

# Transformation of Formal Models

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- **Motivation**
- **Goals and Focus**
- **Types of Transformations**
- **State of the Art**
- **Results**
- **Conclusion**



## Topic

- Transformation of formal models

## Area

- Theoretical computer science, formal language theory

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- transformations play an important role in theory and practice

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## Examples

- normal forms
  - + simplification of proofs
  - + more efficient construction of parsers
- elimination of erasing rules
  - + simplification of proofs
  - + requirement for some parsing methods

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- develop new transformations of formal models
  - introduce new formal models
- ⇒ contribution to formal language theory

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## Focus

Regulated formal models:

- regulated grammars
- regulated L systems
- regulated grammar systems
- regulated automata



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- conversion between related formal models
  - + establishment of generative power
- generation of extended languages
  - + addition of some useful information



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- reduction (descriptive complexity)
  - done in terms of many computationally complete regulated grammars (e.g. 2 nonterminals in scattered context grammars)



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  - equivalence between grammars and automata
  - computational completeness



- conversion between related formal models
  - equivalence between grammars and automata
  - computational completeness
  
- generation of extended languages
  - extended Szilard languages (matrix grammars, scattered context grammars)

Several results are based on:



A. Meduna and P. Zemek

Regulated Grammars and Their Transformations

FIT BUT, Brno, CZ, 2010, p. 239



## One-sided random context grammars



A. Meduna and P. Zemek

One-Sided Random Context Grammars

In: *Acta Informatica*, 2011



A. Meduna and P. Zemek

Nonterminal Complexity of One-Sided Random Context Grammars

In: *Acta Informatica*, 2012 (in press)



A. Meduna and P. Zemek

One-Sided Random Context Grammars with Leftmost Derivations.

In: LNCS Festschrifts Series, 2012 (to appear)



A. Meduna and P. Zemek

On One-Sided Forbidding Grammars and Selective Substitution Grammars

In: *International Journal of Computer Mathematics*, 2012 (in press)



A. Meduna and P. Zemek

Generalized One-Sided Forbidding Grammars

Submitted to: *International Journal of Computer Mathematics*

## Left random context ETOL systems



A. Meduna and P. Zemek

Left Random Context ETOL Grammars

Submitted to: *Fundamenta Informaticae*



A. Meduna and P. Zemek

Nonterminal Complexity of Left Random Context EOL Grammars

Unsubmitted manuscript

## Controlled pure grammar systems



A. Meduna and P. Zemek

Controlled Pure Grammar Systems

Submitted to: *Journal of Universal Computer Science*

## Regular-controlled grammars

- Workspace theorems



A. Meduna and P. Zemek

Workspace Theorems for Regular-Controlled Grammars

In: *Theoretical Computer Science*, 2011

- Generation of sentences with their parses



A. Meduna and P. Zemek

On the generation of sentences with their parses by propagating regular-controlled grammars

Submitted to: *Theoretical Computer Science*

## Programmed grammars

- Normal forms
- Reduction of nondeterminism



A. Meduna and L. Vrábel and P. Zemek

On Nondeterminism in Programmed Grammars

In: 13th International Conference on Automata and Formal Languages, HU, 2011

## Unregulated formal models

- Modification of a finite automaton



A. Meduna and P. Zemek  
Jumping Finite Automata

Submitted to: *International Journal of Foundations of Computer Science*

- Alternative elimination of erasing rules from context-free grammars



A. Meduna and P. Zemek

On Elimination of Erasing Rules from EOS Grammars  
Unsubmitted manuscript

- New normal form of phrase-structure grammars



Z. Křivka and A. Meduna and P. Zemek

A New Normal Form for Phrase-Structure Grammars  
Unsubmitted manuscript

## Parsing and compilation

- Parsing based on LL versions of regulated grammars



A. Meduna and L. Vrábel and P. Zemek

LL Leftmost  $k$ -Linear Scattered Context Grammars

In: Symposium on Computer Languages, Impl. and Tools, GR, 2011



A. Meduna and L. Vrábel and P. Zemek

LL Random Context Grammars

Unsubmitted manuscript

## Molecular genetics

- Information processing in molecular genetics based on one-sided random context grammars

## What was presented

- the focus and motivation of my Ph.D. thesis
- state of the art
- a brief summary of the obtained results

## Concluding notes

- the core results have been published or submitted
- some further results remain to be investigated (regulated finite automata)

# Discussion