 3 CFU*
2019/2020	Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre	Teacher for the course *Numerical Analysis II* - 9 CFU Laboratory Tutor for the course *Numerical Analysis I* (Teacher Prof. R. Ferretti)
2018/2019	Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre	Teacher for the PhD course *Advanced Graphics for Scientific Data - 3 CFU* Laboratory Tutor for the course *Numerical Analysis II* (Teacher Prof. R. Ferretti) Laboratory Tutor for the course *Numerical Analysis I* (Teacher Prof. R. Ferretti)

2017/2018	Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre	Teacher for the PhD course *Advanced Graphics for Scientific Data - 3 CFU* Laboratory Tutor for the course *Numerical Analysis I* (Teacher Prof. R. Ferretti)
2016/2017	Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre	Laboratory Tutor for the course *Numerical Analysis I* (Teacher Prof. R. Ferretti)
2015/2016	Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre	Laboratory Tutor for the course *Numerical Analysis I* (Teacher Prof. R. Ferretti)
2014/2015	Dipartimento di Matematica Guido Castelnuovo, "Sapienza" Università di Roma	Teacher for the Course *Visualization Laboratory* for the II level Master in Scientific Computing
2013/2014	Dipartimento di Matematica Guido Castelnuovo, "Sapienza" Università di Roma	Teacher for the Course *Visualization Laboratory* for the II level Master in Scientific Computing Teacher for the course *Advanced Programming and Graphics*
2012/2013	Dipartimento di Matematica Guido Castelnuovo, "Sapienza" Università di Roma	Teacher for the course *Visualization Laboratory* for the II level Master in Scientific Computing Teacher for the course *Numerical methods for partial differential equations* for the II level Master in Scientific Computing Laboratory Tutor for the course *Institutions of Numerical Analysis* (Teacher Prof. M. Falcone)
2011/2012	Dipartimento di Matematica Guido Castelnuovo, "Sapienza" Università di Roma	Teacher for the course *Visualization Laboratory* for the II level Master in Scientific Computing Laboratory Tutor for the course *Numerical methods for partial differential equations* (Teachers Prof. E. Carlini and Prof. M. Falcone) Laboratory Tutor for the course *Numerical Analysis* (Teacher Prof. M. Falcone)
2010/2011	Dipartimento di Chimica, "Sapienza" Università di Roma Dipartimento di Matematica Guido Castelnuovo, "Sapienza" Università di Roma	Tutor for the course *Institutions of Mathematics I* (Teachers Prof. A. Ardito and Prof. M.V. Marchi) Laboratory Tutor for the course *Numerical methods for partial differential equations* (Teacher Prof. M. Falcone)
2008/2009	Dipartimento di Ingegneria Meccanica, "Sapienza" Università di Roma	Tutor for the course *Differential Calculus I-II* (Teacher Prof. F. Scarabotti)

2007/2008	Dipartimento di Matematica Guido Castelnuovo, "Sapienza" Università di Roma Dipartimento di Ingegneria Informatica, "Sapienza" Università di Roma Dipartimento di Ingegneria Meccanica, "Sapienza" Università di Roma	Laboratory Tutor for the course *Numerical methods for Optimization* (Teacher Prof. M. Falcone) Tutor for the course *Analysis I (II module)* (Teachers Prof. F. Scarabotti and Prof. D. Giachetti) Tutor for the course *Differential Calculus I-II* (Teacher Prof. F. Scarabotti)
2006/2007	Dipartimento di Ingegneria Meccanica, "Sapienza" Università di Roma	Tutor for the course *Differential Calculus I-II* (Teacher Prof. F. Scarabotti)
2005/2006	Dipartimento di Ingegneria Meccanica, "Sapienza" Università di Roma	Tutor for the course *Differential Calculus I-II* (Teacher Prof. F. Scarabotti)
2004/2005	Dipartimento di Ingegneria Meccanica, "Sapienza" Università di Roma	Tutor for the course *Differential Calculus I-II* (Teacher Prof. F. Scarabotti)

Part V - Society Memberberships

Year	Title
2021	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2020	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2019	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2018	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2017	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2016	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2015	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2014	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2013	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2012	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)
2011	Affiliato ad Ente di ricerca, INdAM-GNCS (Gruppo Nazionale per il Calcolo Scientifico)

Part VI - Investigator in Research Projects

Year	Title	Program	Grant Value
2019	Approssimazione numerica di problemi di natura iperbolica ed applicazioni	Progetto INdAM-GNCS 2019. Coordinator: Prof. E. Carlini.	6.400 EUR
2018	Metodi numerici per problemi di controllo multiscala e applicazioni	Progetto INdAM-GNCS 2018. Coordinator: Dr. G. Albi.	5.000 EUR

2016	Modelli differenziali Non Lineari: analisi, approssimazione ed applicazioni	Progetto di Ateneo 2016, "Sapienza" Università di Roma. PI: Prof. M. Falcone.	11.000 EUR
2015	Modelli differenziali Non Lineari: analisi, approssimazione ed applicazioni	Progetto di Ateneo 2015, "Sapienza" Università di Roma. PI: Prof. M. Falcone.	12.500 EUR
2015	Metodi numerici semi-impliciti e semi-Lagrangiani per sistemi iperbolici di leggi di bilancio	Progetto INdAM-GNCS 2015. Coordinator: Prof. L. Bonaventura.	7.000 EUR
2014	Modelli differenziali Non Lineari: analisi, approssimazione ed applicazioni	Progetto di Ateneo 2014, "Sapienza" Università di Roma. PI: Prof. M. Falcone.	12.000 EUR
2014	Metodi ad alta risoluzione per problemi evolutivi fortemente non lineari	Progetto INdAM-GNCS 2014. Coordinator: Prof. R. Ferretti	8.000 EUR
2013-2016	Efficient numerical methods for optimal control problems and games via Dynamic Programming equations	EOARD (European Office of Aerospace Research and Development), contract n. FA8655-13-1-3016. PI: Prof. M. Falcone	176.000 USD
2009-2012	Numerical solution of Hamilton-Jacobi equations in high dimension	AFOSR (Air Force Office of Scientific Research), contract n. FA9550-10-1-0029. PI: Prof. M. Falcone	127.000 USD

Part VII - Research Activities

Numerical methods for Hamilton-Jacobi equations, optimal control of ODEs, differential games.

In optimal control theory of ODEs, the application of Bellman's dynamic programming principle allows one to obtain partial differential equations of Hamilton-Jacobi type, satisfied by the value functions of the underlying control problems. Such equations are in general nonlinear and they do not admit explicit solutions. My research focuses on the efficient numerical solution of these equations. The main difficulty is the typically high dimension of the problems, which makes unfeasible the application of standard solvers based on full-grid fixed-point iterations. The idea is then to exploit the hyperbolic nature of the equations, i.e. the fact that the relevant information propagates along characteristics (causality), to reduce as much as possible the number of computations. In this direction, one can mimic the causality at the discrete level, by reordering the grid nodes in a suitable way, so to produce, in a Gauss-Seidel like fashion, a relevant reduction of the iterations needed for the convergence of the algorithms (Fast-Marching, Fast-Sweeping, Fast-Iterative methods). On the other hand, one can employ domain decomposition techniques, to split the CPU load of the algorithms among parallel processors. Using again the causality, I have

been able to build a smart decomposition, by cutting the domain along the characteristics. In this way, the resulting partition is composed of almost independent patches, which implies a relevant reduction of the synchronization between the parallel processors. I have studied and implemented these methods in very different settings, to solve problems on structured/unstructured meshes via finite-difference/semi-Lagrangian schemes, and also for more general equations related to stochastic differential games for hybrid systems. More recently, part of my research is devoted to the implementation of these methods in CUDA on GPUs, in order to attack some interesting real-world problems. Finally, I am also working on the implementation of fast algorithms to localize points in an arbitrary mesh, a crucial step for the efficiency of semi-Lagrangian schemes running on unstructured meshes.

Numerical methods for Mean Field Games, Clustering algorithms.

Mean Field Games (MFG) theory is a generalization of the theory of stochastic differential games to the case of a huge (formally infinite) number of players (or agents), which applies to very complex scenarios, e.g. in the study of financial markets, population dynamics and communication networks. The main assumptions are the fact that all the agents are indistinguishable (i.e. they have the same goal) and that the actions of a single agent, based only on a "mean" information of all the agents, have a negligible impact on the evolution of the whole system. This leads to a system of strongly coupled nonlinear partial differential equations, one Hamilton-Jacobi equation for the optimal control of the agents, one Fokker-Planck equation for the probability distribution of the agents.

My research focuses on the convergence and implementation of numerical methods for the solution of MFG systems. For stationary problems, I have introduced a new algorithm, based on iterations of Gauss-Newton type, which provides a relevant speedup over the existing methods. I also have extended the method in different directions: to the case of multi-population Mean Field Games, in which each population is described by a MFG system, and all the systems are coupled by some interaction terms; to the case in which the state space for the game is a network, namely a collection of nodes connected by continuous arcs. In this case, the MFG system is much more complicated, due to the transmission conditions of Kirchhoff type at the nodes.

More recently, part of my research is devoted to the study of clustering algorithms in Machine Learning (K-means, Expectation-Maximization), which are able to extract relevant features from scattered big-data, organizing them in groups (clusters), according to some (more or less specified) membership criterion. In this direction, I have proposed a connection between Mean Field Games and Cluster Analysis, namely an attempt to provide a mathematical model in a mainstream research field which is, nowadays, still far from being well understood. In particular, I have proved that the clusters obtained by the classical Expectation-Maximization algorithm, given by mixtures of probability distributions, coincide with the solutions of a multi-population Mean Field Game, in which each population represents a cluster and the coupling terms are suitably chosen according to the type of distributions (Gaussian, Bernoulli, Categorical).

Finally, I have studied and proved the convergence of a "policy iteration method" for Mean Field Games, an iterative technique initially proposed in the literature for Hamilton-Jacobi equations, which allows to decouple the non linear MFG system into a sequence of linear problems, and results in a relevant acceleration for the convergence to the solution of the problem.

Modeling and control of soft-robots, optimal control of PDEs, numerical methods for constrained optimization.

Soft Robotics is an emerging branch of classical Robotics. Differently from standard manipulators widely employed in industrial applications, mainly composed of rigid joints with a relatively small number of degrees of freedom, soft robots are realized using soft materials and they can perform very complex tasks thanks to a potentially very large number of (pneumatic, piezoelectric) actuators. The aim is to create a new generation of machines that can operate in synergy with humans, ensuring safe interactions, also in unknown environments. Some futuristic applications: microsurgery, rehabilitation, exploration and rescue.

My research focuses on the mathematical modeling and control of bio-inspired soft manipulators, using the tools of optimal control theory of PDEs and numerical techniques for constrained optimization. I have proposed a model for an octopus tentacle-like soft manipulator in two dimensions, which results in a generalization of the nonlinear Euler-Bernoulli beam model, namely a system of controlled, fourth order, partial differential algebraic equations. The model accounts for inextensibility and curvature constraints on the manipulator, plus the actuators, represented by distributed controls on the local curvature of the device symmetry axis. I have addressed several optimal control problems in a stationary setting, including low energy consumption, reachability and grasping, also in presence of obstacles and in case of mechanical breakdowns. Discretization is performed by finite-differences in space combined with a velocity Verlet time integrator, while the numerical optimization employs augmented-Lagrangian methods. For optimal reachability problems, I also have investigated the dynamic setting, using adjoint-based gradient descent methods for the numerical solution of the related optimality systems.

Part VIII - Computer Skills

Keywords	Softwares
Operative Systems	Linux, MacOs, Windows
Programming Languages	C, C++, Matlab, Fortran, C#, Python
Computer Graphics Libraries	OpenGL, SDL, SDL2, Qt
Rigid Body Dynamics Libraries	ODE (Open Dynamics Engine)
Finite Elements Libraries	Deal.II, FreeFem++, libMesh
Mesh Generation Libraries	Triangle, TetGen
Computer Algebra System libraries	GiNaC
Image Editing	Gimp, Adobe Photoshop, Inkscape
Video Editing	FFmpeg, Adobe Premiere, KDEnlive
3D Modelling	Blender
Scientific Data Processing	Paraview, Gnuplot
Word Processors	LaTex, OpenOffice, MS Word, Xournal++
3D Game and App Development	Unity3D
Web Pages Editing	Html, WordPress

Software Development	Developer of algorithms for the numerical solution of PDEs, videogames, apps, real-time physics simulations, biological simulations, including *SPNET - Sand Piles on NETworks*, based on the numerical solution of a system of PDEs of Monge-Kantorovich type on networks: http://ricerca.matfis.uniroma3.it/users/cacace/SPNET *Pacman^HJ - A classic arcade videogame powered by Hamilton-Jacobi equations*, based on the numerical solution of PDEs related to classical optimal control problems and differential games: http://ricerca.matfis.uniroma3.it/users/cacace/PacmanHJ *Vurpo,* an interactive simulator of an octopus tentacle-like soft manipulator, based on the numerical solution of optimal control problems for a PDE related to the nonlinear Euler-Bernoulli beam model: http://ricerca.matfis.uniroma3.it/users/cacace/Vurpo *Myrmedrome*, an interactive simulator of the evolution of ant colonies in competition for environmental resources, inspired by the classical Game of Life: http://ricerca.matfis.uniroma3.it/users/cacace/Myrmedrome *Not Equal - The first point & click graphic adventure in wheelchair*, winner of the competition "Giovani Idee Cambiano l'Italia", promoted for purposes of social utility by "Presidenza del Consiglio dei Ministri - Dipartimento per le politiche giovanili e le attività sportive" in 2007: http://ricerca.matfis.uniroma3.it/users/cacace/NotEqual

Part IX - Scientific Achievements

Full list of Publications indexed on databases

Articles

1. Aquilanti, L., Cacace, S., Camilli, F., De Maio, R., *A Mean Field Games Approach to Cluster Analysis*, (2021) Applied Mathematics and Optimization, 84 (1), pp. 299-323. Citations: 0 (Scopus), Impact Factor 2020: 3,582 (Journal Citation Reports).

2. Cacace, S., Camilli, F., Goffi, A., *A policy iteration method for mean field games*, (2021) ESAIM - Control, Optimisation and Calculus of Variations, 27, art. no. 85. Citations: 1 (Scopus), Impact Factor 2020: 1,619 (Journal Citation Reports).

3. Aquilanti, L., Cacace, S., Camilli, F., Maio, R.D., *A Mean Field Games model for finite mixtures of Bernoulli and Categorical distributions*, (2021) Journal of Dynamics and Games, 8 (1), pp. 35-59. Citations: 0 (Scopus), Impact Factor: n/a.

4. Cacace, S., Ferretti, R., Festa, A., *Stochastic hybrid differential games and match race problems*, (2020) Applied Mathematics and Computation, 372, art. no. 124966.
Citations: 0 (Scopus), Impact Factor 2020: 4,091 (Journal Citation Reports).

5. Cacace, S., Lai, A.C., Loreti, P., *Modeling and optimal control of an octopus tentacle*, (2020) SIAM Journal on Control and Optimization, 58 (1), pp. 59-84.
Citations: 4 (Scopus), Impact Factor 2020: 2,267 (Journal Citation Reports).

6. Cacace, S., Camilli, F., De Maio, R., Tosin, A., *A measure theoretic approach to traffic flow optimisation on networks*, (2019) European Journal of Applied Mathematics, 30 (6), pp. 1187-1209.
Citations: 1 (Scopus), Impact Factor 2019: 1,487 (Journal Citation Reports), Impact Factor 2020: 1,413 (Journal Citation Reports).

7. Cacace, S., Camilli, F., Cesaroni, A., Marchi, C., *An ergodic problem for mean field games: Qualitative properties and numerical simulations*, (2018) Minimax Theory and its Applications, 3 (2), pp. 211-226.
Citations: 2 (Scopus), Impact Factor: n/a.

8. Cacace, S., Camilli, F., Corrias, L., *A differential model for growing sandpiles on networks*, (2018) SIAM Journal on Mathematical Analysis, 50 (3), pp. 2509-2535.
Citations: 0 (Scopus), Impact Factor 2018: 1,334 (Journal Citation Reports), Impact Factor 2020: 1,860 (Journal Citation Reports).

9. Cacace, S., Cristiani, E., Ferretti, R., *Blended numerical schemes for the advection equation and conservation laws*, (2017) ESAIM - Mathematical Modelling and Numerical Analysis, 51 (3), pp. 997-1019. Citations: 2 (Scopus), Impact Factor 2017: 1,850 (Journal Citation Reports), Impact Factor 2020: 1,716 (Journal Citation Reports).

10. Cacace, S., Cristiani, E., Rocchi, L., *A level set based method for fixing overhangs in 3D printing*, (2017) Applied Mathematical Modelling, 44, pp. 446-455.
Citations: 15 (Scopus), Impact Factor 2017: 2,617 (Journal Citation Reports), Impact Factor 2020: 5,129 (Journal Citation Reports).

11. Cacace, S., Camilli, F., Marchi, C., *A numerical method for Mean Field Games on networks*, (2017) ESAIM - Mathematical Modelling and Numerical Analysis, 51 (1), pp. 63-88.
Citations: 7 (Scopus), Impact Factor 2017: 1,850 (Journal Citation Reports), Impact Factor 2020: 1,716 (Journal Citation Reports).

12. Cacace, S., Falcone, M., *A dynamic domain decomposition for the eikonal-diffusion equation*, (2016) Discrete and Continuous Dynamical Systems - Series S, 9 (1), pp. 109-123.
Citations: 1 (Scopus), Impact Factor 2016: 0,781 (Journal Citation Reports), Impact Factor 2020: 2,425 (Journal Citation Reports).

13. Cacace, S., Camilli, F., *A generalized Newton method for homogenization of Hamilton-Jacobi equations*, (2016) SIAM Journal on Scientific Computing, 38 (6), pp. A3589-A3617. Citations: 12 (Scopus), Impact Factor 2016: 2,195 (Journal Citation Reports), Impact Factor 2020: 2,373 (Journal Citation Reports).

14. Cacace, S., Cristiani, E., Falcone, M., *Two semi-Lagrangian fast methods for Hamilton-Jacobi-Bellman equations*, (2014) IFIP Advances in Information and Communication Technology, 443, pp. 74-84. Citations: 3 (Scopus), Impact Factor: n/a.

15. Cacace, S., Cristiani, E., Falcone, M., *Can local single-pass methods solve any stationary Hamilton-Jacobi-Bellman equation?*, (2014) SIAM Journal on Scientific Computing, 36 (2), pp. A570-A587. Citations: 12 (Scopus), Impact Factor 2014: 1,854 (Journal Citation Reports), Impact Factor 2020: 2,373 (Journal Citation Reports).

16. Cacace, S., Chambolle, A., De Simone, A., Fedeli, L., *Macroscopic contact angle and liquid drops on rough solid surfaces via homogenization and numerical simulations*, (2013) ESAIM - Mathematical Modelling and Numerical Analysis, 47 (3), pp. 837-858. Citations: 4 (Scopus), Impact Factor 2013: 1,631 (Journal Citation Reports), Impact Factor 2020: 1,716 (Journal Citation Reports).

17. Cacace, S., Cristiani, E., Falcone, M., Picarelli, A., *A patchy dynamic programming scheme for a class of Hamilton-Jacobi-Bellman equations*, (2012) SIAM Journal on Scientific Computing, 34 (5), pp. A2625-A2649. Citations: 35 (Scopus), Impact Factor 2012: 1,949 (Journal Citation Reports), Impact Factor 2020: 2,373 (Journal Citation Reports).

18. Cacace, S., Chambolle, A., Monneau, R., *A posteriori error estimates for the effective Hamiltonian of dislocation dynamics*, (2012) Numerische Mathematik, 121 (2), pp. 281-335. Citations: 6 (Scopus), Impact Factor 2012: 1,329 (Journal Citation Reports), Impact Factor 2020: 2,223 (Journal Citation Reports).

19. Cacace, S., Garroni, A., *A multi-phase transition model for dislocations with interfacial microstructure*, (2009) Interfaces and Free Boundaries, 11 (2), pp. 291-316. Citations: 16 (Scopus), Impact Factor 2009: 0,938 (Journal Citation Reports), Impact Factor 2020: 1,389 (Journal Citation Reports).

Conference Papers

1. Cacace, S., Lai, A.C., Loreti, P., *Multi-target optimal control problems for a tentacle-like soft manipulator*, (2021) Proceedings of the 18th International Conference on Informatics in Control, Automation and Robotics, ICINCO 2021, pp. 39-48. Citations: 0 (Scopus), Impact Factor: n/a.

2. Cacace, S., Lai, A.C., Loreti, P., *Optimal Reachability and Grasping for a Soft Manipulator*, (2021) Lecture Notes in Electrical Engineering, 720, pp. 16-34.Citations: 0 (Scopus), Impact Factor: n/a.

3. Cacace, S., Lai, A.C., Loreti, P., *Optimal reachability with obstacle avoidance for hyper-redundant and soft manipulators*, (2020) ICINCO 2020 - Proceedings of the 17th International Conference on Informatics in Control, Automation and Robotics, pp. 134-141. Citations: 1 (Scopus), Impact Factor: n/a.

4. Cacace, S., Lai, A.C., Loreti, P., *Control strategies for an octopus-like soft manipulator*, (2019) ICINCO 2019 - Proceedings of the 16th International Conference on Informatics in Control, Automation and Robotics, 1, pp. 82-90. Citations: 3 (Scopus), Impact Factor: n/a.

5. Cacace, S., Cristiani, E., Falcone, M., *A local ordered upwind method for Hamilton-Jacobi and Isaacs equations*, (2011) IFAC Proceedings Volumes (IFAC-PapersOnline), 44 (1 PART 1), pp. 6800-6805. Citations: 12 (Scopus), Impact Factor: n/a.

Book Chapters

1. Cacace, S., Ferretti, R., Rafiei, Z., Computation of optimal trajectories for delay systems: An optimize-then-discretize strategy for general-purpose NLP solvers, (2018) Springer INdAM Series, 29, pp. 39-62.
   Citations: 0 (Scopus), Impact Factor: n/a.

2. Cacace, S., Camilli, F., Finite Difference Methods for Mean Field Games Systems, (2018) Springer INdAM Series, 28, pp. 21-47.
   Citations: 0 (Scopus), Impact Factor: n/a.

Summary of Scientific Achievements

Product type	Number	Data Base	Start	End
Articles	**19**	Scopus	2009	2021
Conference Papers	**5**	Scopus	2009	2021
Book Chapters	**2**	Scopus	2009	2021

Total Impact Factor	**38,265** (sum of *journal Impact Factors,* where available (16 products), related to the year *2020* - source *Journal Citation Reports*) **31,374** (sum of *journal Impact Factors,* where available (16 products), related to the *publication year* - source *Journal Citation Reports*)
Average Impact Factor per Product	**2,391** (computed dividing 38,265 , the Total IF related to the year 2020, by the 16 products in journals with an impact factor - source *Journal Citation Reports*) **1,960** (computed dividing 31,374 , the Total IF related to the publication year, by the 16 products in journals with an impact factor - source *Journal Citation Reports*)
Total Citations	**137** (source *Scopus*)
Average Citations per Product	**5,269** (computed dividing 137 citations by 26 products (source *Scopus*))
Hirsch (H) index	**7** (source *Scopus*)
Normalized H index (H index divided by the academic seniority)	**0,583** (7/12, where 12 is the number of years since the first publication in 2009 - source *Scopus*) **0,500** (7/14, where 14 is the number of years since phD achievement in 2007)

Part X - Other Achievements and Scientific Activities

"**Abilitazione Scientifica Nazionale** alle funzioni di professore di II fascia per il settore concorsuale 01/A5 - Analisi Numerica, conseguita in data 31/08/2018, nella tornata 2016-2018, V quadrimestre, con validità fino al 31/08/2027".

Organization of Conferences

1. Co-organizer of the Mini-symposium "Optimal control, differential games and applications" at "SIMAI 2020+2021**"**: 31 August - 4 September 2021, Parma (Italy).

2. Co-organizer of the conference "Numerical methods for PDEs: optimal control, games and image processing": 4-5 December 2014, Rome (Italy).

Invited Talks

1. "SIMAI 2020+2021": 31 August - 4 September 2021, Parma (Italy), *A PDE approach to a tentacle-like soft manipulator: optimal control and numerical approximation.*

2. "LSSC - 13th International Conference on Large-Scale Scientific Computations": 7-11 June 2021, Sozopol (Bulgaria), *Modeling and Optimal Control of an octopus-like soft-manipulator*, in the special session "Optimal Control of ODEs, PDEs and Applications".

3. "Numerical approximation of hyperbolic problems and applications"*:* 6-7 February 2020, Rome (Italy)*, A Mean Field Game model for Cluster Analysis.*

4. "Workshop on Control Theory and Applications": 28-29 March 2019, L'Aquila (Italy), *Modeling and Optimal Control of an Octopus Tentacle.*

5. "SIMAI 2018": 2-6 July 2018, Rome (Italy), *An adjoint-based numerical method for traffic flow optimization on networks.*

6. "Control of State Constrained Dynamical Systems": 25-29 September 2017, Padua (Italy), *Pacman^HJ, a classical arcade videogame powered by Hamilton-Jacobi equations.*

7. "Numerical methods for optimal control problems, algorithms, analysis and applications": 19-23 June 2017, Rome (Italy), *Direct numerical solution of cell problems in homogenization of Hamilton-Jacobi equations via generalized Newton's method for inconsistent nonlinear systems.*

8. "SIMAI 2016": 13-16 September 2016, Politecnico di Milano, Milan (Italy), A*n efficient numerical method for Stationary Mean Field Games.*

9. "11th AIMS Conference on Dynamical Systems, Differential Equations and Applications": 1-5 July 2016, Orlando (USA), *An efficient numerical method for Stationary Mean Field Games.*

10. “Workshop on semi-implicit and semi-Lagrangian methods for hyperbolic problems”: 1-2 March 2016, Milan (Italy), *A new approach to the numerical solution of ergodic problems for Hamilton-Jacobi equations.*

11. “SIAM Conference on Control and its Applications”: 8-10 July 2015, Paris (France), *A dynamic domain decomposition for a class of second order Hamilton-Jacobi equations.*

*12. “1*3th Viennese Workshop on Optimal Control and Dynamic Games”: 13-16 May 2015, University of Technology, Wien (Austria), *Domain decomposition techniques for deterministic and stochastic optimal control problems.*

13. “CGS 2015 - II International Seminar on Control Theory and Theory of Generalized Solutions of Hamilton-Jacobi Equations”: 1-3 April 2015, Yekaterinburg (Russia), *A domain decomposition method for second order Hamilton-Jacobi equations.*

14. “Numerics for Nonlinear PDEs in Roma Tre”: 29-30 January 2015, Università degli Studi Roma Tre, Rome (Italy), *Domain decomposition techniques for first and second order Hamilton-Jacobi equations.*

15. “10th AIMS Conference on Dynamical Systems, Differential Equations and Applications”: 7-11 July 2014, Madrid (Spain), *A Dynamic Domain Decomposition Method for Optimal Control Problems.*

16. “NETCO 2014 Conference”: 23-27 June 2014, Tours (France), poster-session with the videogame *Pacman^HJ: a classic arcade game powered by Hamilton-Jacobi equations.*

17. “Fluid Dynamics and Electromagnetism: theory and numerical approximation”: 3-6 June 2014, Levico Terme, Trento (Italy), *A Dynamic Domain Decomposition for Hamilton-Jacobi-Bellman equations.*

18. “SIAM Conference on Control and its Applications”: 8-10 July 2013, San Diego (USA), *Can local single-pass methods solve any Hamilton-Jacobi equations?*

19. “Semi-Lagrangian day Workshop”: 6-7 February 2013, Politecnico di Milano, Milan (Italy), *On Single-Pass Methods for Stationary Hamilton-Jacobi Equations.*

20. “12th Viennese Workshop on Optimal Control, Dynamic Games and Nonlinear Dynamics”: 30 May - 2 June 2012, University of Technology, Wien (Austria), *Efficient numerical methods for optimal control problems and games via Hamilton-Jacobi equations.*

21. “Matematica e Cultura 2012”: 30-31 March, 3 April 2012, Venice and Rome (Italy), *Myrmedrome: an ant colony simulator.*

22. “SIAM Conference on Control and its Applications”: 25-27 July 2011, Baltimore (USA), *A Patchy Dynamic Programming Method for the Numerical Solution of Hamilton-Jacobi-Bellman Equations.*

23. “Motions of Interfaces and Nonlinear PDEs”: 1-4 February 2010, Tours (France), *A posteriori error estimates for the effective Hamiltonian of dislocation dynamics.*

24. “Canum 2008”: 26-30 May 2008, Saint Jean de Monts (France), *A multi-phase transition model for dislocations with interfacial microstructure.*

Reviewing Activity

2020: Reviewer for *ICIAM-2019 SEMA SIMAI Springer Series*.

2019: Reviewer for *ESAIM-M2AN, Mathematical Modelling and Numerical Analysis*.

2015: Reviewer for *ESAIM-M2AN, Mathematical Modelling and Numerical Analysis*.

2014: Reviewer for *DCDS-A, Discrete and Continuous Dynamical Systems - Series A*.

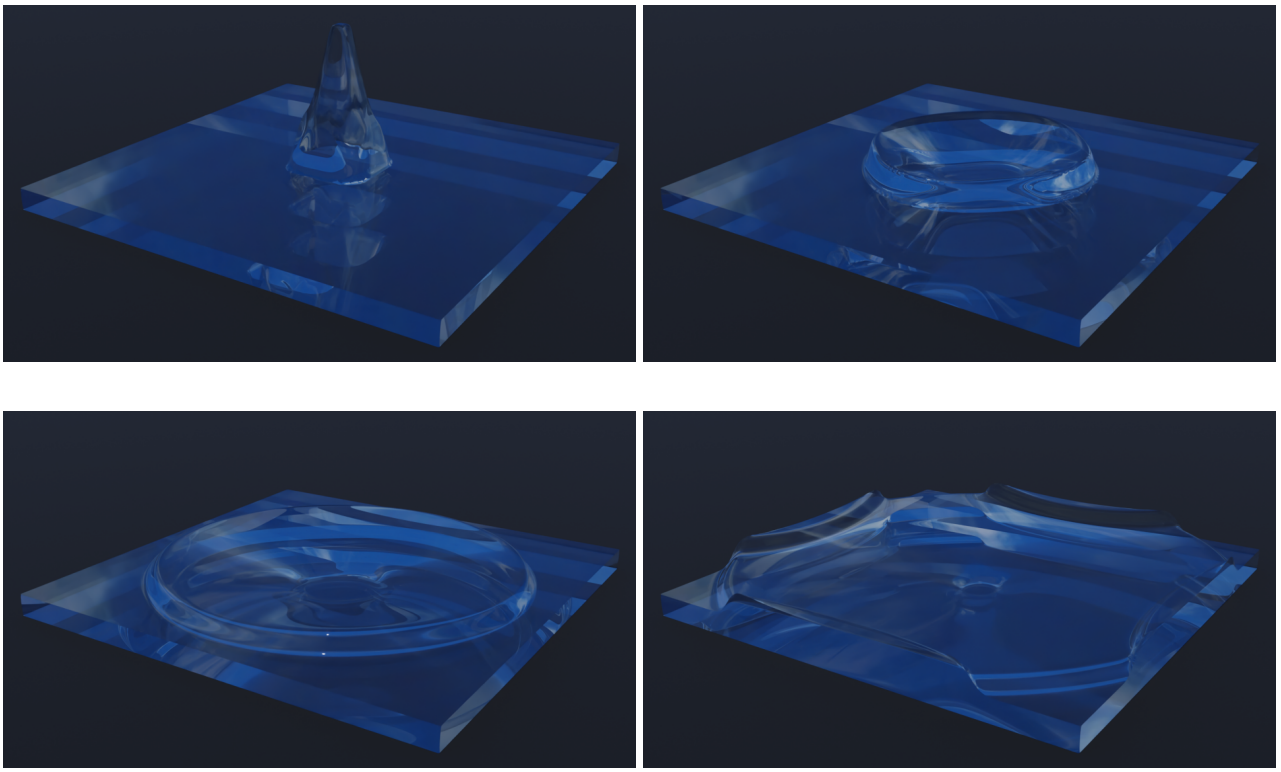
Graduation Committees

Academic Year	Description
2019/2020	“Controrelatore” for the thesis “Modelli matematici e simulazioni numeriche per i cristalli liquidi” by student Martina Trani, supervisor Prof. L. Teresi, in the final exam for “Laurea Magistrale in Matematica”, Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre. President of the committee for the thesis “Stime a posteriori e adattatività per ricostruzioni spaziali di tipo Shepard” by student Sarah Tofoni, supervisor Prof. R. Ferretti, in the final exam for “Laurea Magistrale in Matematica”,Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre..
2018/2019	“Controrelatore” for the thesis “Strategie efficienti di localizzazione di punti su triangolazioni non strutturate” by student Beatrice Beco, supervisor Prof. R. Ferretti, in the final exam for “Laurea Magistrale in Matematica”, Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre.

Popular Science Events

20-25 September 2021: “European Researchers’ Night” at Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre, webinar *Pacman^HJ - La matematica nei giochi* and porting for the Web in Unity3D (using Blender for graphics and C# for scripting) of the videogame *Pacman^HJ* developed in 2019, http://ricerca.matfis.uniroma3.it/users/cacace/PacmanHJ/

21-27 November 2020: European Researchers' Night at Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre, realization of a numerical simulation for the shallow-water equations, using Python scripting and ray-tracing rendering in Blender, inserted in the short-film "Un matematico a spasso: Saint-Venant e l'Isola Tiberina" by prof. R. Ferretti, https://www.youtube.com/watch?v=fU_DbfXDI98



15 February 2019: "Occhi su Marte" at Dipartimento di Matematica e Fisica, Università degli Studi Roma Tre, realization of a wooden arcade cabinet and of the videogame *Pacman^HJ* (using C++ language and SDL/OpenGL graphics libraries*)*, a reinterpretation of the classic videogame Pacman, based on the numerical solution of a Hamilton-Jacobi-Isaacs equation, whose value function makes the ghosts of the original game cooperative.

Roma, 5 Ottobre 2021 Firma

(non soggetta ad autentica ai sensi dell'art. 39 del D.P.R. 28.12.2000, n. 445)