Dr Alexander Bolotov's Research Profile

This statement summarises my main research achievements in the three main areas of expertise, and their impact, provides the list of publications and main keynote and invited talks.

I. RESEARCH ACHIEVEMENTS

1. PROOF METHODS FOR BRANCHING-TIME LOGIC.

Main results:

- Development of the Deductive Proof technique, the Clausal Resolution Method, for the Branching-time Logic setting, (computation tree logic CTL and its extensions) commonly used in computer science;
- Extension of the applicability of the Clausal Resolution technique capturing Temporal Fixpoint Logics;
- Formulation of a Loop Searching Algorithm enabling the automation of the method;
- Study of expressiveness of obtained formalisms and complexity analysis.

This is the only clausal resolution based deductive proof method for branching-time logics.

2. AUTOMATION OF NATURAL DEDUCTION.

Main results:

- Full automation of the Fitch-style natural deduction in Classical Propositional Logic and its implementation as an automatic theorem-prover;
- Extension of the proof searching algorithm to the First-order setting, Temporal and Paraconsistent Logics.

The only analogous method developed in Carnegie Mellon University (W.Sieg et al.) tackles different setting of natural deduction, and is formulated only for Classical Logic. Our approach is generic and has the potential to capture other formalisms; it has resulted in Natural Deduction Calculi for the following Non-Classical Logics: Linear and Branching-time Temporal Logics, Temporal Logic with propositional quantification and, very recently, for Paraconsistent Logic.

3. FORMAL MODELLING OF CONCURRENT AND DISTRIBUTED SYSTEMS, INTELLIGENT AGENTS, GRID SYSTEMS.

Main results:

- Development of the specification language for the Logic of Rational Agency and corresponding resolution based proof technique (KARO framework);
- Extension of the specification language to capture Normative Agents; Introduction of the formal framework for specification and verification of Grid Component Model in the setting of Branching-time Logic;
- Specification of Components and Resources for the General Component Model;
- Application of the Automata-based Approach to represent General Component Model and its environment.

II. NATIONAL AND INTERNATIONAL RECOGNITION AND IMPACT.

To the best of my knowledge, my published works have been cited by other researchers more than seventy times. Obtained results prompted five successful PhD programmes and were utilised in a number of theoretical or practical developments, nationally and internationally, in particular by: B. Moszkoski, (De Montfort University), J. Mohasefi (Indian Institute of Technology, New Delhi), Alan Frisch (University of York), Daniel Sheridan (University of Edinburgh), and Toby Walsh (University of New South Wales), U. Hustadt, C. Dixon, M. Fisher (University of Liverpool), R. Schmidt (University of Manchester, M., Meyer and, J.-J., van der Hoek (University of Urtrecht), I. Broersen, J.Dignum and J. Meyer (University of Utrecht), W. Truszkowski, J.Rash and M. Hinchey (NASA Goddard Space Flight Center), D. Basin (University of Zurich) and Luca Vigano (University of Verona, Italy).