

# Workshop on the theory of regular cost functions *and beyond*

**Friday 21 September 2018**

14:00–14:30 **Nathanaël Fijalkow**

SIMPLE CONSTRUCTION FOR HISTORY-DETERMINISTIC AUTOMATA

The theory of regular cost functions over finite words extends the crisp relationship between finite automata, monadic second-order logic, and semigroups, to a quantitative setting. A key technical notion to achieve this is that of history-deterministic automata.

In this talk, I will show a simple construction for history-deterministic automata based on a correspondence with automata over infinite words. This is a joint work with Thomas Colcombet published in ICALP 2016.

14:30–15:00 **Christof Löding**

REGULAR COST FUNCTIONS ON INFINITE TREES

Regular cost functions on infinite trees are defined in terms of a variant of distance-desert automata or B-automata using a parity condition in combination with set of counters that can be incremented, reset, or left unchanged in the transitions of the automaton. Such an automaton assigns a value to each tree that it accepts (a natural number or infinity). The central problem for these automata is the boundedness problem: Is the function computed by the automaton bounded on the set of accepted trees?

While this problem is known to be decidable for finite words, finite trees, and infinite words, the problem is still open for infinite trees.

The aim of this talk is to give an overview of known results and tools that have been developed for regular cost functions on infinite trees.

15:00–15:30 **Jean-Éric Pin**

VARIETIES OF COST FUNCTIONS: RESULTS AND OPEN PROBLEMS

This lecture is based on a joint paper with Laure Daviaud and Denis Kuperberg. The goal is to extend standard results on regular languages to the setting of regular cost functions, notably Eilenberg's variety theorem and its consequences.

15:30–16:00 Coffee break

16:00–16:30 **Damian Niwiński**

ON POSITIONAL STRATEGIES OVER FINITE ARENAS

This lecture reports on the ongoing work with Thomas Colcombet. We have previously realized that parity condition is essentially the only prefix-independent criterion that guarantees positional determinacy over all arenas. For finite arenas, there are more such criteria, often with quantitative flavour. We propose lexicographic energy condition as an analogue of parity condition for finite arenas, but can prove its universality only under some additional closure assumption, which possibly can be eliminated.

16:30–17:00 **Michał Skrzypczak**

ON FINITE MEMORY DETERMINACY FOR BOUNDEDNESS GAMES

A series of works by Thomas Colcombet and Christof Löding proved that a logic called cost-MSO is decidable over a variety of structures. The proofs build upon a number of important concepts, just to mention boundedness games and history determinisation. However, we still lack one decidability result: cost-MSO is not known to be decidable over infinite trees. The importance of this problem is witnessed by a reduction from Rabin-Mostowski index problem to a boundedness problem over infinite trees. The lacking piece of the puzzle is an appropriate finite memory determinacy result, in the spirit of the famous Büchi-Landweber construction. During the talk, I will overview the known results, proving (in)determinacy under finite memory for certain classes of boundedness games.

17:00–17:30 **Gabriele Puppis**

THE COST OF EQUIPPING LANGUAGES WITH INFINITE DATA

Data languages are sets of words where each position carries a letter (data value) from a potentially infinite alphabet. Because data values can be used to represent pointers in a heap, attributes of XML documents, key constraints in a database, etc., data languages have attracted much attention in the recent literature. However, they also pose intriguing questions concerning expressiveness (e.g. to what extent the ideal correspondence between automata, logic, and algebra can be lifted to the setting of data languages?), effectiveness (e.g. which formalisms for data languages have decidable emptiness and equivalence problems?), robustness (e.g. which formalisms are closed under union, complement, projection?).

In this talk I will tell about some recent attempts to identify well-behaved classes of data languages via formalisms based on monoids, logics, and automata. The talk is based on joint works with Thomas Colcombet, Clemens Ley, and Michał Skrzypczak.