

# Curriculum Vitae and Publications

Antongiulio Fornasiero

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## Personal information

Born on 13th June 1976 in Venice (Italy).

Citizenship: Italian.

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## Work, education, and training

Since August 2014 **Post-doctoral** scholarship at Università di Parma (Italy).

August 2012–July 2014 **Post-doctoral** scholarship at Seconda Università di Napoli (Caserta, Italy);

*Assegno di Ricerca “New advances in model theory of exponentiation”, FIRB 2010.*

October 2008–July 2012 **Assistant** position at the University of Münster (Germany);

*Wissenschaftlicher Mitarbeiter.*

August 2007–September 2008 **Post-doctoral** scholarship at the University of Freiburg (Germany).

December 2003–July 2007 **Post-doctoral** scholarship at the University of Pisa (Italy);

*Assegno di Ricerca “O-minimalità, metodi e modelli nonstandard, linguaggi per la computabilità”, PRIN 2004.*

January–March 2005 I **visited** the Algebra and Logic Group at the University of Saskatchewan (Saskatoon, Canada), where I worked with Salma and Franz-Viktor Kuhlmann.

January 2000–January 2004 I was a **PhD** student at the University of Edinburgh, under the supervision of Angus Macintyre; I was funded by a scholarship by the Istituto Nazionale di Alta Matematica, and by the Engineering and Physical Sciences Research Council. I graduated with the thesis “Integration on Surreal Numbers”.

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October 1994–April 1999 I was a **student** in mathematics at the University of Pisa and at the Scuola Normale Superiore of Pisa.

I specialised in mathematical logic, graduating *cum laude* with the thesis “O-minimalità del campo dei numeri reali con la funzione esponenziale”, under the direction of Alessandro Berarducci.

### Other

30-12-2014 *Abilitazione scientifica II fascia* (Italian scientific habilitation for associate professor) in Algebra and Geometry.

07-03-2014 *Abilitazione scientifica II fascia* in Mathematical Logic.

### Teaching

- During the Summer Semester 2008, I taught the course “O-minimality of Pfaffian functions” at the University of Freiburg.
- From 2009 to 2012 I have been a teaching assistant for various courses at the University of Münster, and I supervised a diploma student.
- In 2013 I taught part of the course in Model Theory and part of the course on Galois theory at the Seconda Università di Napoli.
- During the Summer Semester 2015, I am teaching the course “Mathematical Logic” at the University of Parma.

### Research interests

My main research interests are in **model theory** and its interaction with algebra.

I work especially on **ordered structures**, **valued fields**, **fields of power series**, **o-minimality**, and **lovely pairs**.

In my PhD thesis I studied Conway’s field of surreal numbers. The main concern was the study of a class of functions on the surreals satisfying a certain general definition schema. I proved the existence of an integral for such functions, which, in favourable cases, satisfies the traditional formulae of analysis. Moreover, the sign-change property can be proved for such functions, giving a new proof of the existence of a logarithm [PhD, F05, F06b].

In [F06a], I studied valued fields, and, generalising a theorem of Mourgues and Ressayre, I proved that a Henselian field of residue characteristic 0 can be embedded in a field of generalised power series, and therefore admits an integer part. Similar results hold, with some additional hypothesis, in the finite and the mixed

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characteristic cases. An easy consequence is a different proof of the Ax-Kochen-Ershov theorem. In [FKK08], together with Franz-Viktor and Salma Kuhlmann, we studied more in details integer parts of valued fields, and investigated their connection to special (additive) complements of valuation rings in ordered fields.

In [FM08], together with Marcello Mamino, we studied the arithmetic of Dedekind cuts on ordered Abelian groups, obtaining an axiomatisation of the universal part of the theory of the such structures.

I am also interested in the correlations between o-minimality and other areas of mathematics, especially measure theory and algebraic topology. In [FV12], together with Elisa Vasquez-Rifo, we gave a notion of  $d$ -dimensional area for bounded sets definable in an o-minimal structure expanding a field, extending the work of Berarducci and Otero on the Lebesgue measure of definable sets. It is possible to give different definitions for area, and it turns out that they coincide, and that many of the formulae from classical geometric measure theory can be transferred to this context.

I also worked on the space of types of o-minimal structure, endowed with the spectral topology. In [F06d], I showed that the definability of a type can be apprehended from its specialisations. In my joint work with Alessandro Berarducci [BF07], we studied the Čech and sheaf cohomology of the spectrum of o-minimal structures expanding a group, and we showed that the cohomology of closed and bounded definable sets is finitely generated and invariant under elementary extensions and o-minimal expansions (generalising known results for structures expanding a field).

I studied structures with a dimension function (such as d-minimal and geometric structures), and introduced a notion of dense pairs (also known as “lovely pairs” in a different context) for such structures [F11a, FH12]. In a joint work with Gareth Boxall, we studied lovely pairs of structures endowed with an independence relation, bringing together the work on lovely pairs of geometric structures and of lovely pairs of simple structures [F10e].

Together with Tamara Servi, we studied definably complete Baire structures and we proved a generalization of Wilkie’s theorem of the complement to such structures [FS10, FS12, FS11, F12a].

In [F13, F11b, F10d, F11b, FHM13, F12c] I studied “tame” definably complete (DC) structures (e.g., locally o-minimal and d-minimal structures), and prove that various results from o-minimality can be generalised to DC structures, solving some conjectures by C. Miller. In particular, in [FHM13, F11b] we showed that there is a sharp dichotomy for expansions of the real field: either they define the set of natural numbers, or no closed fractal set is definable in them.

Together with P. Hieronymi, we also generalized Hieronymi’s dichotomy to any DC expansion of a field: any such structure is either “tame” in a strong sense, or it

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defines a model of second order Peano arithmetic [FH]. We also show that, using the above result, many facts (e.g.: Lebesgue Theorem on monotone functions) can be transferred from expansions of  $\mathbb{R}$  to DC structures.

With P. d'Aquino, V. Mantova and G. Terzo we are working on exponential fields, and in particular on consequences of Schanuel Conjecture.

## Publications

- [PhD] A. Fornasiero. Integration on Surreal Numbers. Doctoral thesis, University of Edinburgh, January 2004.
- [F06a] —. Embedding Henselian fields into power series. *J. Algebra*, 304:1 (2006), 112–156.
- [BF07] Alessandro Berarducci and —. O-minimal cohomology: finiteness and invariance results. *J. Mathematical Logic*, 9:2 (2009), 167–182
- [FKK08] —, Franz-Viktor and Salma Kuhlmann. Towers of complements to valuation rings and truncation closed embeddings of valued fields. *J. Algebra*, 323:1 (2010), 574–600. Also appeared in: *Séminaire de Structures Algébriques Ordonnées*, Prépublications de l'équipe de logique mathématique, Université Paris VII, Février 2008.
- [FM08] — and Marcello Mamino. Arithmetic of Dedekind cuts on ordered Abelian groups. *Annals of Pure and Applied Logic*, 156: 2–3 (2008), 210–244.
- [FS10] — and Tamara Servi. Definably complete Baire structures. *Fund. Math.*, 209:3 (2010), 215–241.
- [FS11] — and Tamara Servi. Relative Pfaffian closure for definably complete Baire structures. *Illinois Journal of Mathematics* 55 (2011), 1203–1219.
- [FS12] — and Tamara Servi. Theorems of the complement. In “Lecture Notes on O-Minimal Structures and Real Analytic Geometry”, (C. Miller, J.-P. Rolin, P. Speissegger Editors), *Fields Institute Communications* 62 (2012), 219–242.
- [F11a] —. Dimensions, matroids, and dense pairs of first-order structures. *Annals of Pure and Applied Logic*, 162:7 (2011), 514–543.
- [F11b] —. Definably complete structures are not pseudo-enumerable. *Archive for Mathematical Logic*, 50:5–6 (2011), 603–615.

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- [FV12] — and Elisa Vasquez-Rifo. Hausdorff measure on o-minimal structures. *J. Symbolic Logic*, 77:2 (2012), 631–648.
- [F12a] —. Definably connected nonconnected sets. *Mathematical Logic Quarterly*, 58 (2012), 125–126.
- [FH12] — and Immanuel Halupczok. Dimension in topological structures: Topological closure and local property. *Contemporary Mathematics*, 576 (2012), 89–94.
- [F13] —. Locally o-minimal structures and structures with locally o-minimal open core. *Annals of Pure and Applied Logic*, 164:3 (2013), 211–229.
- [FHM13] —, Philipp Hieronimi and Chris Miller. A dichotomy for expansions of the real field. *Proc. Amer. Math. Soc.*, 141 (2013), 697–698.
- [FH] — and Philipp Hieronimi. A fundamental dichotomy for definably complete expansions of ordered fields. 15 pp., 2015; **to appear** in *J. Symbolic Logic*.

### Unpublished papers

- [F05] —. Recursive definitions on surreal numbers. 19 pp., 2005.
- [F06b] —. Initial embeddings in  $\mathbf{No}$  of models of  $T_{an}(\text{exp})$ . 13 pp., 2006.
- [F06d] —. O-minimal spectrum. 33 pp., 2006.
- [F10d] —. D-minimal structures. 25 pp., 2010.
- [F10e] —. Lovely pairs for independence relations. 24 pp., 2010.
- [F11b] —. Expansions of the reals which do not define the natural numbers. 14 pp., 2011.
- [F12c] —. Groups and rings definable in d-minimal structures. 25 pp., 2012.

### Conference Talks and Posters

*International Congress M.ARI.AN. 2004: Nonstandard Models of Arithmetic and Analysis*, Pisa, June 2004.

International Congress *NonStandard Methods and Applications in Mathematics*, Pisa, May 2006.

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*Oxford Workshop in Model Theory*, September 2006.

*Colloque autour de l'o-minimalité*, Paris, September 2006.

*Joint meeting UMI-DMV*, Perugia, June 2007.

*Incontro Italiano Insiemi e Modelli*, Torino, April 2007.

*Logic Colloquium 2009*, Sofia, Bulgaria, August 2009.

*Model Theory: Around Valued Fields and Dependent Theories*, Oberwolfach, January 2010.

*British Postgraduate Model Theory Conference*, Leeds, January 2011.

*Groups and Model Theory*, Mülheim an der Ruhr, May 2011.

*Géométrie et Théorie des Modèles*, Paris, October 2011.

*Model Theory in Algebra, Analysis and Arithmetic*, Cetraro, July 2012.

*Konstanz-Naples Model Theory Days 2012*, Konstanz, December 2012.

*Model Theory 2013*, Ravello, June 2013 (**local organizer**).

*Model Theory and Applications to Geometry*, Lisbon, July 2013.

*AILA 2014*, Pisa, April 2014.

*First Joint International Meeting RSME-SCM-SEMA-SIMAI-UMI*, Bilbao, July 2014.

*Recent developments in the applications of model theory to algebraic, analytic and diophantine geometry*, Edinburgh, July 2014.

### **Other conferences I attended recently**

*Unlikely intersections in algebraic groups and Shimura varieties*, Pisa, March 2011.

*Recent Developments in Model Theory*, Oléron, June 2011.

*Interactions of Model Theory with Number Theory and Algebraic Geometry*, Bonn, June 2012.

*Geometry, Structure and Randomness in Combinatorics*, Pisa, September 2012.

*Logic Colloquium 2013*, Évora, July 2013.

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*Naples-Konstanz Model Theory Days*, Caserta, November 2013 (**local organizer**).

*Comfort 2015*, Pisa, May 2015

## **Dichiarazione sostitutiva di certificazioni e dell'atto di notori- et **

Il sottoscritto

Fornasiero Antongiulio, Codice Fiscale FRNNNG76H13L736B Nato a Venezia (VE) il 13/06/1976, Sesso M,

consapevole che chiunque rilascia dichiarazioni mendaci, forma atti falsi o ne fa uso   punito ai sensi del codice penale e delle leggi speciali in materia,

### **Dichiara**

che quanto affermato e riportato nel presente curriculum corrisponde al vero.

Dichiaro, inoltre, di essere informato, ai sensi e per gli effetti del D.L.vo n.196/2003, che i dati personali raccolti saranno trattati, anche con strumenti informatici, esclusivamente nell'ambito del procedimento per il quale la presente dichiarazione viene resa.

*Antongiulio Fornasiero*

Parma, 1 Luglio 2015

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*CAF*