

# Equipe Méthodes Formelles\*

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\* 32 permanents (8 PR, 2 DR, 15 MdC, 7 CR), 21 doctorants, 4 ingénieurs



# THEMES

## LGL: Logiques, Graphes et Langages

Formal language theory, Graph decompositions, Automata, Algebra

## IL: Informatique Linguistique

Tools and methods for syntactic and semantic analysis of natural languages

## MV: Modélisation et Vérification

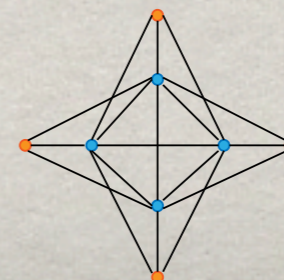
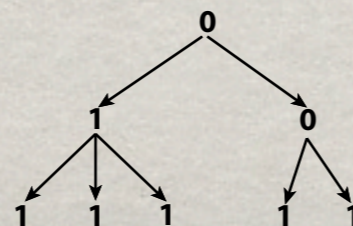
Verification, Distributed Systems, Infinite state systems, Games

## VISIDIA: Simulation, Visualisation et Preuves d'Algos. Distr.

Development of strong foundations for applications

Objects of interest: words, trees, graphs

*abcaab*





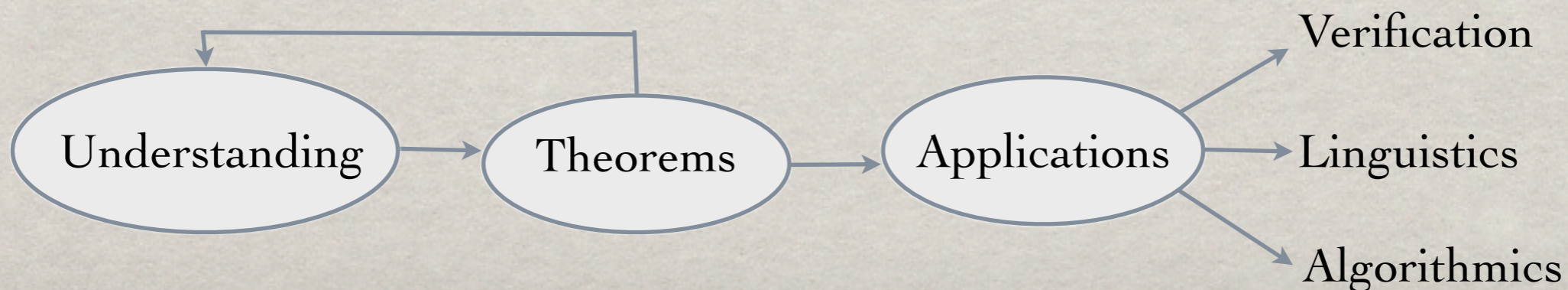
# GOALS

Manipulate, if possible effectively, infinite discrete objects using finite representations.

- ✱ Languages of words
- ✱ Languages of trees
- ✱ Classes of graphs



- ✱ Automata
- ✱ Grammars
- ✱ Logic
- ✱ Algebra





# LGL

(LOGIQUES, GRAPHERS ET LANGAGES)

Formal language theory, Graph decompositions, Automata, Algebra

## Algebra and Automata

- ✱ Algebra for trees
- ✱ Varieties
- ✱ Combinatorics of monoids
- ✱ Pushdown automata
- ✱ Rewriting

Forest algebras

## Graph decompositions and monadic second-order logic (MSOL)

- ✱ Tree-width and other decompositions
- ✱ Infinite graphs and graph grammars
- ✱ Expressiveness of MSOL
- ✱ Algorithmic Applications

Seese's conjecture



# MV

(MODELISATION ET VERIFICATION)

Verification, Distributed Systems, Infinite state systems, Games

## Games: synthesis and verification

- ✱ Fundamental properties
- ✱ Distributed synthesis
- ✱ Higher-order programs

## Infinite state systems

- ✱ Acceleration
- ✱ Presburger Arithmetic
- ✱ Timed systems

Higher-order/probabilistic

Automata -> Presburger



# IL

(INFORMATIQUE LINGUISTIQUE)

Tools and methods for syntactic and semantic analysis of natural languages.

## Formal grammars

- ✱ Rewriting grammars
- ✱ Logic based grammars
- ✱ Syntax description of natural languages

## Correspondence syntax/semantics

## Type theory and language semantics

Grammars  $\leftrightarrow$   $\lambda$ -calculus

Lexical semantics



# SYSTEMS

## AltaRica

- ✱ Formalism for modeling large discrete systems.
- ✱ Well-known in aerospace industry (Dassault, EADS, Thales)
- ✱ 6 PhD's CIFRE.
- ✱ New tools developed.

## Grail

- ✱ Construction of a grammar from a tree bank.
- ✱ 9 million words, 1 million annotated words, 130 000 annotated sentences
- ✱ Fine analysis of sentences: proof and graph theory.
- ✱ Precision: 81% - 98%

## Visidia

- ✱ Visualization, simulation, and proofs of distributed algorithms.
- ✱ Joint project of CombAlgo and MF.
- ✱ Environment for visualizing distributed algorithms.
- ✱ 3 PhD's CIFRE,
- ✱ RECORDS (Pôle de compétitivité)