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

Since 2015	Assistant Professor (UK position “Lecturer”) in Applied Mathematics Kingston University, London, UK Faculty of Science, Engineering and Computing, School of Mathematics
2009-2015	Researcher Intelligent Robotics and Communication Laboratories, ATR, Kyoto, Japan Member of the Kanda JST CREST project Studying the behaviour of pedestrians and the design of a mobile robot that can smoothly navigate in pedestrian facilities
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, Biophys'07, Biophys'08, Biophys'09), held annually in Arcidosso, Grosseto, Italy.

Computer skills

C, C++, Fortran, Java, Matlab, Mathematica, Maple
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

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

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

Additional information

Driving licence(s)	B (cars)
Personal interests	Foreign languages, marathon and triathlons, travelling, music, digital photography.

Teaching experience

2015-2016

Mathematical and Numerical Methods
Numerical Linear Algebra module
School of 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). The course includes also an introduction to the solution of nonlinear systems.

2015-2016

Mathematical Models and Computation
Programming module
School of 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 aquiring the abilities for performing scientific programming.

2015-2016

Engineering Mathematics and Computing
Computing module
School of Civil Engineering, Kingston University
This course revises the fundamental concepts of applied calculus (up to ordinary differential equations) and teaches how to solve the related problems by using high level Numerical (Matlab) and Symbolic (Maple) languages.

From 2016 (planned)

Applications of Calculus
Partial Differential Equations module
School of Mathematics, Kingston University
This course introduces the theory of Linear and Quasi-Linear Partial Differential Equations, along with analytical and numerical solution techniques.

2008-2009

Analytical Mechanics
Instructed by Prof. Turchetti and F. Zanlungo
Department of Physics, University of Bologna
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
Piacenza branch of Milan Polytechnic University (Architecture)
This was 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”)
Piacenza branch of Milan Polytechnic University (Architecture)
An introductory course to “Institutions of Mathematics”, intended for those students that passed the University entry exam but scored poorly in mathematics, and 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, University of Bologna

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

Department of Physics, University of Bologna

For this course, I prepared lectures on genetic algorithms, population dynamics (evolutionary game theory) and neural networks.

Research experience

Pedestrian dynamics

Kingston University and ATR

My research in Kingston University and previously in ATR focused mainly on the mathematical modelling of pedestrian behaviour and crowd dynamics. With my research group in ATR, we have 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 **[5]**.
2. The finding that (Japanese) pedestrians have a tendency 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 **[4,16,17]**.
3. The finding that large pedestrian groups are not stable, and usually break up in more stable 2 or 3 pedestrian sub-units **[18]**.
4. The development of 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 **[3]**.
5. The empirical study and mathematical modelling of how crowd density and other environment features affect the behaviour of pedestrian groups **[1,2,15]**.

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 **[13,22,25]**, and the development of algorithms to automatically detect pedestrian walking goals **[23]** and pedestrian groups **[14,24]**.

Discrete chaotic systems

Analysis of the effect of noise on discrete maps, in collaboration with S. Vaienti and G. Turchetti

The research activity was focused on the analysis of the effect of noise on discrete maps, and in particular on the identification of a method that allows to find a threshold beyond which the numerical results on chaotic maps are not reliable, and on the analysis of the differences between the effect of random noise and the effect of numerical round-off on the dynamics of the map **[6,7,8]**.

Evolutionary dynamics of agent systems

Microscopic Dynamics of Artificial Life Systems (Ph.D. graduation thesis, supervisor G. Turchetti, and in collaboration with T. Arita)

The research activity was mainly focused on the study of systems composed of many independent parts provided with some form of perception and data processing capability (agents). The purpose of this research was to combine an Artificial Life approach in which agents could adapt to the environment with a mean field approach based on differential equations that could describe the dynamics of macroscopic observables. Using this approach I studied the following problems:

1. I developed a cellular automata model of the T cell clonal expansion in the Immune System, and the corresponding mean field model, and I compared the results obtained by using these two approaches **[11]**.
2. Using agent simulations and a replicator dynamics differential approach, I studied the relation between the evolution of collision avoidance strategies and the evolution of the Theory of Mind (ability to understand that also other people have a mind) **[12,19,20]**.
3. Combining a cellular automaton model and a replicator dynamics analysis, I studied the evolution of "traffic conventions" (such as driving on the left or right side of streets) in a mobility system **[9,21]**.
4. Using both computational and analytical methods, I studied 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 **[10]**.

Numerical study of statistical properties of relativistic fields

Numerical study of the ultraviolet cascade in ϕ^4 classical model (Laurea graduation thesis, supervisor C. Destri)

In this work I used a numerical algorithm that treats time and space in a symmetrical way, preserving thus the relativistic structure of the field theory, and conserves energy at machine precision, to study 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 and T. Kanda
A mesoscopic model for the effect of density on pedestrian group dynamics
Europhysics Letters, 111, 38007 (2015) **(impact factor 2.095)**

2 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)**

3 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)

4 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)**

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

6 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)**

7 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)**

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

9 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)

10 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)**

11 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)

12 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

13 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)**

14 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

15 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

16 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

17 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)

Peer-reviewed conference papers

18 F. Zanlungo and T. Kanda
Do walking pedestrians stably interact inside a large group? Analysis of group and sub-group spatial structure
The annual meeting of cognitive science society, Humbolt University Berlin, 2013

19 F. Zanlungo
Evolution of high level recursive thinking in a collision avoiding model
Artificial Life and Evolutionary Computation, Wivace 2008

20 F. Zanlungo, A. Bazzani, B. Giorgini, S. Rambaldi, G. Servizi and G. Turchetti
An evolutionary crowd dynamics model
European Conference on Complex Systems 2007, Dresden TU

21 F. Zanlungo and T. Arita
Evolutionary Simulation of an Agent Based Mobility System Using Indirect Communication
International Symposium of Artificial Life and Robotics, pp. 319-322, 2006

Other peer-reviewed conference papers

22 M. Shiomi, F. Zanlungo, K. Hayashi and T. Kanda
A Framework with a Pedestrian Simulator for Deploying Robots into a Real Environment
SIMPAR 2012

23 T. Ikeda, Y. Chigodo, D. Rea, F. Zanlungo, M. Shiomi and T. Kanda
Modeling and Prediction of Pedestrian Behavior based on the Sub-goal Concept
Robotics: Science and Systems, Sidney University, 2012

24 Z. Yücel, F. Zanlungo, T. Ikeda, T. Miyashita, N. Hagita
Modeling Indicators of Coherent Motion
IEEE/RSJ IROS, 2012

25 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

26 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

27 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

28 F. Zanlungo, G. Turchetti
An evolutionary collision avoiding model based on the theory of mind
The 9^{th} International Conference on the Simulation of adaptive behavior (SAB'06), La Sapienza University, Rome, 2006

29 F. Zanlungo, G. Turchetti
Dynamics and thermodynamics of a gas of automata
III Italian Workshop in Artificial Life (WIVA3), 2006

30 G. Turchetti , F. Zanlungo
Termodinamica di un gas di automi (in Italian)
II Italian Workshop in Artificial Life , 2005, La Sapienza University, Rome

31 G. Turchetti, S. Rambaldi, G. Salustri and F. Zanlungo
Mathematical models of clonal expansion
WSEAS Transactions on Biology and Biomedicine 1, 373-378, 2004

Invited talks

32 *Potential for the dynamics of pedestrians in a socially interacting group*
Department of Physics of Bologna University
Bologna, Italy, 2014

33 *Potential for the dynamics of pedestrians in a socially interacting group*
Artificial Life Laboratory of Nagoya University (Arita Lab)
Nagoya, Japan, 2014

34 *Experimental study and modelisation of pedestrian space occupation and motion pattern in a real world environment*
Department of Physics of Bologna University
Bologna, Italy, 2012

35 *Experimental study and modelisation of pedestrian space occupation and motion pattern in a real world environment*
Artificial Life Laboratory of Nagoya University (Arita Lab)
Nagoya, Japan, 20122

36 *Social force model with explicit collision prediction*
Artificial Life Laboratory of Nagoya University (Arita Lab)
Nagoya, Japan, 2011

37 *Evolution of Behaviours in Artificial Life*
International Summer School: Interfacing Sciences and Humanities
Rimini, Italy, 2009

38 *Chaos and Complexity*
International Summer School: Interfacing Sciences and Humanities
Rimini, Italy, 2009

39 *Error statistics in perturbed discrete dynamical systems*
Department of Mathematics of Bologna University
Bologna, Italy, 2009

40 *Evolutionary techniques in a traffic model*
Nagatani Laboratory of Shizuoka University
Hamamatsu, Japan, 2008

Patents

Registered patents

1 T. Ikeda, F. Zanlungo, T. Miyashita and T. Kanda
System for the prediction of pedestrian motion and robot control
Japanese patent 5763384, registered on 19/6/2015