

# Overview of Automated Reasoning in Serbia

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History of Logic in Serbia  
Belgrade, June 14-15, 2010.

# Field of Automated Reasoning

Automated Reasoning involves:

- mathematical logic
- algorithmics
- artificial intelligence

„The object of **automated reasoning** is to write computer programs that assist in solving problems and in answering questions requiring reasoning.“

# Key Topics of Automated Reasoning

- Logics of interest include:
  - propositional, first-order, equational, higher-order, description, modal, temporal, many-valued, intuitionistic, type theory...
- Methods of interest include:
  - resolution, tableaux, term rewriting, decision procedures, model checking, induction, unification, proof checking...
- Applications of interest include
  - software and hardware verification, ontology reasoning, deductive databases, robotics, planning, and other areas of AI..

## Key Forums for Automated Reasoning

- Association: Association for Automated Reasoning (AAR)
- Journal: Journal of Automated Reasoning
- Conferences: Conference on Automated Deduction (CADE),  
International Joint Conference on Automated Reasoning  
(IJCAR)

## Key Areas of AR in Serbia

- Automated Theorem Proving
  - Uniform proving procedures (e.g., resolution, tableaux)
  - Specialized decision procedures
  - Automated reasoning in geometry
- Interactive Theorem Proving

## Disclaimer for this Overview

- This overview focuses on
  - results published (e.g., visible via DBLP)
  - implemented systems
- Omissions are very possible

## Uniform Proving Procedures: Resolution and Tableaux

- 1980s Dragoš Cvetković (University of Belgrade) and his team: a resolution-based theorem prover for the graph theory (within the system GRAPH)
- 1992 A. Krapež, M. Kapetanović, Z. Ognjanović, T. Petrović (Mathematical Institute, Belgrade): PROVER91 – a tableaux-based parallel theorem prover
- 1994 Z. Ognjanovic: A tableaux-like proof procedure for normal modal logics
- 1997 S. Prešić: one extension of the resolution method
- 2000s Petar Hotomski (University of Novi Sad) and his team: ATP: a resolution-based theorem prover (used in program verification and scheduling).

## Specialized Decision Procedures

- 2002 Predrag Janičić (University of Belgrade), Ian Green, Alan Bundy: GS — a generic platform for decision procedures
- 2003 Aleksandar Jovanović (University of Belgrade) and his team: a decision procedure for monadic calculus, based on a procedure designed by Žarko Mijajlović (University of Belgrade)
- 2004 Filip Marić, Predrag Janičić (University of Belgrade), ArgoLib — a library for decision procedures



# Automated Reasoning in Geometry

- 1995 Predrag Janičić, Stevan Kordić (University of Belgrade):  
Euclid — a theorem prover based on coherent logic
- 2006 Predrag Janičić, Pedro Quaresma: GCLCprover – a theorem  
prover based on the area method
- 2008 Goran Predović, Predrag Janičić: theorem provers based on  
Wu's method and Gröbner bases method

# Interactive Theorem Proving with Isabelle

2009 Filip Marić (University of Belgrade): formal correctness proof of a DPLL-based SAT solver

## AR Related Activities in Serbia

- Conferences: Workshop on Formal and Automated Theorem Proving and Applications (2008, 2009, 2010, hosted by the Faculty of Mathematics, Belgrade)
- Seminar: Seminar on Automated Reasoning (ARGO seminar), regular since October 2007.
- National Research Grants: 144030 (focused mainly on AR) (from 2006 till 2010);
- EU Research Grants: COST Action IC0901 (with participants from the Faculty of Mathematics, Belgrade)

# Conclusions

- Automated Reasoning has been attracting a lot of research efforts in Serbia over the last decades
- So far:  $\approx 30$  publications,  $\approx 20$  SCI publications
- More results are expected in years to come
- Collaboration with research groups from the region is welcome