YEHIA ABD ALRAHMAN

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Dept. Of Computer Science and Eng., Rännvägen 6B, 412 96 Göteborg, Sweden

EDUCATION

Ph.D., Computer Science, IMT School for Advanced Studies *March 2017*
Thesis: A Foundational Theory for Attribute-based Communication

M.Sc., Computer Science, Philadelphia University *Feb 2013*
Thesis: A Denotational Semantics for the Language Cloud#

B.Sc., Computer Engineering, Philadelphia University *Feb 2009*
Thesis: Design and Implementation of a Real-Time Obstacles Avoidance Mobile Robot

WORK EXPERIENCE

Dept. Of Computer Science and Eng., Formal methods Div. *March 2019 - present*
Postdoctoral Researcher, University of Gothenburg, Gothenburg, Sweden
I continue working on an ERC Consolidator Project (Described next).

Dept. Of Computer Science and Eng., Formal methods Div. *Sept. 2018 - March 2019*
Research Associate, University of Leicester, Leicester, UK
I work on an ERC Consolidator Project, named D-SynMA: Distributed Synthesis from Single to Multiple Agents. We developed a formalism to model and reason about multi-agent systems. We allow agents to interact and communicate in different modes so that they can pursue joint tasks; agents may dynamically synchronize, exchange data, adapt their behaviour, and reconfigure their communication interfaces. The formalism defines a local behaviour based on shared variables and a global one based on message passing. We extended LTL to be able to reason explicitly about the intentions of the different agents and their interaction protocols. Currently, we are exploiting the interaction mechanisms in our formalism to conduct verification analysis compositionally. We want to find a compositional solution to the distributed synthesis problem.

Dept. Of Computer Science and Eng., SysMA research unit *Feb. 2017 - Sept. 2018*
Postdoctoral Researcher, IMT School for Advanced Studies, Lucca, Italy
I worked on a project to ensure safe operation of power distribution grids. The idea is that future power grids will comprise a large number of components, each potentially able to carry out operations autonomously. Clearly, in order to ensure safe operation of the grid, individual operations must be coordinated among the different components. Since operation safety is a global property, modelling component coordination typically involves reasoning about systems at a global level. In this project, we proposed a language for specifying grid operation control protocols from a global point of view. We showed how such global specifications can be used to automatically synthesise local controllers of individual components, and that the distributed implementation yielded by such controllers operationally corresponds to the global specification.

Dept. Of Informatics, LFCS Laboratory *Jan. 2016 - June 2016*
Visiting Researcher, University of Edinburgh, UK
I worked on a language-based approach for Performance Modelling. A stochastic specification language was designed based on the linguistic primitives of the interaction model that I proposed during my PhD. The language supports quantitive analysis of collective-adaptive systems. Interaction operations in this language are associated with execution rates that can be dynamically adjusted according to environmental conditions. A model can then be automatically translated into a CTMC process which can be simulated and thus its dynamics can be studied.

Programming Languages & Verification Group *Sept. 2016 - Dec. 2016*
Research Intern, Max Planck Institute for Software Systems, Germany
I worked on a project about approximate computing. The idea of approximate computing is to deliberately reduce accuracy to save energy, memory and/or time. However, the reduction of accuracy should not alter the behaviour of a program.

SCHOLARSHIPS

- Scholarship from Max Planck Institute for Software Systems for 3-months Internship, Germany, Saarbrucken. 2016
- Scholarship of 50% increase from IMT for 6-months visiting period at the University of Edinburgh, UK. 2016
- Erasmus+ Traineeship scholarship for 6-months visiting period at the University of Edinburgh. UK. 2016
- Ph.D. in Computer Science Scholarship from IMT Institute for Advanced Studies, Italy, Lucca. 2013
- M.Sc. in Computer Science Scholarship from Philadelphia University, Jordan 2010
- B.Sc. in Computer Engineering Scholarship from Philadelphia University, Jordan 2004

PUBLICATIONS

A full list is available at Google Scholar: Link

JOURNAL ARTICLES:

- **Alrahman, Y.A et al**.(2019). A calculus for collective-adaptive systems and its behavioural theory. **Information and Computation Journal** (available at: j.ic.2019.104457)
- **Alrahman, Y.A et al**.(2019). A Coordination Protocol Language for Power Grid Operation Control. **Journal of Logical and Algebraic Methods in Programming** (available at: j.jlamp.2019.100487)
- **Alrahman, Y.A et al**.(2019). A Distributed API for Coordinating AbC Programs. **To appear in the International Journal on Software Tools for Technology Transfer**
- **Alrahman, Y.A et al**.(2019). Programming Interactions in Collective-Adaptive Systems by relying on Attribute-based Communication. **under revision** (arXiv draft available at: 1711.06092)

CONFERENCE ARTICLES:

- **Alrahman, Y.A et al**.(2019). Modelling and Verification of Autonomous and Collaborative Agents. **Submitted** (an early arXiv draft available at: 1906.10793)
- **Alrahman, Y.A et al**.(2019). Testing for Coordination Fidelity. In Boreale M. et al. (eds) Models, Languages, and Tools for Concurrent and Distributed Programming. Lecture Notes in Computer Science, vol 11665. Springer, Cham (pp. 1–20). DOI: 10.1007/978-3-030-21485-2_10
- **Alrahman, Y.A et al**.(2018). A Distributed Communication Infrastructure for Attribute-based Interaction. In C. Baier & L. Caires (Eds.). Formal Techniques for Distributed Objects, Components, and Systems - 38th IFIP WG 6.1 International Conference, FORTE 2018, Madrid, Spain, June 18-21, 2018, Proceedings (pp. 1–20). DOI: 10.1007/978-3-319-92612-4_1
- **Alrahman, Y.A et al**.(2016). On the Power of Attribute-Based Communication. In T. Margaria & B. Steffen (Eds.), Formal Techniques for Distributed Objects, Components, and Systems - 36th IFIP WG 6.1 International Conference, FORTE 2016, Heraklion, Crete, Greece, June 6-9, 2016, Proceedings (pp. 1–18). DOI: 10.1007/978-3-319-39570-8_1
- **Alrahman, Y.A et al**.(2016). Programming of CAS Systems by Relying on Attribute-Based Communication. In T. Margaria & B. Steffen (Eds.), 7th International Symposium, ISoLA 2016 Imperial, Corfu, Greece, October 10–14, 2016 Proceedings, Part I (pp. 539–553). DOI: 10.1007/978-3-319-47166-2_38
- **Alrahman, Y.A et al**.(2015). A Calculus for Attribute-based Communication. SAC '15 Proceedings of the 30th Annual ACM Symposium on Applied Computing (pp. 1840–1845). DOI: 10.1145/2695664.2695668
- **Alrahman, Y.A et al**.(2018). Goat: Attribute-based Interaction in Google Go. ISOLA2018. In T. Margaria & B. Steffen (Eds.), 8th International Symposium, ISoLA 2018, Cyprus, October 2018 (pp. 1–16). DOI: 10.1007/978-3-030-03424-5_19
- **Alrahman, Y.A et al**.(2014). Can We Efficiently Check Concurrent Programs Under Relaxed Memory Models in Maude?. Santiago Escobar (Ed.), 10th International Workshop, WRLA 2014 Held as a Satellite Event of ETAPS Grenoble, France, April, 2014. DOI: 10.1007/978-3-319-12904-4_2

TALKS

- A Calculus for Attribute-based Communication, CINA meeting, Turin, Italy, 2015.
- A Calculus for Attribute-based Communication, SAC'15, Salamanca, Spain, 2015.
- On Expressiveness and Behavioural Theory of Attribute-based Communication, QUANTICOL, Lucca, Italy, 2015.
- On the Expressiveness of Attribute-based Communication, PEPA CLUB, Edinburgh, UK, 2016.
- On the Power of Attribute-based Communication, FORTE'16, Heraklion, Greece, 2016.
- A Distributed Coordination Infrastructure for Attribute-based Communication, QUANTICOL, Pisa, Italy, 2017.
- A Theoretical Framework for Collective-Adaptive Systems, Camerino, Italy, January 2018.
- A Distributed Communication Infrastructure for Attribute-based Interaction, FORTE'18, Madrid, Spain, 2018.
- A Computational Framework for Adaptive Systems and its Verification, Bernoulli Institute, Netherlands, 2019.

PROFESSIONAL ACTIVITIES

- Springer International Journal on Software Tools for Technology Transfer: Reviewer, STTT 2019.
- Elsevier Journal of Logical and Algebraic Methods in Programming: Reviewer, JLAMP 2018.
- ACM Transactions on Modelling and Computer Simulation Journal: Reviewer, Special Issues for FORECAST 2017 and QEST 2018.
- Reviewer: SEFM 2019, SEFM 2018, MFCS17, TTCS 2017, TASE 2017, COORDINATION 2016 and 2017, FACS 2014 and 2017, FoCAS@SASO14, and WRLA 2014: additional reviewer.

CO-SUPERVISION

6/2017-8/2018	Giulio Garbi, P.h.D Student	IMT School for Advanced Studies, Italy

SOFTWARE TOOLS

Open source code from my work on Attribute-based communication can be found on Github:

- $Ab^{a}C$uS: A run-time environment for attribute-based interaction in Java. Link
- *AbC* Simulator: Performance Evaluation of attribute-based communication infrastructures. Link
- $\mathcal{GoAt}$: Attribute-based interaction in Google Go. Link
- The $\mathcal{GoAt}$ plugin: An Eclipse plugin for the *AbC* calculus. Link

TECHNICAL SKILLS

Main expertise:	- Concurrency Theory, Theory of Computation, Verification, Formal Methods. - Formal approaches to design Collective-Adaptive Systems.
Software & Formal Tools:	- Maude: An executable rewriting logic framework - Theorem prover: coq
Programming languages:	- Java, C/C++

SPOKEN LANGUAGES

English (fluent); Italian (basic).