

MATHEMATICAL STRUCTURES OF COMPUTATION

LYON 2014

JANUARY 13 - FEBRUARY 14

<http://smc2014.univ-lyon1.fr>

Science Meeting & Scientific Report

CONTENTS

1 Meeting Program	1
2 Scientific Report	2
2.1 Summary	2
2.2 Description of the scientific content of and discussions at the event.	3
2.3 Assessment of the results and impact of the event on the future directions of the field	5
3 Annexes	6
3.1 Programme of the meeting	6
3.1.1 Recent developments in Type Theory	6
3.1.2 Algebra and Computation.	8
3.1.3 Directed Algebraic Topology and Concurrency.	9
3.1.4 Formal Proof, Symbolic Computation and Computer Arithmetic.	10
3.1.5 Concurrency, Logic and Types.	11
3.2 Full list of participants	12

1. MEETING PROGRAM

Proposal Title. Mathematical Structures of Computation.

Application Reference Number. 5177.

Convenor. Mr. MALBOS Philippe (malbos@math.univ-lyon1.fr).

Presentation. The workshop *Directed algebraic topology and concurrency* took place in Lyon last January. It aimed at bringing together researchers interested in applying methods originating in topology in order to solve problems commonly encountered in computer science, particularly, in the study of distributed processes. These themes are precisely in the scope of the ACAT ESF programme, which federates current research in applied algebraic topology, thus motivating our subvention request. In particular, the conference covered the fourth research theme indicated in the ACAT description which is *the theory of concurrent computation and computer networks*.

This workshop is a part of a five weeks thematic session exploring interactions between mathematics and computer science. The whole meeting focused on the notion of computation. On the mathematical side, methods of logic and algebraic topology are used for the formal verification of programs and the theory of programming languages. On the computer science side, techniques, such as rewriting have been used for algebraic decision procedures and computation of homological invariants.

Programme of the five weeks

Week 1: Recent developments in Type Theory, January 13-17.

Week 2: Algebra and Computation, January 20-24.

Week 3: Directed Algebraic Topology and Concurrency, January 27-31.

Week 4: Formal proof, Symbolic computation and Arithmetic of computers, February 3-7.

Week 5: Concurrency, Logic and Types, February 10-14.

Organisers of the five weeks thematic session

- Patrick Baillot, École Normale Supérieure de Lyon,
- Yves Guiraud, Université Paris Diderot,
- Philippe Malbos, Université Claude Bernard Lyon 1.

Organisers of *Directed Algebraic Topology and Concurrency* week

- Lisbeth Fajstrup, Aalborg University,
- Éric Goubault, CEA-LIST et École Polytechnique,
- Samuel Mimram, CEA-LIST et École Polytechnique.

2. SCIENTIFIC REPORT

2.1. SUMMARY

Summary of the five weeks session. The weeks Mathematical Structures of Computation addressed several aspects of the interaction between Mathematics and Computer Science. On the one hand, mathematical methods play a crucial role in several fields of Computer Science, such as the formal verification of programs and the theory of programming languages : logic and proof theory in particular are historical tools in this regard. More recently, others theories such as algebraic topology have gained interesting applications. On the other hand, concepts and techniques coming from Computer Science have notable applications in Mathematics. For instance, rewriting gives algebraic decision procedures and algorithms to compute homological invariants. The central theme of this five-weeks session is the notion of computation. It has been developed under several aspects: algebraic computation, certified numeric computation, execution of concurrent processes, etc.. The following descriptions of the five workshops will illustrate the crossed enrichment between Mathematics and Computer Science around this expanding fields of research.

Summary of the *Directed Algebraic Topology and Concurrency* week. Over the past decades there has been an increasing interest in the potential uses of algebraic topology to study concurrency. This new field at the intersection of topology and computer science originates in a series of works which introduced semantics of concurrent programs based on topological spaces. The points of those spaces represent the states of the programs and the paths, the executions of the program. Since executions of programs always go forward in time, these topological spaces should be equipped with a notion of a direction for paths, which requires an adaptation of the usual tools in algebraic topology to this new setting. Two paths which are homotopic (in a directed sense) correspond to two schedulings of a concurrent program which are equivalent in the sense that they give rise to the same results. Starting from this observation, the study of the space of paths up to homotopy in a directed space provides compact representations of the possible schedulings of concurrent programs, in analogy to the homotopical (or homological) studies of classical topological spaces. This point of view has provided new tools in order to efficiently verify concurrent

programs. Another major application of algebraic topology in the study of concurrent programs can be found in the classification of tasks which can be performed by asynchronous concurrent programs, by modeling coherent states of threads using simplicial complexes and drawing conclusions from the study of their geometrical properties.

2.2. DESCRIPTION OF THE SCIENTIFIC CONTENT OF AND DISCUSSIONS AT THE EVENT.

Recent developments in Type Theory. Organizers: Pierre-Louis Curien, CNRS, Université Paris 7, Hugo Herbelin, INRIA, Université Paris 7.

The meeting on *Recent developments in Type Theory* gathered together about sixty participants, half of them were PhD students or postdoctoral students.

The morning sessions were devoted to lectures. In particular, they focused mainly on two themes:

- on notions of continuation in programming and on their constructive mathematical counterpart. In this direction several research teams are leading in France, specially in Lyon, Paris and Chambéry.
- on homotopical type theory, a new field of research, very attractive, and likely to impact in short terms the development of the interactive theorem prover Coq and more fundamentally algebraic topology and the conception of the foundation of mathematics.

The lecturers proposed exercises in some very interactive sessions with the audience. The afternoon sessions were devoted to research talks on the same themes ; two third of the speakers were young researchers.

The main part of the audience for lectures and research talks came from fundamental computer science, but around twenty people originated in pure mathematics (category theory, homological algebra, topology, mathematical physics).

In conclusion, this meeting was very stimulating for both communities, enjoying the interplay between pure mathematics and computer science, with a crossed enrichment.

Algebra and Computation. Organizers: Stéphane Gaussent, Université de Saint-Étienne, Yves Guiraud, INRIA, Université Paris 7, Philippe Malbos, Université Claude Bernard Lyon 1.

The second week of the Program *Mathematical Structures of Computation* has focused on algebra and its relations to computation. In the two series of lectures Catharina Stroppel and Patrick Dehornoy have respectively explained the Diagram Calculus and the Garside Calculus.

The Diagram Calculus provides bases of algebras that appear in the process of categorification in representation theory. In her four very interesting talks, Catharina Stroppel explained more precisely the calculus of cap and cup diagrams, and how these diagrams are used to describe the interplay between objects in algebraic geometry, topology and representation theory. The Garside Calculus is a framework to achieve computations in left-cancellative categories. It originates in the work of Garside on braid groups. Patrick Dehornoy has made a very comprehensive presentation of the theory, giving a lot of examples and applications.

The program of this week was completed by ten research talks. Four of them were extensions of the lectures series and enlightened the two calculus with more examples of applications. The subjects of the other talks ran from operad theory to Koszul algebras, through rewriting theory.

Among the 50 participants in this conference, the dozen of Ph. D students have particularly appreciated the pace of the lectures and the diversity of approaches to computation in mathematics. We all enjoyed the talks and the discussions during this week!

Directed Algebraic Topology and Concurrency. Organizers: Lisbeth Fajstrup, Aalborg University, Denmark, Éric Goubault, CEA LIST / École Polytechnique, France, Samuel Mimram, CEA LIST / École Polytechnique, France.

The week featured talks and gathered researchers interested in three areas of computer science: concurrency, directed algebraic topology and distributed computing. Even though those research fields are closely related and aim at understanding the same objects (essentially concurrent computations), the techniques developed by the three communities are quite different.

One of the objectives of the week was to bring researchers together in order for each one to understand others' approaches and elaborate link between those. In the morning, two 1h30-long courses were given about those subjects by Rob van Glabbeek (concurrency), Emmanuel Haucourt (directed algebraic topology) and Dmitry Feichtner-Kozlov (distributed computing). These confirmed researchers managed to provide a clear introductory yet detailed view of their field, and it seems that they were quite fruitful, as witnessed by the numerous questions asked during and at the end of the presentations, as well as the discussions they raised during the coffee break.

In the afternoon, more advanced talks were given. They gave rise about interesting connections about higher dimensional automata (discussed in the presentations of van Glabbeek, Fahrenberg, and Kahl), topological models for concurrency (Haucourt, Grandis, Tasson), homological theories and homotopy types for directed spaces (Raussen, Ziemianski, Goubault, Krishnan), etc. Participants were assiduous and concentrated, among which many students who could deepen their knowledge in the topics of the conference.

Formal Proof, Symbolic Computation and Computer Arithmetic. Organizers: Nicolas Brisebarre. (CNRS, LIP, AriC INRIA Grenoble Rhône-Alpes, ÉNS Lyon), Jean-Michel Muller (CNRS, LIP, AriC INRIA Grenoble Rhône-Alpes, ÉNS Lyon).

The workshop *Formal Proof, Symbolic Computation and Computer Arithmetic*, took place in the fourth week of the session at the ISFA building near École Normale Supérieure de Lyon.

Forty-something participants came to listen sixteen research talks and took part of several discussions. One of the objectives of this workshop were to present the last advances on formal proofs related to some problems of

- arithmetics of computers,
- formal calculus.

This was a success, the best specialist of the field explained the state of the art, in particular, the recent advances in mathematical analysis, scientific computation and on the proof of combinatorial identity with applications in Diophantine approximations.

An other aim of this workshop was to present recent works on formal calculus, arithmetics of computers and dynamical systems, which are in the process of formalisation.

Concurrency, Logic and Types. Organizers: Patrick Baillot (LIP, ENS Lyon & CNRS), Damien Pous (LIP, ENS Lyon & CNRS), Daniel Hirschhoff (LIP, ENS Lyon).

The workshop *Concurrency, Logic and Types* has spanned over five days, with the following organization:

- monday and tuesday have been essentially devoted to concurrent systems, as well as to the use of notions coming from concurrency but which find applications also in sequential systems, like bisimulations.

- wednesday has been devoted to topics at the intersection between logic and concurrency, in particular session types, which are a language aiming at structuring interaction in distributed architectures.
- thursday talks have mainly dealt with the topic of verification and languages for computation over semi-structured data; and friday has been devoted to logic and programming languages.

This meeting has allowed to bring together several research communities, which was indeed one of its goals: one the one hand researchers working on process calculi or on session types, and on the other hand people working on the application of logic to programming languages. It has triggered very fruitful discussions.

2.3. ASSESSMENT OF THE RESULTS AND IMPACT OF THE EVENT ON THE FUTURE DIRECTIONS OF THE FIELD

Above all, the goal of the five weeks of the thematic session *Mathematical Structures of Computation* in Lyon was to create a high meeting point for young and confirmed researchers working in fields at the interaction between Mathematics and Computer Sciences. Around 180 participants for the five weeks have achieved this aim and turned the meeting to a success.

We are particularly proud of the

- diffusion with high quality lectures in the different weeks, and an important participation of PhD students and young researchers,
- numerous discussions that popped up at the interplay of the different fields.

Let us mention a few examples of topics which have been discussed from different viewpoints during the thematic session and, we hope, which will have a real impact in the development of the research in these areas.

Week *Recent developments in Type Theory*:

- Through the talks and lectures of Danko Ilik, Nicolas Gambino, Dan Licata and Peter Lumsdaine, and the discussions with specialists of the interactive theorem prover Coq, the homotopical type theory appears as a new field with a great impact in the development of Coq.
- This week was the first part of a French Semester on certified mathematics, programming languages and the mathematical structures of computation, together with the trimester *Semantics of proofs and certified mathematics* organized at the Institut Henri Poincaré, Paris.

Week *Algebra and Computation* has promoted the development of computational methods in algebra and the algebraic formalisation of computation specially in

- Garside calculus and the study of Artin groups,
- some applications of diagram algebras in representation theory,
- rewriting methods in algebra.

Week *Directed Algebraic Topology and Concurrency* has presented and discussed the latest developments resulting from the interaction between algebraic topology and concurrency theory, in particular on

- comparison of the various models for directed algebraic topological spaces,

- mathematical tools in order to study models for directed algebraic topological spaces, such as fundamental category, category of components, homology, etc.
- applications of topology to concurrency: efficient verification of concurrent programs, computability of tasks by asynchronous protocols, etc..

During the week *Formal Proof, Symbolic Computation and Computer Arithmetic* there were discussions, in particular, on

- recent advances in mathematical analysis, scientific computation and on the proof of combinatorial identity, formal calculus, arithmetics of computers and dynamical systems.

On this aspect, the week was a great success, indeed numerous contact between participants were taken by the end of the several discussion sessions.

Week *Concurrency, Logic and Types*:

- session types have given rise to discussions between, on the one hand, people working on programming languages (Scribble: Yoshida and Demangeon), and on the other hand, people working on their logical foundations using linear logic (Pfenning and Guenot);
- various issues of program equivalence by means of bisimulations have been addressed: their use in process calculi, then in sequential languages with control (Lenglet), and finally from the point of view of automation of bisimulation proofs using theorem provers (Abella, Chaudhuri);
- the difficult issue of program equivalence for probabilistic systems has also been a recurrent theme, and for instance the notions discussed in the talk of Gebler have suggested interesting connections in the talk of Barthe about verification of cryptographic functions.

In conclusion the Mathematical Structures of Computation session has fostered interaction and discussion on active research directions between researchers who don't always meet at proper conferences but had a lot to exchange thanks to the complementary viewpoints of their approaches.

3. ANNEXES

3.1. PROGRAMME OF THE MEETING

1.1. Recent developments in Type Theory From January 13 to January 17 at the Université Lyon 1. Amphitheatre of the Polytech'Lyon building.

LECTURES

Prelude to Continuations, Olivier Danvy, University of Aarhus, Denmark, Chung-Chieh Shan, Indiana University, USA.

Proving with side effects: a few examples, Hugo Herbelin, INRIA, Université Paris 7, Danko Ilik, INRIA.

Homotopy Type Theory and Univalent Foundations, Nicola Gambino, University of Leeds, United Kingdom, Dan Licata, Wesleyan University, USA, Peter Lumsdaine, Dalhousie University, Canada.

INVITED SPEAKERS

Thorsten Altenkirch, University of Nottingham, United Kingdom.
Federico Aschieri, ÉNS Lyon, France. Slides
Guillaume Brunerie, ÉNS Paris, France.
Eric Finster, PPS lab, France
Richard Garner, Macquarie University, Australia.
Alexander Kreuzer, ÉNS Lyon, France. Slides
Paul-André Melliès, PPS lab, France.
Alexandre Miquel, Universidad de la República, Montevideo, Uruguay. Slides
Nicolas Tabareau, INRIA, Nantes, France.

SCHEDULE

Monday 13

10h Opening

10h25 - 11h25 Danvy-Shan Identifying control

11h45 - 12h45 Gambino-Licata-Lumsdaine Review of type theory, main metamathematical properties

14h30 - 15h30 Alexander Kreuzer Program extraction and higher order reverse mathematics

15h45 - 16h45 Federico Aschieri Realizability and learning in classical Arithmetic

17h15 - 18h15 Eric Finster Opetopic Diagrams as a Language for Higher Categorical Proofs

Tuesday 14

9h - 10h Danvy-Shan Representing control

10h25 - 11h25 Herbelin-Ilik

11h45 - 12h45 Gambino-Licata-Lumsdaine The homotopy-theoretic model of type theory

14h30 - 15h30 Alexandre Miquel Implicative algebras for noncommutative forcing (or: doing realizability without realizers)

16h - 17h Paul-André Melliès An environment-friendly tensorial logic

Wednesday 15

9h - 10h Danvy-Shan Exercising control

10h25 - 11h25 Herbelin-Ilik

11h45 - 12h45 Gambino-Licata-Lumsdaine The Univalence Axiom

Thursday 16

9h - 10h Danvy-Shan Delimiting control

10h25 - 11h25 Herbelin-Ilik

11h45 - 12h45 Gambino-Licata-Lumsdaine The computational interpretation of the Univalence Axiom

14h30 - 15h30 Thorsten Altenkirch Containers in Homotopy Type Theory

16h - 17h Nicolas Tabareau The sheaf construction in Homotopy Type Theory

Friday 17

9h - 10h Herbelin-Ilik

10h25 - 11h25 Gambino-Licata-Lumsdaine Higher inductive types and examples of homotopy theory in type theory

11h45 - 12h45 Gambino-Licata-Lumsdaine Agda/Coq formalizations

14h30 - 15h30 Guillaume Brunerie Cubical homotopy type theory

16h - 17h Richard Garner Further thoughts on coherence issues in dependent type theory

1.2. Algebra and Computation. From January 20 to January 24 at the Université Lyon 1. Amphitheatre Depéret of the Darwin building.

LECTURES

Patrick Dehornoy, Université de Caen, France.
Catharina Stroppel, Universität Bonn, Germany.

INVITED SPEAKERS

Roland Berger, Université de Saint-Étienne, France.
Pierre-Louis Curien, CNRS, Université Paris 7, France.
Vladimir Dotsenko, Trinity College Dublin, Ireland.
Michael Ehrig, Universität Köln, Germany.
Eric Hoffbeck, Université Paris 13, France.
Bérénice Oger, Université Lyon 1, France.
Luis Paris, Université de Bourgogne, France.
Anne-Laure Thiel, Uppsala Universitet, Sweden.
Vladimir Verchinine, Université Montpellier 2, France.
Alexis Virelizier, Université Lille 1, France.

SCHEDULE

Monday 20

10h30 Opening
11h - 12h30 Patrick Dehornoy Garside calculus I
14h30 - 15h30 Luis Paris Different aspects of the Salvetti complex
15h45 - 16h45 Eric Hoffbeck Leibniz homology as functor homology
17h15 - 18h15 Pierre-Louis Curien A language for the wirings of operads, cooperads and dioperads

Tuesday 21

9h15 - 10h45 Catharina Stroppel Diagram calculus I
11h15 - 12h45 Patrick Dehornoy Garside calculus II
14h30 - 15h30 Bérénice Oger From the cohomology of the motion group of the trivial link to the homology of the hypertree poset
15h45 - 16h45 Anne-Laure Thiel Diagrammatic categorification
17h15 - 18h15 Vladimir Verchinine Two generalizations of braids: inverse braid monoid and virtual braids

Wednesday 22

9h15 - 10h45 Patrick Dehornoy Garside calculus III
11h15 - 12h45 Catharina Stroppel Diagram calculus II

Thursday 23

9h15 - 10h45 Catharina Stroppel Diagram calculus III
11h15 - 12h45 Patrick Dehornoy Garside calculus IV
14h30 - 15h30 Michael Ehrig Graded Brauer algebras and categorification
15h45 - 16h45 Alexis Virelizier 3-dimensional HQFTs
17h15 - 18h15 Roland Berger Confluence: an approach adapted to Koszul algebras

Friday 24

9h - 10h30 Catharina Stroppel Diagram calculus IV
11h - 12h Vladimir Dotsenko Commutative and noncommutative shuffle algebras

1.3. Directed Algebraic Topology and Concurrency. From January 27 to January 31 at the Université Lyon 1, room Fokko du Cloux of the Braconnier building.

LECTURE SERIES

Dmitry Feichtner-Kozlov, Bremen University, Germany.

Simplicial methods in theoretical distributed computing

Emmanuel Haucourt, CEA LIST / École Polytechnique, France.

Introduction to Directed Algebraic Topology with a view towards modelling Concurrency Rob van Glabbeek, University of New South Wales, Australia.

Higher Dimensional Automata and Other Models of Concurrency

INVITED SPEAKERS

Uli Fahrenberg, IRISA, France History-Preserving Bisimilarity for Higher-Dimensional Automata via Open Maps

Lisbeth Fajstrup, Aalborg University, Denmark. Cut-Off-theorems from a geometric viewpoint

Éric Goubault, CEA LIST / École Polytechnique, France. The Geometry of Mutual Exclusion

Marco Grandis, DIMA, Italy A categorical approach to directed algebraic topology

Sanjeevi Krishnan, University of Pennsylvania, USA Directed Poincare Duality

Martin Raussen, Aalborg University, Denmark Combinatorial and topological models for spaces of schedules

Christine Tasson, Université Paris Diderot Paris 7, France. A Geometrical Interpretation of Asynchronous Computability

Krzysztof Ziemiański, Warsaw University, Poland Computing trace spaces of PV-programs

CONTRIBUTED TALKS

Thomas Kahl, Universidade do Minho, Portugal. On topological abstraction of higher dimensional automata

SCHEDULE

Monday 27

10h30 Opening

11h00 - 12h30 Rob van Glabbeek Higher Dimensional Automata and Other Models of Concurrency

14h00 - 15h30 Emmanuel Haucourt Introduction to Directed Algebraic Topology with a view towards modelling Concurrency

16h00 - 17h00 Lisbeth Fajstrup Cut-Off-theorems from a geometric viewpoint

Tuesday 28

9h45 - 11h15 Rob van Glabbeek Higher Dimensional Automata and Other Models of Concurrency

11h45 - 12h45 Éric Goubault The Geometry of Mutual Exclusion

14h30 - 15h30 Uli Fahrenberg History-Preserving Bisimilarity for Higher-Dimensional Automata via Open Maps

15h45 - 16h45 Martin Raussen Combinatorial and topological models for spaces of schedules

17h15 - 18h15 Krzysztof Ziemiański Computing trace spaces of PV-programs

Wednesday 29

9h15 - 10h45 Emmanuel Haucourt Introduction to Directed Algebraic Topology with a view towards modelling Concurrency

11h15 - 12h45 Dmitry Feichtner-Kozlov Simplicial methods in theoretical distributed computing

Thursday 30

9h15 - 10h45 Rob van Glabbeek Higher Dimensional Automata and Other Models of Concurrency

11h15 - 12h45 Dmitry Feichtner-Kozlov Simplicial methods in theoretical distributed computing

14h30 - 15h30 Marco Grandis A categorical approach to directed algebraic topology

16h00 - 17h00 Christine Tasson A Geometrical Interpretation of Asynchronous Computability

17h15 - 17h45 Thomas Kahl On topological abstraction of higher dimensional automata

17h45 - 18h30 students session

Friday 31

9h15 - 10h45 Dmitry Feichtner-Kozlov Simplicial methods in theoretical distributed computing

11h15 - 12h45 Emmanuel Haucourt Introduction to Directed Algebraic Topology with a view towards modelling Concurrency

14h30 - 15h30 Sanjeevi Krishnan Directed Poincare Duality

1.4. Formal Proof, Symbolic Computation and Computer Arithmetic. From February 3 to February 7, I.S.F.A..

INVITED SPEAKERS

Yves Bertot, Inria Sophia-Antipolis - Méditerranée, France

Sylvie Boldo, Inria Saclay - Île-de-France, France

Jean-Christophe Filliâtre, CNRS-LRI, Orsay, France

John Harrison, Intel Corporation, USA

Assia Mahboubi, Inria Saclay - Île-de-France, France

Micaela Mayero, Université Paris Nord, France

Guillaume Melquiond, Inria Saclay - Île-de-France, France

Laurence Rideau, Inria Sophia-Antipolis - Méditerranée, France

Laurent Théry, Inria Sophia-Antipolis - Méditerranée, France

Warwick Tucker, Uppsala University, Sweden

SCHEDULE

Monday 3

9:30 Welcome - coffee - presentation of the conference

10:30 John Harrison 1 An overview of automated reasoning

14:00 Jean-Christophe Filliâtre Deductive Program Verification with Why3

15:00 Assia Mahboubi A computer-aided formal proof of the irrationality of zeta(3)

16:30 Cyril Cohen CoqEAL - The Coq Effective Algebra Library

Tuesday 4

9:00 Laurent Théry Verifying hardest-to-round computation

10:30 Sylvie Boldo Formal Verification of Floating-Point Algorithms and Programs

15:00 John Harrison 2 Applications of automated reasoning

16:30 Catherine Lelay More than real analysis in Coq

Wednesday 5

9:00 Warwick Tucker 1 Relative equilibria for the n-body problem

10:30 Micaela Mayero Formal Verification of Scientific Computing Programs

Thursday 6

9:00 Warwick Tucker 2 Fixed points of a destabilized Kuramoto-Sivashinsky equation

10:30 Guillaume Melquiond Automations for verifying floating-point algorithms

15:00 Frédéric Chyzak DDMF: A Generated, Online Dictionary of Special Functions

16:15 Mioara Jolde? Searching for sinks of Henon map using a multiple-precision GPU arithmetic library

Friday 7

9:00 Yves Bertot PI, Arithmetic geometric means, and formal verification in Coq using Coquelicot

10:30 Marc Mezzarobba Numerical Evaluation of $Ai(x)$ with Reduced Cancellation

11:30 Closing remarks

1.5. Concurrency, Logic and Types. From February 10 to February 14, I.S.F.A..

INVITED SPEAKERS

Ugo Dal Lago, University of Bologna, Italy.

Yuxin Deng, Shanghai Jiaotong University, China.

Dan Ghica, University of Birmingham, UK.

Martin Hofmann, LMU Munich, Germany.

Bas Luttik, Technical University Eindhoven, The Netherlands.

Luke Ong, Oxford University, UK.

Frank Pfenning, Carnegie Mellon University, USA.

Jan Rutten, CWI Amsterdam, The Netherlands.

Davide Sangiorgi, University of Bologna, Italy.

Rob van Glabbeek, University of New South Wales, Australia.

Nobuko Yoshida, Imperial College London, Uk.

SCHEDULE

Monday 10

9:00-9:15 Welcome

9:15-10:15 Bas Luttik Unique Parallel Decomposition

10:30-11:30 Davide Sangiorgi / Valeria Vignudelli On the Discriminating Power of Higher-Order Languages

13:30-14:30 Yuxin Deng Open bisimulation for quantum processes

14:30-15:15 Daniel Gebler Compositional specification and metric reasoning on probabilistic nondeterministic systems

15:45-16:30 Frank Valencia Epistemic Logic for Concurrency

Tuesday 11

10:30-11:30 Rob Van Glabbeek Modelling temporal properties of wireless mesh networks

13:30-14:15 Dale Miller/Kaustuv Chaudhuri Formalization of the Bisimulation-Up-To Technique and its Meta Theory

14:15-15:00 Sergueï Lenglet Bisimulations for delimited-control operators

15:30-16:15 Nicolas Guénot Linear Session Types for Solos

16:30-17:15 Pawel Sobocinski Petri nets and compositionality

Wednesday 12

9:00-10:00 Nobuko Yoshida Scribble, Runtime Verification and Multiparty Session Types

10:30-11:30 Frank Pfenning Concurrent Programming in Linear Type Theory

13:30-14:15 Romain Demangeon Scribble expressiveness: nesting and interrupt

14:15-15:00 Jorge Perez Logic-Based Domain-Aware Session Types
15:30-16:15 Romain Pechoux Tiering and non-interference for complexity analysis of imperative and OO programs
16:15-17:00 Giovanni Bernardi Using higher-order contracts to model session types

Thursday 13

10:00-11:00 Luke Ong Functions, Concurrency and Automatic Verification
11:30-12:30 Gilles Barthe Verified implementations of cryptographic standards
14:00-15:00 Giuseppe Castagna Polymorphic Functions with Set-Theoretic Types

Friday 14

9:00-10:00 Martin Hofmann Buchi Types for Infinite Traces and Liveness
10:30-11:30 Ugo Dal Lago The Geometry of Synchronization
13:30-14:15 Marco Gaboardi A Core Quantitative Coeffect Calculus
14:15-15:00 Damiano Mazza Linear approximations and Boolean circuits
15:30-16:15 Pierre Lescanne Coinduction, Equilibrium and Rationality of Escalation

3.2. FULL LIST OF PARTICIPANTS

Affeldt Reynald National Institute of Advanced Industrial Science and Technology

Ahrens Benedikt IRIT, Université Paul Sabatier, Toulouse
Ajbal Oussama Université de Caen Basse Normandie
Alberti Michele IML - Université d'Aix-Marseille
Allais Guillaume University of Strathclyde / ENS Lyon
Altenkirch Thorsten University of Nottingham
Arcis Diego IMB - Université de Bourgogne
Aschieri Federico ENS de Lyon
Aubert Clément Institut de Mathématiques de Luminy
Baillot Patrick CNRS & ENS Lyon
Barhoumi Sami Taibahu University
Barthe Gilles IMDEA
Beffara Emmanuel IML, Université d'Aix-Marseille
Berger Roland University of Saint-Etienne
Bernardi Giovanni Trinity College Dublin
Bertot Yves Inria
Biagioli Riccardo ICJ - Université Lyon
Blot Valentin ENS de Lyon
Boldo Sylvie Inria
Bonchi Filippo ENS-Lyon (CNRS)
Bordg Anthony Nice, LJAD
Brede Nuria University of Potsdam
Brisebarre Nicolas CNRS, LIP, ENS Lyon
Brunerie Guillaume Université de Nice Sophia Antipolis
Brunet Paul Université de Lyon
Chaudhuri Kaustuv Inria
Chavli Eirini Institut Mathématique de Jussieu - Paris 7
Chenavier Cyrille Université Paris Diderot
Chung-chieh Shan Indiana University
Chyzak Frédéric INRIA
Cisneros de la Cruz Bruno Aaron Université de Bourgogne

Clairambault Pierre ENS Lyon
Clerc Florence CEA & PPS
Cohen Cyril University of Gothenburg
Cristescu Ioana Universite Paris 7
Crubillé Raphaëlle ENS Lyon
Curien Pierre-Louis CNRS, Université Paris 7
Dagand Pierre-Evariste INRIA
Dal Lago Ugo Università di Bologna (Italie)
Danvy Olivier University of Aarhus
De Benedetti Erika ENS de Lyon
Dehornoy Patrick Universite de Caen
Demangeon Romain Université Pierre et Marie Curie, Paris 6
Deng Yuxin Shanghai Jiaotong University
Díaz-Caro Alejandro U Paris X & INRIA Paris-Rocquencourt
Dotsenko Vladimir Trinity College Dublin
Dubut Jérémy Ens Cachan
Duchesne Etienne University of Bath
Ehrig Michael University of Cologne
Fahrenberg Uli Inria / IRISA Rennes
Fajstrup Lisbeth Aalborg University
Feichtner-Kozlov Dmitry Bremen University
Filliatre Jean-Christophe CNRS
Finstér Eric PPS, Université Paris 7
Flori Cecilia Perimeter Institute
Franco Juliana LaSIGE, University of Lisbon, Faculty of Sciences
Fritz Tobias Perimeter Institute for Theoretical Physics
Fu Yuxi BASICS, Jiao Tong University, Shanghai
Gaboardi Marco University of Dundee
Gambino Nicola University of Leeds
Garner Richard Macquarie University
Gaussent Stéphane ICJ
Gebler Daniel VU University Amsterdam
Geneste Olivier Université de Bourgogne
Ghica Dan Univ. of Birmingham (UK)
Given-Wilson Thomas INRIA
Goubault Éric CEA List, École Polytechnique
Graillat Stef LIP - ENS Lyon
Grandis Marco Dipartimento di Matematica, Genova
Grégoire Thomas ENSL
Guenot Nicolas IT University of Copenhagen
Guiraud Yves INRIA - Université Paris 7
Hage Nohra Institut Camille Jordan
Hanrot Guillaume ENS Lyon
Harmer Russ CNRS
Harrison John Intel Corporation
Haucourt Emmanuel CEA LIST
Herbelin Hugo INRIA - PPS
Hirai Yoichi National Institute for Advanced Industrial Science and Technology, Japan

Hirschhoff Daniel ENS Lyon
Hirschowitz Tom CNRS
Hoffbeck Eric Université Paris 13
Hofmann Martin LMU Munich
Ilik Danko INRIA
Iohara Kenji ICJ
Joldes Mioara LAAS-CNRS
Kahl Thomas Universidade do Minho
Kravchenko Olga ICJ, Université Lyon 1
Kreuzer Alexander P. ENS Lyon
Krishnan Sanjeevi University of Pennsylvania
Lafont Yves Institut de Mathématiques de Marseille
Lasson Marc Université Paris 7
Laurent Olivier CNRS
Lefèvre Vincent INRIA / LIP
Lelay Catherine Inria
Lenglet Serguei Université de Lorraine
Li Guoqiang BASICS, Jiao Tong University, Shanghai
Licata Dan Wesleyan University
Litak Tadeusz FAU Erlangen-Nürnberg
Lucas Maxime PPS
Lumsdaine Peter Institute for Advanced Study
Luttik Bas Tech. Univ. Eindhoven (Netherlands)
Madiot Jean-Marie ENS Lyon
Magron Victor LAAS
Mahboubi Assia Inria
Malbos Philippe Institut Camille Jordan, Université Claude Bernard Lyon 1
Mamouni My Ismail CRMEF Rabat, Morocco
Marques Fabio UFSC
Maulat Sébastien ENS de Lyon
Mayero Micaela LIPN - Université Paris 13
Mazza Damiano CNRS, Université Paris 13 - Sorbonne Paris Cité
Melliès Paul-André CNRS, Université Paris 7
Melquiond Guillaume Inria
Ménissier-Morain Valérie UPMC
Mezzarobba Marc CNRS, UPMC (LIP6)
Millès Joan Université de Toulouse
Mimram Samuel CEA LIST / École Polytechnique
Miquel Alexandre Universidad de la República, Montevideo
Moal Hervé ASTRANCE
Morales Karolina Universidad de Los Andes
Morehouse Edward Carnegie Mellon University
Mörtberg Anders University of Gothenburg
Muller Jean-Michel CNRS, Laboratoire LIP
Murawska Agata IT University of Copenhagen
Nadeau Philippe CNRS & ICJ, Université Lyon 1
Neiger Vincent INRIA - ENS de Lyon
Ninin Nicolas CEA - Université Paris Sud

North Paige University of Cambridge
Obradovic Jovana Faculty of Technical Sciences, University of Novi Sad, Serbia
Oger Bérénice Institut Camille Jordan
Ong Luke Oxford University
Paris Luis Université de Bourgogne
Péchoux Romain Université de Lorraine
Perez Jorge A. FCT Universidade NOVA de Lisboa
Perrinel Matthieu ENS Lyon
Pfenning Frank Carnegie Mellon University (USA)
Plet Antoine ENS de Lyon
Pous Damien CNRS
Prisacariu Cristian University of Oslo
Radenovic Jovana Faculty of Technical Sciences
Rasouli Majid Sharif University of Technology
Raussen Martin Dept Mathematical Sciences, Aalborg Univ.
Reusche Daniel TU Berlin
Richter Tim University of Potsdam
Rideau Laurence Inria
Rieg Lionel ENSIIE
Rutten Jan CWI (Amsterdam, The Netherlands)
Salamanca Valencia Edward Julian Sergio Arboleda University
Salvy Bruno Inria
Sangiorgi Davide Università di Bologna (Italy)
Sibut-Pinote Thomas ENS Lyon
Sironi Eugenia IML
Sobocinski Pawel University of Southampton
Sozeau Matthieu INRIA Paris
Stancu Radu Université de Picardie
Stroppel Catharina Universität Bonn
Tabareau Nicolas Inria
Tasson Christine PPS
Théry Laurent INRIA Sophia-Antipolis - Méditerranée
Thiel Anne-Laure Uppsala Universitet
Tucker Warwick Dept. of mathematics, Uppsala University
Turgay Neset Deniz
van Glabbeek Rob NICTA
Verchinine Vladimir Université Montpellier 2
Vignudelli Valeria University of Bologna - Inria
Villard Gilles CNRS, LIP
Virelizier Alexis Université Lille 1
von Glehn Tamara University of Cambridge
Williams David VU University Amsterdam
Xu Xian East China University of Science and Technology, Shanghai
Yang Xuan
Yoshida Nobuko Imperial College London
Zanasi Fabio ENS Lyon
Zeilberger Noam MSR-INRIA
Ziemianski Krzysztof University of Warsaw