Personal information

Surname(s) / First name(s)	**Zanlungo Francesco**
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Nationality(-ies)	Italian, **Holder of Japanese permanent residence permit**
Date of birth	10/03/1976
Gender	Male

Professional experience

From November 2017	Researcher Intelligent Robotics and Communication Laboratories, ATR, Kyoto, Japan Studying the behaviour of pedestrians and robot-pedestrian interactions
April 2017- October 2017	Visiting researcher Intelligent Robotics and Communication Laboratories, ATR, Kyoto, Japan Studying the behaviour of pedestrians and robot-pedestrian interactions
November 2016- March 2017	Researcher Intelligent Robotics and Communication Laboratories, ATR, Kyoto, Japan Studying the behaviour of pedestrian groups for the design of machines able to navigate autonomously in pedestrian facilities
2015-2016	Lecturer in Applied Mathematics Kingston University, London, UK Faculty of Science, Engineering and Computing, School of Computer Science and Mathematics **Tenured position**, resigned to go back to Japan for family related reasons, currently visiting researcher
2009-2015	Researcher Intelligent Robotics and Communication Laboratories, ATR, Kyoto, Japan Studying the behaviour of pedestrians and robot-pedestrian interactions
2008-2009	Visiting researcher CPT (Theoretical Physics Center), Marseilles, France Collaboration with Prof. Sandro Vaienti

| 2008 | Instructor |
| Milan Polytechnic University |
| Teaching Introductory course of Mathematics ("College Algebra") |

| 2007-2009 | Post-doctoral researcher |
| University of Bologna |
| Analysis of the effect of random noise and numerical round-off on discrete maps |

| 2005-2006 | Visiting researcher |
| Artificial Life Laboratory at Nagoya University |
| Collaboration with Prof. Takaya Arita |

Education and training

2004-2007	Ph.D. course
Major	Theoretical Physics
Institution	Graduate school of Physics, University of Bologna, Italy
Graduation Thesis	Microscopic Dynamics of Artificial Life Systems, supervised by Prof. Giorgio Turchetti

| 2003 | Japanese language education |
| Institution | Yamasa Language school, Okazaki-shi, Aichi-ken, Japan |

| 2002 | Italian Laurea in Physics |
| *(The Italian "Laurea" is legally equivalent to a Master degree. To obtain the degree, the candidate was supposed to work on a one year Graduation Thesis project requiring original research.)* |
Major	Theoretical Physics
Institution	University of Milan, Italy
Graduation Thesis	Studio numerico della cascata ultravioletta nel modello ϕ^4 classico (in Italian), supervised by Prof. Claudio Destri

Experience in event organisation

| 2006-2009 | In-chief of the organising committee |
| The Italian workshop on Biophysics (Biophys'06-09), held annually in Arcidosso, Grosseto, Italy. |

Computer skills

C, C++, Fortran, Java, Matlab, Mathematica
MS Office, HTML
Latex

Languages

Mother tongue(s) | **Italian**

Self-assessment
European level[(*)]

	Understanding			Speaking			Writing	
	Listening		Reading		Spoken interaction		Spoken production			
English	C2	Proficient user	C2	Proficient user	C2	Proficient user	C2	Proficient user	C2	Proficient user
Japanese(**)	C2	Proficient user	C2	Proficient user	C2	Proficient user	C2	Proficient user	C1	Proficient user
Spanish	C2	Proficient user	C2	Proficient user	C2	Proficient user	C2	Proficient user	C2	Proficient user
Portuguese	C1	Proficient user	C1	Proficient user	B2	Independent user	B2	Independent user	B1	Independent user
French	B2	Independent user	C1	Proficient user	B1	Independent user	B1	Independent user	A2	Basic user

Turkish	A1	Basic user	A1	Basic user	A1	Basic user	A1	Basic user	A1	Basic user
Mandarin Chinese	A1	Basic user	A1	Basic user	A1	Basic user	A1	Basic user	A1	Basic user

(*) *Common European Framework of Reference (CEF) level*

(**) *Holder of first (highest) level of Japanese proficiency, approved in 2008*

Additional information

Home page	www.irc.atr.jp/~zanlungo/
Driving licence(s)	B (cars)
Personal interests	Foreign languages, marathon and triathlons, basketball, travelling, music, digital photography, books in general, my family.

Teaching experience

2016-2017 (Appointed, and prepared lecture notes, before resigning)	Applications of Calculus, Partial Differential Equations module, School of Computer Science and Mathematics, Kingston University

This undergraduate course introduces the theory of Linear and Quasi-Linear Partial Differential Equations, along with Analytical and Numerical solution techniques. The course starts with an introduction to the geometrical meaning of vector calculus leading to the expression of the Laplace operator in the principal curvilinear coordinate systems. Then the Heat, Wave, Poisson and Schrödinger equations are introduced, along with separation of variables solutions in Cartesian and spherical coordinates. A short introduction to other analytical solution methods (Distribution Theory and Green Functions, Characteristics) and to Non Linear problems follow. The course ends with an introduction to numerical solutions.

Course notes   https://www.dropbox.com/s/ja2arlaweqycn8b/notes_prova.pdf?dl=0

2015-2016   Mathematical and Numerical Methods, Numerical Linear Algebra module, School of Computer Science and Mathematics, Kingston University

This undergraduate course revises the main theoretical concepts of linear algebra (linear systems, vector space, linear operators, vector and matrix norm, contraction theorem, eigenvalues and eigenvectors, matrix diagonalisation), and introduces numerical algorithms for the solution of related problems (Gaussian Elimination, LU decomposition, iterative methods, eigenvalue power method).

Course notes   https://www.dropbox.com/s/z7d28niwldy734m/notes.pdf?dl=0

2015-2016   Mathematical Models and Computation, Programming module, School of Computer Science and Mathematics, Kingston University

This undergraduate course introduces the fundamental sorting and search algorithms, along with the theoretical concepts necessary for their analysis (algorithm complexity). Part of the course is directed to practical exercitations aimed at acquiring the abilities for performing scientific programming.

2015-2016   Engineering Mathematics and Computing, School of Civil Engineering, Kingston University

This undergraduate course revises the fundamental concepts of applied calculus (up to ordinary differential equations) and teaches how to solve the related problems by Matlab.

2008-2009   Analytical Mechanics, Instructed by Prof. Turchetti and F. Zanlungo, Dep. of Physics, Bologna University

This course was focused on a throughout analysis of Lagrangian Mechanics (Lagrange equations, symmetries, central field, two body problem, stability, small oscillations, rigid body) and a solid introduction to Hamiltonian dynamics (Hamilton equations, canonical transformations, Noether theorem, integrable systems, Liouville theorem, ergodicity). My task on the course was to give part of the theoretical classes.

2008-2009   Teaching assistant of the Institutions of Mathematics course, Instructed by Prof. Bazzani, Milan Polytechnic University

An introductory calculus course, focused in particular on the concepts of real numbers, functions, limits and derivation, along with some notions of linear algebra. My task on the course was to give some theoretical classes in absence of Prof. Bazzani, hold practice sessions and prepare examination tests.

2008   Introductory course of Mathematics ("College Algebra"), Milan Polytechnic University

A course intended for those students that passed the University entry exam but scored poorly in mathematics, focused mainly on the concept of elementary real functions.

2007-2008   Teaching assistant of the Numerical Methods course, Instructed by Profs. Turchetti and Bazzani, Master course in Physics, Bologna University

This course was focused on an introduction of numerical methods for physical sciences (interpolation, numerical solution of non linear equations, numerical integration, numerical solution of differential equations, stochastic systems). My task on the course was to give a few theoretical classes and to assist students during practice sessions.

2007-2008	Teaching assistant of the Complex Systems Laboratory course, Instructed by Dr. Giorgini, Dep. of Physics, Bologna University
	For this course, I prepared lectures on genetic algorithms, population dynamics (evolutionary game theory) and neural networks.

Research experience

Mathematical modelling of pedestrian behaviour and crowd dynamics	Kingston University and ATR

In ATR we collected a large amount of data concerning the behaviour of pedestrians in experimental settings and in real world environments, which I used to develop original models of pedestrian and crowd dynamics. More in detail, the major findings regarded:

1. The need to include a velocity dependent potential in a collision avoiding model for pedestrians, and the development of a corresponding mathematical and computational model [6].

2. The tendency of (Japanese) pedestrians to walk on the left side of corridors, and to overtake other pedestrians on the right side, and the development of a method to introduce in a realistic way such a tendency in any pedestrian collision avoidance model [5,18,19].

3. Large pedestrian groups are not stable, and usually break up in more stable 2 or 3 pedestrian sub-units [21].

4. A mathematical model for the behaviour of social pedestrian groups, which was able to correctly predict the shape and velocity of pedestrian groups in low density, large environments [4].

5. Empirical study and mathematical modelling of how crowd density and other environment features affect the behaviour of pedestrian groups [2,3,17].

6. How group composition and social roles affect the behaviour of pedestrian groups [1,16].

7. How gestures affect the behaviour of pedestrian groups [25].

Socially acceptable mobile robot navigation

As part of the JST CREST project of T. Kanda

While working at ATR I have been also involved in more engineering oriented works, such as the development of a robot able to smoothly navigate inside a human crowd [14,20,27,28,31,33], and the development of algorithms to automatically detect pedestrian walking goals [29] and pedestrian groups [15,26,30].

Discrete chaotic systems

Analysis of the effect of noise on discrete maps, in collaboration with S. Vaienti and G. Turchetti
Development of a method to find a threshold beyond which the numerical results on chaotic maps are not reliable, and analysis of the differences between the effect of random noise and the effect of numerical round-off on the dynamics of the map [7,8,9].

Evolutionary dynamics of agent systems

Microscopic Dynamics of Artificial Life Systems (Ph.D. thesis, sup. G. Turchetti, in collaboration with T. Arita)
Using an approach combining cellular automata or agent models with differential equation (replicator dynamics) models, I studied:

1. the Immune System T cell clonal expansion [12].

2. the relation between the evolution of collision avoidance strategies and the evolution of a *Theory of Mind* [13,22,23].

3. the evolution of "traffic conventions" (such as driving on the left or right side of streets) in a mobility system [10,24].

4. the consequences of the fact that interactions dependent on vision (such as the collision avoidance in crowd dynamics) do not follow the action-reaction law of dynamics [11].

Numerical study of statistical properties of relativistic fields

Numerical study of the ultraviolet cascade in ϕ^4 classical model (Master thesis, sup. C. Destri)

Using a numerical algorithm that treats time and space in a symmetrical way, preserving thus the relativistic structure of the field theory, and conserving energy at machine precision, I studied the energy diffusion to the higher (ultraviolet) modes of a relativistic scalar field with a quartic interaction term. The results were compared with a more traditional numerical treatment of hyperbolic partial differential equations.

Publications

Peer reviewed journal papers (or book chapters) of which I was the corresponding author

1   F. Zanlungo, Z. Yücel, D. Brščić, T. Kanda and N. Hagita
Intrinsic group behaviour: dependence of pedestrian dyad dynamics on principal social and personal features
Submitted to Plos One, preprint athttps://arxiv.org/abs/1703.02672 (2017)

2   F. Zanlungo and T. Kanda
A mesoscopic model for the effect of density on pedestrian group dynamics
Europhysics Letters, 111, 38007 (2015) **(impact factor 2.095)**

3   F. Zanlungo, D. Brščić and T. Kanda
Spatial-size scaling of pedestrian groups under growing density conditions
Physical Review E 91 (6), 062810 (2015) **(impact factor 2.288)**

4   F. Zanlungo, T. Ikeda and T. Kanda
Potential for the dynamics of pedestrians in a socially interacting group
Physical Review E 89 (1), 012811 (2014) **(impact factor 2.288)**
(Paper chosen as "editor suggestion", i.e. as being of particular clarity and importance)

5   F. Zanlungo, T. Ikeda and T. Kanda
A microscopic social norm model to obtain realistic macroscopic velocity and density pedestrian distributions
PLoS ONE 7 (12), e50720 (2012) **(impact factor 3.73)**

6   F. Zanlungo, T. Ikeda and T. Kanda
Social force model with explicit collision prediction
Europhysics Letters, 93, 68005 (2011) **(impact factor 2.171)**

7   G. Turchetti, S. Vaienti and F. Zanlungo
Asymptotic distribution of global errors in the numerical computations of dynamical systems
Physica A 389 (2010) pp. 4994-5006 **(impact factor 1.521)**

8   G. Turchetti, S. Vaienti and F. Zanlungo
Relaxation to the asymptotic distribution of global errors due to round off
Europhysics Letters, 89, 40006 (2010) **(impact factor 2.753)**

9   P. Marie, G. Turchetti, S. Vaienti and F. Zanlungo
Error distribution in randomly perturbed orbits
CHAOS 19, 043118 (2009) **(impact factor 1.795)**

10   F. Zanlungo, T. Arita, S. Rambaldi
Emergence of a traffic flow convention in a multiagent model
Advances in Complex Systems. Vol.11, Issue 5, pp. 789-802 (2008)

11   G. Turchetti, F. Zanlungo, B. Giorgini
Dynamics and thermodynamics of a gas of automata
Europhysics Letters, Volume 78, Issue 5, 58003 (2007) **(impact factor 2.206)**

12	F. Zanlungo, G. Turchetti, S. Rambaldi
	An Automata Based Microscopic Model Inspired by Clonal Expansion
	Mathematical Modeling of Biological Systems, Volume II. A. Deutsch et al. (eds.), Birkhäuser, Boston, pp. 133-144 (2007)

13	F. Zanlungo
	A collision avoiding mechanism based on a theory of mind
	Advances in Complex Systems. Vol. 10 suppl. No. 2, pp. 363-371 (2007)

Other peer-reviewed journal papers

14	M. Shiomi, F. Zanlungo, K. Hayashi and T. Kanda
	Towards a Socially Acceptable Collision Avoidance for a Mobile Robot Navigating Among Pedestrians Using a Pedestrian Model
	International Journal of Social Robotics, 1-13 (2014) **(impact factor 1.207)**

15	Z. Yücel, F. Zanlungo, T. Ikeda, T. Miyashita, N. Hagita
	Deciphering the crowd: Modeling and identification of pedestrian group motion
	Sensors, 13(1), 875-897, 2013 **(impact factor 1.953)**

Journal papers (or book chapters) of which I was the corresponding author, only abstract subjected to peer reviewing

16	F. Zanlungo, Z. Yücel and T. Kanda
	The effect of social roles on group behaviour
	2016 Pedestrain and Evacuation Conference, Hefei, China

17	F. Zanlungo, D. Brščić and T. Kanda
	Pedestrian group behaviour analysis under different density conditions
	Transportation Research Procedia 2, 149-158, Proceedings of PED 2014, Delft TU

18	D. Brščić, F. Zanlungo and T. Kanda
	Density and velocity patterns during one year of pedestrian tracking
	Transportation Research Procedia 2, 77-86, Proceedings of PED 2014, Delft TU

19	F. Zanlungo, Y. Chigodo, T. Ikeda and T. Kanda
	Experimental study and modelling of pedestrian space occupation and motion pattern in a real world environment
	Pedestrian and Evacuation Dynamics 2012, Zurich ETH, Weidmann et al. (eds.), pp. 289-304, Springer, (published as a book in 2014)

31	M. D. Cooney, F. Zanlungo, S. Nishio, H. Ishiguro
	Designing a Flying Humanoid Robot (FHR): Effects of Flight on Interactive Communication
	IEEE RO-MAN, 2012
32	A. Bazzani, B. Giorgini, F. Zanlungo and S. Rambaldi
	Cognitive Dynamics in an automata gas
	Artificial Life and Evolutionary Computation, Wivace 2008

Other presentations at conferences

33	F. Zanlungo, Z. Yücel, F. Ferreri, J. Even, L.Y. Morales Saiki, T. Kanda
	Autonomous vehicles moving as a human group
	Poster presentation at IROS 2017
34	F. Zanlungo, G. Turchetti
	Dynamics and Thermodynamics of Automata with a visual cone. Comparison with a recursive thinking model
	Dynamics and Thermodynamics of Systems with Long Range Interactions: Theory and Experiments, 2007
35	F. Zanlungo, G. Turchetti
	An evolutionary collision avoiding model based on the theory of mind
	The 9th International Conference on the Simulation of adaptive behavior (SAB'06), La Sapienza University, Rome, 2006
36	F. Zanlungo, G. Turchetti
	Dynamics and thermodynamics of a gas of automata
	III Italian Workshop in Artificial Life (WIVA3), 2006
37	G. Turchetti , F. Zanlungo
	Termodinamica di un gas di automi (in Italian)
	II Italian Workshop in Artificial Life , 2005, La Sapienza University, Rome
38	G. Turchetti, S. Rambaldi, G. Salustri and F. Zanlungo
	Mathematical models of clonal expansion
	WSEAS Transactions on Biology and Biomedicine 1, 373-378, 2004

Japanese language papers

50 | 林宏太郎、塩見昌裕、Francesco ZANLUNGO、神田崇行
歩行者モデルを用いた話しかけやすい移動行動
日本ロボット学会第３２回学術講演会講演論文集RJS2014, 3P2-07, 2014

51 | 池田徹志、児堂義弘、Daniel REA、Francesco ZANLUNGO、塩見昌裕、神田崇行
街角における歩行者のサブゴール遷移モデル
日本ロボット学会第３1回学術講演会講演論文集RJS2013, 3I2-03, 2013

52 | 塩見昌裕、Francesco ZANLUNGO、林宏太郎、神田崇行
街角で活動する移動ロボットのための歩行者シミュレータ
日本ロボット学会第第30回学術講演会講演論文集RJS2012, 2N1-8, 2012

53 | 塩見昌裕、Francesco ZANLUNGO、林宏太郎、神田崇行
歩行者モデルを用いた街角でのロボットナビゲーション
日本ロボット学会第第30回学術講演会講演論文集RJS2012, 2N1-8, 2012

Patents

Registered patents

1 | T. Ikeda, F. Zanlungo, T. Miyashita and T. Kanda
System for the prediction of pedestrian motion and robot control
（移動予測装置、ロボット制御装置、移動予測プログラムおよび移動予測方法）
Japanese patent 5763384, registered on 19/6/2015

2 | M. Shiomi, T. Kanda, F. Zanlungo and T. Ikeda
A robot able to predict pedestrian motion and perform automatic collision avoidance
（歩行者の軌跡を予測して自己の回避行動を決定するロボット）
Japanese patent 5768273, registered on 3/7/2015