

## GAUDEL, Marie-Claude

### Short CV

Marie-Claude Gaudel was appointed as a professor at the University of Paris-Sud at Orsay in 1984. Before joining UPS, she was a researcher at INRIA from 1973 to 1981, and then in charge of the Software Engineering group at the industrial research centre of Alcatel-Alsthom (Marcoussis, France) from September 1981 to January 84.



Her research interests are in the areas of software: formal methods, program robustness, testing and certification.

Her main achievements are listed below:

- Development of formal specification languages and environments motivated and validated by industrial case studies (telephone, train control, and nuclear plant...), or reference case studies (Unix File Management System, Production Cell, Steam Boiler Control System...)
- Development of a generic theory, and of several tools, for tests selection from formal specifications; application to several formal methods and case studies.
- Automation of statistical and random software testing; assessment of ultra-reliability

### Recent research activities

During the last years, she has been involved in different projects and international collaborations corresponding to three main streams.

- *Testing based on formal specifications embedding both concurrency and complex data structures.* She is strongly involved in a collaboration with the University of York on testing systems specified in the *Circus* language. *Circus* specifications define both data and behavioural aspects of systems using a combination of *Z* and *CSP*. This collaboration has been supported by the Royal Society, the University of Paris-Sud. It has yielded several publications (11, 13, 15, 23, 25)
- *Approximate verification of complex software systems.* The VERAP project was funded by the French National Research Agency. The objective is to develop efficient methods to approximately verify that a transition system satisfies some property (16). By efficient we mean linear or sub-linear. By approximately we mean that the approximation is quantifiable either deterministically or probabilistically, and can be as small as wished depending on the effort devoted to the verification process (26). Verification of probabilistic systems is considered too.
- *Random exploration of complex models with application to model checking and software testing.* The aim of the RASTA project (Random Software Testing and Analysis) is to develop algorithms for random exploration of very large models. These methods are based on uniform drawing of combinatorial structures. Among the results there is **Rukia**, a free library (LGPL license) that generates paths of a fixed size from

a graph described in GraphViz format, and ensures a uniform coverage of paths, and several publications (6, 9, 12, 14, 16) where other coverage criteria are considered.

### **Positions held recently**

Since March 2007, she is an Emeritus Professor at the University of Paris-Sud.

From 2006 to 2013, she was the chair of the “Comité des Programmes” of the Digiteo scientific cluster in the south of Paris (see [www.digiteo.fr/](http://www.digiteo.fr/)). Bringing together the expertise of 1,200 researchers on the « plateau de Saclay », Digiteo launches ambitious collaborative research projects in Science and Technology of Information and Communication.

### **Education and qualifications**

- Maîtrise de Mathématiques et Applications Fondamentales, Université de Nancy, 1968 ;
- DEA de Mathématiques, Université de Nancy, 1969 ;
- Doctorat de troisième cycle en Informatique, Université de Nancy, 1971 ;
- Doctorat d'état, Université de Nancy, 1980.

### **Awards and Prizes**

In 1984, she got an Outstanding Paper Award of the IEEE Chapter of Software Engineering for the work of her group on program robustness in Marcoussis.

She is a Doctor Honoris Causa of EPFL (Ecole Polytechnique Fédérale de Lausanne).

She got the CNRS Silver Medal in 1996 for her work on software testing.

In 2011, she has been awarded *Chevalier de la Légion d'Honneur*.

In July 2013, she was awarded Doctor Honoris Causa of the University of York.

She was awarded “Membre d'Honneur de la Société Informatique de France” in 2013.

Honorary Visiting Professor, the University of York (UK), octobre 2015

### **Some invitations**

In 1996-1997 she was an *invited professor at IME-USP*, Instituto de Matematica e Estatistica, Universidade de Sao Paulo. Since then, she leads various collaborations with this university: direction of a PhD thesis in co-tutelle (defended in November 2011), and currently a *Pesquisador Visitante Especial (PVE)* grant within the *Ciência sem Fronteiras* program.

In 2006-2008 she got a grant from the *Royal Society* for an *International Incoming Short Visits* and then for a *joint international project with The University of York* visiting Prof. Ana Cavalcanti. This was followed in 2010 by a *Distinguishing Visiting Fellowship Award* of the *Royal Academy of Engineering* for a one month visit to York, and in 2012-2013 by a joint grant from the CNRS and the Royal Society.

### **Recent invited lectures**

FM'2005, International Symposium on Formal Methods, plenary keynote talk, Newcastle, July 2005

RESIST Network of Excellence Summer School : Resilience in Computing Systems and Information Infrastructures, Porquerolles, September 2007

Pernambuco School on Software Engineering, Recife, December 2007

ETAPS Workshop on Model Based Testing, invited talk, Budapest, March 2008

TAP, Test and Proof Conference, plenary keynote talk , Zurich, July 2010

ICTSS, International Conference on Testing Software and Systems, plenary keynote talk, Paris, November 2010

Universities of Bremen, Leicester, Newcastle, Swansea, York, USP (ICMC, São Carlos)

### **Editorial Boards and programme committees**

She is on the editorial board of two international scientific journals: *Science of Computer Programming* (Elsevier) and *Formal Aspects of Computing* (Springer); she has been a member of, and chaired, numerous programme committees of important conferences. For instance, in 2008 she was the general chair of QSIC (International Conference on Quality Software) in Oxford and in 2010 the general chair of the 3<sup>rd</sup> IEEE-ICST (International Conference on Software Testing, Verification and Validation) in Paris.

She is co-editor-in-chief of the recently created (12/2015) sub-line on Formal Methods of the Lecture Notes on Computer Science series (Springer-Verlag).

*Some other recent programme committees:*

ICTAC 2010, 7<sup>th</sup> International Colloquium on Theoretical Aspects of Computing, Natal, Brasil

MSR'11, Colloque Francophone sur la Modélisation des Systèmes Réactifs, Lille

QSIC 2011, International Conference on Quality Software, Madrid, 2011

ISSTA'13, ACM International Symposium in Software Testing and Analysis,

MSR'13, Colloque Francophone sur la Modélisation des Systèmes Réactifs

FM'2014, International Symposium on Formal Methods, Singapore

### **Scientific Evaluation Committees**

Reviewer for ERC (European Research Council, starting and advanced grants), ANR (Agence Nationale de la Recherche, France), DFG (Germany), ESF (European Science Foundation), EPSRC, Royal Society, NSERC (Canada), FQRNT (Québec), NWO (Netherlands), NICTA (Australia), etc.

### **Publications**

Go to <https://www.lri.fr/~mcg/mcg.html> to get the main ones.

#### **Some recent ones**

1. — with A. Galves, *Rare Events in Stochastic Dynamical Systems and Failures in Ultra-Reliable Reactive Programs*, IEEE Fault Tolerant Computing Symposium, pp. 324-333, Munich, 1998.
2. — with P. R. James, M. Endler, *Development of an Atomic Broadcast Protocol using LOTOS*, Software Practice and Experience, 29(8), 699-719, 1999.
3. — with P. R. James, *Testing Algebraic Data Types and Processes: a unifying theory*, Formal Aspects of Computing, 10(5-6), 436-451, 1999.
4. — with S. D. Gouraud, A. Denise, B. Marre, *A new Way of Automating Statistical Testing Methods*, 16th IEEE International Conference on Automated Software Engineering, San Diego, pp. 5-12, 2001.
5. — with G. Lestiennes, *Testing Processes from Formal Specifications with Inputs, Outputs and data types*, 13th IEEE Int. Symposium on Software Reliability Engineering, Annapolis, pp. 3-14, 2002.

6. — with A. Denise, S. D. Gouraud, *A Generic Method for Statistical Testing*, 15th IEEE Int. Symposium on Software Reliability Engineering , Saint-Malo, pp. 25-34, 2004.
7. *Toward Undoing in Composite Web Services*, in Architecting Dependable Systems III, Lecture Notes in Computer Science n° 3549, pp 59-68, Springer Verlag, 2005.
8. *Formal Methods and Testing: Hypotheses, and Correctness Approximations*, keynote lecture, Formal Methods Conference, Newcastle, Lecture Notes in Computer Science n° 3582, pp. 2-8, Springer Verlag, 2005.
9. — with A. Denise, S.-D. Gouraud, R. Lassaigne, and S. Peyronnet, *Uniform random sampling of traces in very large models*. In 1st ACM International Workshop on Random Testing (RT), pages 10–19, 2006.
10. — with N. Baskiotis, M. Sebag and S.-D. Gouraud, *A Machine Learning Approach for Statistical Software Testing*, in IJCAI, Proceedings of the 20th International Joint Conference on Artificial Intelligence, pages 2274-227, 2007.
- 11.— with A. Cavalcanti, *Testing for refinement in CSP*. In Formal Methods and Software Engineering, ICFEM 2007, volume 4789 of Lecture Notes in Computer Science, pages 151-170. Springer Verlag, 2007.
- 12.— with A. Denise, S.-D. Gouraud, R. Lassaigne, J. Oudinet and S. Peyronnet, *Coverage-biased random exploration of large models*, invited lecture, ETAPS Workshop on Model Based Testing, Electronic Notes in Theoretical Computer Science, vol. 220, pages 3-14, March 2008
- 13.— with A. Cavalcanti, *A note on traces refinement and the conf relation in the Unifying Theories of Programming*, Unifying Theories of Programming 2008, 8th-10th September, Trinity College Dublin, volume 5713 of Lecture Notes in Computer Science, pages 42-61.
14. — with Alain Denise, Sandrine-Dominique Gouraud, Richard Lassaigne, Johan Oudinet, and Sylvain Peyronnet. *Coverage-biased random exploration of large models and application to testing*, pages 73-93, STTT, International Journal on Software Tools for Technology Transfer, vol. 14, n°1, 2012.
- 15.— with Ana Cavalcanti. *Testing for Refinement in Circus*. 47 pages, Acta Informatica, 48(2):97-147, 2011.
16. — with Johan Oudinet, Alain Denise, Richard Lassaigne, and Sylvain Peyronnet. *Uniform Monte-Carlo model checking*. 14th Conference on Fundamental Approaches to Software Engineering - FASE 2011, volume 6603 of Lecture Notes in Computer Science, pages 127-140.
17. *Checking models, proving programs, and testing systems*, invited conference, *TAP 2011 proceedings*, volume 6706 of *Lecture Notes in Computer Science*, pages 1-13. Springer, 2011.
18. *Counting for random testing*, invited conference, in Testing Software and Systems, proceedings of the 23rd IFIP WG 6.1 International Conference, ICTSS 2011, volume 7019 of *Lecture Notes in Computer Science*, pages 1-8. Springer, 2011.
19. *Le test de logiciel : pourquoi et comment*. Rayonnement du CNRS, pages 33-39, Mars 2012.

- 20.—, with A. Feliachi and B. Wolff., *Isabelle/Circus: A process specification and verification environment*. In *Verified Software: Theorie, Tools, Experiments (VSTTE)*, volume 7152 of *Lecture Notes in Computer Science*, pages 243-260, 2012
21. — with J. Oudinet and A. Denise. *A new dichotomic algorithm for the uniform random generation of words in regular languages*. TCS, Theoretical Computer Science, 502:165-176, 2013.
22. — with A. Feliachi, M. Wenzel and B. Wolff. *The Circus testing theory revisited in Isabelle/HOL*. In 15th International Conference on Formal Engineering Methods, *ICFEM 2013*, volume 8144 of *Lecture Notes in Computer Science*, pages 131-147. Springer, 2013.
23. — with A. Cavalcanti. *Test selection for traces refinement*, Theoretical Computer Science, 563:1-42, 2015.
24. — with A. Cavalcanti. *A note on test selection for conf refinement*. Rapport LRI 1569, Université de Paris-Sud, 2013.
25. — with A. Cavalcanti. *Data flow coverage for Circus-based testing*. In *FASE/ETAPS proceedings*, volume 8411 of *Lecture Notes in Computer Science*, pages 515-429, 2014.
26. — with R. Lassaigne, F. Magniez, M. de Rougemont: *Some approximations in Model Checking and Testing*. CoRR abs/1304.5199 (2013)