

# Luca Di Stefano

Curriculum vitae

January 2022

## Personal information

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## Research interests

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My research mainly concerns the formal modelling and analysis of agent-based models of complex collective systems. On one hand, this entails the development of formally defined high-level languages to concisely describe the features of individual agents; on the other hand, it requires applying and improving state-of-the-art verification techniques to check the collective behaviour of the resulting system.

Keywords associated with my interests include:

**Modelling:** Agent-based modelling, Attribute-based communication, Collective adaptive systems, Domain-specific languages, Multi-agent systems, Process algebras, Stigmergic interaction, Structural operational semantics, Temporal logics.

**Analysis:** Bounded model checking, Explicit-state and symbolic model checking, Software verification, Static analysis.

## Education

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**Gran Sasso Science Institute**

**L'Aquila, Italy**

*PhD in Computer Science*

*November 2016 – October 2020*

**Thesis:** *Modelling and Verification of Multi-Agent Systems via Sequential Emulation*

**Advisors:** Rocco De Nicola, Omar Inverso

**URL:** [hdl.handle.net/20.500.12571/10181](http://hdl.handle.net/20.500.12571/10181)

**Other activities:** Student representative in the academic senate (2018–2020).

**University of L'Aquila**

**L'Aquila, Italy**

*MSc in Computer Science and Systems Engineering March 2014 – October 2016*

**Thesis:** *Design of a reactive system for autonomous UAV navigation in unknown environments.* Thesis written in Italian. Original title: *Progettazione di un sistema reattivo per la navigazione autonoma di un drone in ambienti sconosciuti.*

**Advisors:** Eliseo Clementini, Enrico Stagnini

**Final grade:** 110/110, *cum laude*

**Official degree name:** *Ingegneria Informatica e Automatica.*

## Positions held

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**CONVECS, Inria/LIG**

**Grenoble, France**

*Post-doctoral researcher*

*November 2020 – Present time*

The aim of this post-doc is to enable efficient model checking of temporal properties in the context of collective adaptive systems. Building upon previous work with the CONVECS team, I developed an automated translation of a state-based temporal property language into MCL (an extension of the alternation-free fragment of the modal  $\mu$ -calculus), and used it to verify a selection of systems. I am also investigating how compositional verification techniques may help with model checking of large systems.

**SySMA, IMT Lucca**

**Lucca, Italy**

*Grant holder*

*December 2019 – October 2020*

The grant topic was “Verification of Emerging Properties in Collective Adaptive Systems”. I adapted a structural encoding procedure I had been working upon as part of my PhD to multiple verification tools implementing a variety of techniques, including predicate abstraction,  $k$ -induction and property-directed reachability.

**CONVECS, Inria/LIG**

**Grenoble, France**

*Visiting PhD student*

*March – July 2019*

As a visitor at CONVECS I focussed on topics related to my thesis, such as defining a structural encoding of multi-agent systems in the LNT specification language and using it to verify these systems through model checking.

## Teaching

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**Polytech Paris-Saclay**

**Paris, France**

*MSc course in Modelling and Verification*

*April – May 2021*

36-hour course for Master students in Computer Science Engineering, *filière apprentissage*. Held remotely as a supply teacher (*intervenant vacataire*). The course focused on the following topics: modelling of concurrent systems through communicating automata (labelled transition systems); behavioural equivalences; process algebras (CCS, LNT); modal and temporal logics (HML,  $\mu$ -calculus, MCL); model checking; modelling of real-time systems through timed automata; model-based testing. Tools such as CADP and UPPAAL were showcased in lab sessions.

## Other academic activities

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**Reviewing activity**.....

I have served as a reviewer or sub-reviewer for the following conferences and journals:

- International Conference on Autonomous Agents and Multiagent Systems (AAMAS)
- International Symposium on Formal Methods (FM)
- International Conference on Software Technologies (ICSOFT)
- International Conference on Software Engineering and Formal Methods (SEFM)

- Science of Computer Programming, Elsevier
- Theoretical Aspects of Software Engineering Conference (TASE)

## Participation to PhD schools.....

### 1st VMCAI Winter School

**Lisbon, Portugal**

*January 2019*

The school featured lectures on several topics associated with the VMCAI conference series, including: abstract interpretation (Patrick Cousot, New York University); computing with SAT oracles (João Marques-Silva, University of Lisbon); neural network verification (M. Pawan Kumar, University of Oxford); verification of distributed protocols (Ken McMillan, Microsoft Research).

## Invited presentations.....

- *Multi-agent (smart) systems with virtual stigmergies*. Kickoff meeting of Italian national research project (PRIN) *IT MATTERS: Methods and Tools for Trustworthy Smart Systems*. Pisa, Italy, 14 October 2019.
- *Multi-agent systems with virtual stigmergies*. Invited presentation at IMT School for Advanced Studies. Lucca, Italy, 3 July 2018.

## Skills

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**Technical skills:** My experience in programming spans more than a decade. As of now my languages of choice are mainly F# and Python, but I have worked with a number of popular languages across the years (e.g., C, C++, C#, Erlang, Go, Java, Prolog). I have some knowledge of control theory, computer architectures, assembly languages, and hardware description languages (mainly VHDL). I am also familiar with version control systems such as Git and Subversion.

**Language skills:** Italian is my first language. I am fluent in English (CEFR level C1–C2) and have some knowledge of French (CEFR level A2–B1).

**Soft skills:** Having been the main contributor to all my publications so far, I have acquired good academic writing skills, as well as an ability to work in groups, meet deadlines, and present my ideas both to my team mates and to external audiences.

## Publications

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### Journal articles.....

- Luca Di Stefano, Rocco De Nicola, and Omar Inverso. 2021. “Verification of Distributed Systems via Sequential Emulation”. In: *TOSEM*. To appear.
- Rocco De Nicola, Luca Di Stefano, and Omar Inverso. 2020. “Multi-Agent Systems with Virtual Stigmergy”. In: *Sci. Comput. Program.* 187.

Rocco De Nicola, Luca Di Stefano, and Omar Inverso. 2018. "Toward Formal Models and Languages for Verifiable Multi-Robot Systems". In: *Front. Robot. AI* 5.

#### **Peer-reviewed conference and workshop papers.....**

Luca Di Stefano and Frédéric Lang. 2021. "Verifying temporal properties of stigmergic collective systems using CADP". In: *ISoLA*.

Luca Di Stefano, Frédéric Lang, and Wendelin Serwe. 2020. "Combining SLIVER with CADP to Analyze Multi-agent Systems". In: *COORDINATION*.

Rocco De Nicola, Luca Di Stefano, and Omar Inverso. 2018. "Multi-Agent Systems with Virtual Stigmergy". In: *STAF Workshops*.

#### **Citation indices.....**

Accessed on Scopus on January 17, 2022.

**Citations:** 16

**h-index:** 3

#### **Received research grants**

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- "Verification of Emerging Properties in Collective Adaptive Systems". Short-term grant, December 2019 – October 2020, IMT Lucca, Italy (see page 2).

#### **References**

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For references, please contact:

- Rocco De Nicola, Professor of Computer Science, IMT School for Advanced Studies, Lucca, Italy. E-mail: rocco.denicola@imtlucca.it
- Omar Inverso, Assistant Professor, Gran Sasso Science Institute, L'Aquila, Italy. E-mail: omar.inverso@gssi.it
- Frédéric Lang, Research Fellow, Inria and LIG, Montbonnot Saint-Martin, Grenoble, France. E-mail: frederic.lang@inria.fr
- Radu Mateescu, Research Director, Inria and LIG, Montbonnot Saint-Martin, Grenoble, France. E-mail: radu.mateescu@inria.fr

Rocco De Nicola and Omar Inverso supervised my PhD thesis from 2017 to 2020. Frédéric Lang is a permanent member of the CONVECS research team (led by Radu Mateescu), where I worked as a post-doctoral researcher from 2020 to 2022.