Book of Abstracts

FICS 2026

Fixed Points in Computer Science

Paris, France

23-24/02/2026

https://fics2026.github.io/#news

Contents

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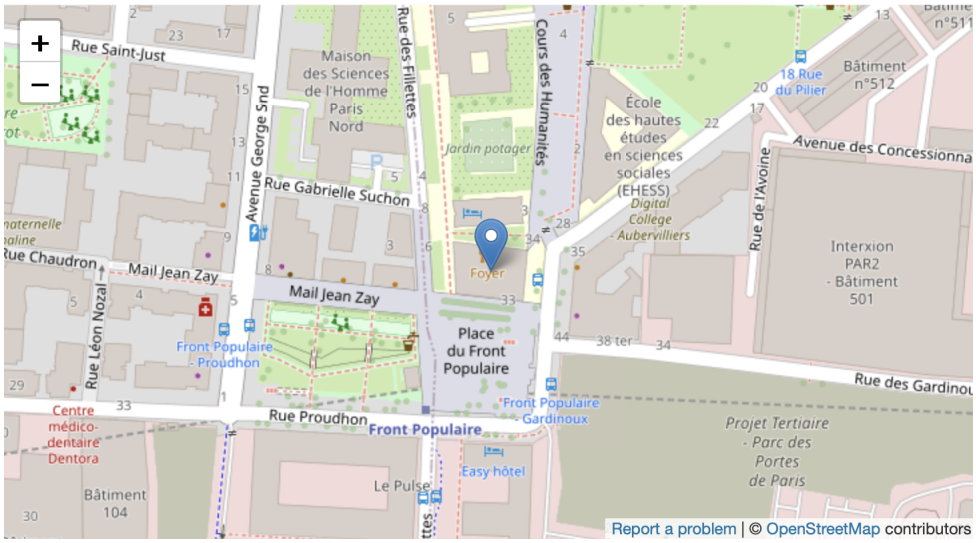
Program

Venue

FICS 2026 takes place at the Campus Condorcet Conference Center, Place du Front Populaire 93322 Aubervilliers, France. See the CSL website page https://csl2026.github.io/#venue.



Monday, February 23rd

Session 1: Cyclic and Non-Wellfounded Proof Theory

08:50 - 09:00 **Workshop Opening**

09:00 - 09:30 **Contributed Talk**

Towards Proof-relevant interpolation for circular proofs

Daniel Osorio-Valencia and Alexis Saurin

09:30 - 10:00 **Contributed Talk**

Unravelling cyclic proofs into proofs by well-founded induction

Lide Grotenhuis and Daniël Otten

10:00 - 10:30 **Contributed Talk**

Compression for Coinductive Infinitary Rewriting: A Generic Approach, with Applications to Cut-Elimination for Non-Wellfounded Proofs

Rémy Cerda and Alexis Saurin

10:30 - 11:00 **Coffee Break**

Session 2: Computation

11:00 - 11:30 **Contributed Talk**

Semantics for Datalog with Subsumption

Luka Janjić and Michael D. Adams

11:30 - 12:00 **Contributed Talk**

Global flattening of nested inductive definitions

Paul Blain Levy

12:00 - 12:30 **Contributed Talk**

On the power of additive branching in affine higher-order recursion schemes

Lê Thành Dũng Nguyên

12:30 - 14:00 **Lunch**

Session 3: Invited Talk and Soapbox Session

14:00 - 15:00 **Invited Talk**

Coalgebra Automata over Thin Structures

Clemens Kupke

15:00 - 16:00 **Soapbox Session** :

mail the organisers - gianluca.curzi@gu.se and f.bruse@tum.de to get 5-10 minutes (depending in interest) to present work in progress, brief announcements, etc.

16:00-16:30 **Coffee Break**

Business Meeting & Welcome Reception

16:30 - 17:30 **Business Meeting**

General Assembly of Workshop Participants

17:30 - 19:30 **CSL Welcome Reception**

Tuesday, February 24th

Session 4: Invited Talk

09:00 - 10:00 **Invited Talk** (joint with CSL)

TBA

Pierre Clairambault

10:00 - 10:30 **Coffee Break**

Session 5: Games and Complexity

10:30 - 11:00 **Contributed Talk**

A Dichotomy Theorem for Ordinal Ranks in MSO

Damian Niwinski, Paweł Parys and Michał Skrzypczak

11:00 - 11:30 **Contributed Talk**

The Negotiation Function: Subgame-perfect Equilibria in Graph Games as Fixed Points

Léonard Brice, Jean-Francois Raskin and Marie Van Den Bogaard

11:30 - 12:00 **Contributed Talk**

Different Proof of the Time Hierarchy Theorem

Michael Wehar and András Z. Salamon

12:00 - 12:10 **Workshop Conclusion**

12:30 - 14:00 **Lunch**

Abstracts

Towards Proof-relevant interpolation for circular proofs

Daniel Osorio-Valencia[1] and Alexis Saurin[2]

[1]University of Turin [2]IRIF-CNRS

Saurin recently proposed a proof-relevant generalization of Craig-Lyndon interpolation theorem obtained by refining Maehara's lemma. In the present ongoing work, we extend this approach to linear logic extended with least and greatest fixed points and circular proofs. While Maehara lemma's (and its proof relevant version) strongly relies on the tree and inductive structure of sequent proofs, we present the current status of our investigation on how to relax this assumption for circular proofs, under the assumption of strong validity.

Keywords: interpolation theorem, linear logic, mu-calculus, cut-elimination, circular proofs.

Unravelling cyclic proofs into proofs by well-founded induction

Lide Grotenhuis[1] and Daniël Otten[1]

[1]University of Amsterdam

Cyclic proof theory allows certain infinite proofs: those that can be represented as a finite cyclic graph satisfying a global soundness condition. We consider an abstract cyclic proof system, extend it with a first-order notion of well-founded induction, and show how to transform a cyclic proof into a traditional finite proof in this extended system.

Our approach leverages a specific graph representation, derived from reset proofs, to extract induction hypotheses, and determine their introduction order. This allows us to replace each cycle with an appropriate application of the induction rule. We build on work by Leigh and Wehr, who give a similar translation for arithmetic, and make their translation applicable in a general setting. This requires a more delicate selection of induction hypotheses since we cannot assume that the underlying sort is linearly ordered.

This generalization is motivated by type theory, where the size-change termination principle induces cyclic proof structures through the Curry-Howard correspondence.

Keywords: cyclic proof, well-founded induction, reset proof, Safra's determinization construction, size-change termination, type theory, Curry-Howard correspondence.

Compression for Coinductive Infinitary Rewriting: A Generic Approach, with Applications to Cut-Elimination for Non-Wellfounded Proofs

Rémy Cerda[1] and Alexis Saurin[2]

[1,2]Université Paris Cité, CNRS-IRIF [1]University of Bologna

Infinitary rewriting, i.e. rewriting featuring possibly infinite terms and sequences of reduction, is a convenient framework for describing the dynamics of non-terminating but productive rewriting systems. In its original definition based on metric convergence of ordinal-indexed sequences of rewriting steps, a highly desirable property of an infinitary rewriting system is Compression, i.e. the fact that rewriting sequences of arbitrary ordinal length can always be 'compressed' to equivalent sequences of length at most ω. Since then, the standard examples of infinitary rewriting systems have been given another equivalent presentation based on coinduction. In this work, we extend this presentation to the rewriting of arbitrary non-wellfounded derivations and we investigate compression in this setting. We design a generic proof of compression, relying on a characterisation factorising most of the proof and identifying the key property a compressible infinitary rewriting system should enjoy. Typical examples are first-order rewriting and infinitary λ-calculi, but in this abstract we focus on compression of cut-elimination sequences in the non-wellfounded proof system $\mu\mathsf{MALL}^{\infty}$ for multiplicative-additive linear logics with fixed points, which is a key lemma of several cut-elimination results for similar proof systems.

Keywords: abstract rewriting systems, infinitary rewriting, coinduction, compression lemma, non-wellfounded proof theory, cut-elimination.

Semantics for Datalog with Subsumption

Luka Janjić[1] and Michael D. Adams[2]

[1]King's College London [1]National University of Singapore

Many programming problems can be naturally viewed as computing the least fixed point of a monotonic transition function over sets of known facts (database states). Datalog is the prototypical programming language based on this view of computation. However, core Datalog is not expressive enough for many problem domains, leading to a host of extensions. Two features that significantly broaden the applicability are the subsumption of facts and completion of database states. Subsumption allows for the facts to be partially ordered, indicating that some facts are "stronger" than others and make them obsolete, while completion selects a subset of database states as "complete" and sends any other states into complete ones. Traditionally, the semantics of Datalog programs are given model-theoretically in terms of Herbrand structures, and operationally in terms of so called fixed point semantics. We give a generalized version of both flavors of semantics, incorporating the notions of subsumption and completion, and entailing the capabilities of many Datalog extensions.

Keywords: Datalog, Programming Language, Semantics.

Global flattening of nested inductive definitions

Paul Blain Levy

University of Birmingham

For a calculus of nested inductive definitions, interpreted over posets using least prefixpoints, we see how to regard the semantics of closed terms as a single mutually inductive definition.
By duality, the same result applies to a calculus of nested coinductive definitions.

Keywords: least prefixpoint, initial algebra, inductive definition, coinductive definition.

On the power of additive branching in affine higher-order recursion schemes

Lê Thành Dũng Nguyên

CNRS and Aix-Marseille University

Higher-order recursion schemes (HORS) are a formalism based on the λ-calculus for describing infinite trees; their study has been motivated by model-checking recursive functional programs. We investigate the expressive power of HORS subject to an affine typing discipline – more precisely, we revisit Clairambault and Murawski's multiplicative-additive HORS. Our contrasting results, which focus on understanding the expressiveness afforded by the use of the additive conjunction of linear logic, are:

- Every MAHORS with a multiplicatively typed tree alphabet generates a regular tree, i.e. is equivalent to some order-0 HORS. This generalizes a theorem of Clairambault and Murawski concerning multiplicative HORS, by allowing the types of non-terminals to contain additives. Unlike their proof, ours is purely syntactic and does not involve an automaton model.
- There is some MAHORS with an additively typed alphabet that is not equivalent to any safe HORS (in fact, it generates a known example of unsafe tree, related to Urzyczyn's language).

Keywords: higher-order recursion scheme, linear logic, safe lambda-calculus.

A Dichotomy Theorem for Ordinal Ranks in MSO

Damian Niwinski, Paweł Parys and Michał Skrzypczak

University of Warsaw

Recall that a least fixed point $\mu X.F(X)$ in a given structure can be computed by starting from the empty set and then iteratively applying F; in general, a transfinite number of iterations is needed, where for limit ordinals we take the union of all sets obtained so far. The necessary number of iterations depends both on a formula and on a structure. We may however ask if a formula F admits some upper bound: an ordinal $\mathrm{rank}(F)$, called the closure ordinal of $\mu X.F(X)$, such that in every structure the fixed-point is reached in at most $\mathrm{rank}(F)$ steps. Assuming that the variable X does not occur in F in the scope of any further fixed-point operations, we prove that either the closure ordinal of $\mu X.F(X)$ is uncountable, or strictly smaller than ω^2. We also provide a way of deciding which of these cases holds. The same result (with minor differences) was shown by Afshari, Barlucchi, and Leigh at FICS 2024; we provide an alternative proof, by reducing to an analogous dichotomy for MSO-definable relations over the infinite binary tree. The main part of the proof is then done in the framework of finite automata over the infinite binary tree, and involves a game-based technique.
A full version of our result was presented at STACS 2025.

Keywords: mu-calculus, dichotomy result, countable ordinals, tree models, monadic second-order logic.

The Negotiation Function: Subgame-perfect Equilibria in Graph Games as Fixed Points

Léonard Brice[1], Jean-Francois Raskin[2] and Marie Van Den Bogaard[3]

[1]IST Austria [2]Université Libre de Bruxelles (U.L.B.) [3]Université Gustave Eiffel

We present the negotiation function, a tool that has been created for the algorithmic study of subgame-perfect equilibria (SPEs) in graph games. We summarise the results that have been recently obtained using this tool, in particular the NP-completeness of the SPE constrained existence problem in both parity and mean-payoff games. Moreover, we propose new directions to use that concept in other contexts, in particular for the study of weak SPEs, or the study of randomised epsilon-SPEs.

Keywords: graph games, equilibria, SPEs, mean-payoff objectives, parity objectives.

A Different Proof of the Time Hierarchy Theorem

András Z. Salamon[1] and Michael Wehar[2]

[1]University of St Andrews [2]Bryn Mawr College

We reinvestigate the classical time hierarchy theorem in computational complexity theory from Hartmanis and Stearns (1965). We provide a seemingly different proof of the time hierarchy theorem by defining a slow growing computable function that is infinitely often smaller than any $t(n)$-time computable superconstant function. The time complexity lower bound is obtained by considering whether the function itself is $t(n)$-time computable.

Keywords: Time Complexity Lower Bounds, Time Hierarchy Theorem, Fixed Points.