

16th Logical and Semantic Frameworks with Applications
LSFA 2021

<https://mat.unb.br/lfa2021>

23rd and 24th July, 2021

Affiliated with FSCD 2021

Pre-proceedings' Preface

This volume contains the pre-proceedings of the Sixteenth Logical and Semantic Frameworks with Applications (LSFA 2021). The meeting was held online on July 23-24, 2021, organised by the Universidad de Buenos Aires, Argentina. LSFA started in 2006 in Natal (LSFA06), and its second and third editions were held in Ouro Preto (LSFA07) and Salvador (LSFA08), always as a satellite event to the Brazilian Symposium on Formal Methods (SBMF). In 2009 (LSFA09), it was held as a satellite event of RDP 2009 in Brasília, and subsequently, it was a satellite event of IC-TAC in Natal (LSFA10). Since its sixth edition, it has been held alone in Belo Horizonte (LSFA11), Rio de Janeiro and Niteroi (LSFA12) and São Paulo (LSFA13). In the last years, LSFA was held in Brasília (LSFA14) and then in Natal (LSFA15) as part of NAT@Logic 2015. The eleventh edition, (LSFA16), was held as a satellite event of FSCD 2016 in Porto, the twelfth edition, (LSFA17), in Brasília, as a satellite of the collocated conferences Tableaux+FroCoS+ITP, the thirteenth edition, (LSFA18), was held alone in Fortaleza, the fourteenth edition, (LSFA19), as a satellite of CADE 2019 in Natal. The fifteenth edition (LSFA20) took place in Bahia with the First Brazilian Workshop on Logic WBL.

LSFA aims to bring researchers and students interested in theoretical and practical aspects of logical and semantic frameworks and their applications. The covered topics include proof theory, type theory and rewriting theory, specification and deduction languages, and formal semantics of languages and systems. For LSFA 2021, seven regular papers were accepted for presentation out of twelve complete submissions. At least three reviewers reviewed each submission, and an electronic Program Committee meeting was

held using Voronkov’s EasyChair system. The reviews were written by the PC members and one additional reviewer. Abstracts of the three invited talks and the selected presentations are included in the Pre-Proceedings, distributed digitally during the workshop.

After the workshop, authors are invited to resubmit the revised versions of their papers. After a second round of reviewing, papers will be selected for the post-proceedings publication as a volume of EPTCS.

The invited talks were given by:

- **Alejandro Díaz-Caro** (Universidad Nacional de Quilmes and Universidad de Buenos Aires)
An overview on the quantum control approach to the lambda calculus
- **Alexandra Silva** (University College London)
Guarded Kleene Algebra with Tests: Coequations, Coinduction, and Completeness
- **Giulio Guerrieri** (University of Bath)
Understanding the lambda-calculus via (non-)linearity and rewriting

We are most grateful for the work and support of the invited speakers.

We want to thank the PC members and the additional reviewers for doing such a great job writing high-quality reviews in time and participating in the electronic PC discussion. In addition to the PC members, the authors and the invited speakers, many people helped make LSFA 2021 a success. In particular, we would like to thank the LSFA 2021 Organisers, Daniele Nantes Sobrinho and Cristian F. Sottile, the FSCD 2021 Local Organisers, Alejandro Díaz-Caro and Carlos López Pombo; and the FSCD SC Workshop Chair, Jamie Vicary. All they worked hard and were highly instrumental in guaranteeing this success.

Mauricio Ayala-Rincón Eduardo Bonelli
Brasília DF Hoboken NJ
16th July 2021
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Abstracts of LSFA 2021 Invited Talks

- **Alejandro Díaz-Caro** (Universidad Nacional de Quilmes and Universidad de Buenos Aires)

An overview on the quantum control approach to the lambda calculus

Abstract: In this talk I will start with the basics of quantum computing, explaining the difference between the quantum and the classical control paradigms. I will give an overview of the line of research of the quantum control within the lambda calculus, ranging from untyped calculi up to categorical and realizability models. I will try to summarize the last 20 years of research in this area, from van Tonder and Arrighi-Dowek’s seminal works until today.

- **Alexandra Silva** (University College London)

Guarded Kleene Algebra with Tests: Coequations, Coinduction, and Completeness

Abstract: Guarded Kleene Algebra with Tests (GKAT) is an efficient fragment of KAT, as it allows for almost linear decidability of equivalence. In this talk, we will explore the (co)algebraic properties of GKAT. We develop an operational (coalgebraic) and denotational (algebraic) semantics and show that they coincide. We then use coequations to provide a precise characterization of the behaviors of GKAT expressions and prove that the axioms of the reduced fragment are sound and complete w.r.t. the semantics. If time permits, we will also discuss how coequations can play a role in completeness proofs more generally. This is joint work with Todd Schmid, Tobias Kappé, and Dexter Kozen.

- **Giulio Guerrieri** (University of Bath)

Understanding the lambda-calculus via (non-)linearity and rewriting

Abstract: The lambda-calculus is the model of computation underlying functional programming languages and proof assistants. Actually, there are many lambda-calculi, depending on the evaluation mechanism (e.g., call-by-name, call-by-value, call-by-need) and computational features that the calculus aims to model (e.g., plain functional, non-deterministic, probabilistic, infinitary).

The existence of different paradigms is troubling because one apparently needs to study the theory and semantics of each one separately.

We propose a unifying and uniform meta-theory of lambda-calculi, where the study is rooted on a unique core language, the bang calculus, a variant of the lambda-calculus inspired by Girard’s linear logic and

Levy's Call-by-Push-Value: a bang operator marks which resources can be duplicated or discarded.

The bang calculus subsumes both call-by-name and call-by-value. A property studied in the bang calculus is automatically translated in the corresponding property for the call-by-name lambda-calculus and the call-by-value lambda-calculus, thanks to two different embeddings of the lambda-calculus in the bang calculus. These embeddings are grounded on proof theory: they are an adaptation of Girard's two translations of intuitionistic logic into linear logic.

Advanced computational features are usually obtained by adding new operators to a core language. Instead of studying the operational properties of the extended language from scratch, we propose a simple method to study them modularly: if an operational property holds in the core language and in the new operators separately, then a simple test of good interaction between core language and new operators guarantees that the property lifts to the whole extended language. This approach is first developed in abstract rewriting systems.

Links to LSFA 2021 Papers Accepted for Presentation

- Daniele Nantes, Carlos Olarte and Daniel Ventura.
A subexponential view of domains in session types [↗](#)
- Asta Halkjær From, Frederik Krogsdal Jacobsen and Jørgen Villadsen.
SeCaV: A Sequent Calculus Verifier in Isabelle/HOL [↗](#)
- Rafael Romero and Alejandro Díaz-Caro.
A note on confluence in typed probabilistic lambda calculi [↗](#)
- Juan Carlos Agudelo-Agudelo and Andrés Sicard-Ramírez.
About Opposition and Duality in Paraconsistent Type Theory [↗](#)
- Joel Felipe Gomes, Vitor Greati, Sérgio Marcelino, João Marcos and Umberto Rivieccio.
On Logics of Perfect Parafinite Algebras [↗](#)
- Patricia Johann, Enrico Ghiorzi and Daniel Jeffries.
GADTs, Functoriality, Parametricity: Pick Two [↗](#)
- Mario Benevides and Luiz Fernandez.
Tableaux Calculus for Dolev-Yao Multi-Agent Epistemic Logic [↗](#)