Reachability Problems for Infinite State Systems

Preface

This special issue of the Fundamenta Informaticae contains nine papers, which are revised and extended versions of the papers selected from the 6th of the Reachability Problems Workshop hosted by the University of Bordeaux, France from 17 till 19 September 2012 and the 7th Edition of the Workshop hosted by Uppsala University, Sweden from 25 till 27 September 2013.

RP2012 and RP 2013 were the sixth and the seventh in the series of workshops following five successful meetings at the University of Genoa, Italy, in 2011, Masaryk University of Brno, Czech Republic, in 2010, Ecole Polytechnique, France, in 2009, at the University of Liverpool, UK, in 2008, and at Turku University, Finland, in 2007. After that the eighth edition (RP'14) was organized at Oxford University and ninth (RP'15) at Warsaw University. The tenth edition of the workshop will be organized at Denmark in 2016.

The Reachability Workshop series gathers together researchers from diverse disciplines and backgrounds interested in reachability problems that appear in algebraic structures, computational models, hybrid systems, infinite games, logic and verification. The workshop is aimed at to fill the gap between results obtained in different fields, but sharing common mathematical structures or conceptual difficulties.

Reachability is a fundamental problem which appears in the context of many models and abstractions of computational processes: finite- and infinite-state concurrent systems, computational models like cellular automata and Petri nets, decision procedures for classical, modal, and temporal logic, program analysis, discrete and continuous systems, time critical systems, hybrid systems, rewriting systems, algebraic structures (groups, semigroups and rings), deterministic or non-deterministic iterative maps, probabilistic and parametric systems, and open systems modelled as games.

Typically, for a fixed system description given in some form (rewriting rules, transformations by computable functions, systems of equations, logical formulas, etc.) a reachability problem consists in checking whether a given set of target states can be reached starting from a fixed set of initial states. The set of target states can be represented explicitly or via some implicit representation (e.g., a system of equations, a set of minimal elements with respect to some ordering on the states). Sophisticated quantitative and qualitative properties can often be reduced to basic reachability questions. Decidability and complexity boundaries, algorithmic solutions, and efficient heuristics are all important aspects to be

considered in this context. Algorithmic solutions are often based on different combinations of exploration strategies, symbolic manipulations of sets of states, decomposition properties, reduction to linear programming problems, and they often benefit from approximations, abstractions, accelerations, and extrapolation heurisitics. Ad hoc solutions as well as solutions based on general-purpose constraint solvers and deduction engines are often combined in order to balance efficiency and flexibility.

The papers of this special issue cover theoretical and practical aspects of reachability problems in Model Checking, Timed and Counter Automata, Time Petri Nets, Communication-free Petri Nets, Counter Reachability Games, Sandpile Model, Verification of Broadcast Networks. For the special issue, we decided to select about one third of the accepted papers from RP'12 and RP'13, ranking them in accord with the evaluation of the RP reviewers. As a result we accepted 9 papers which are extended versions of those presented in the conference. All the papers were rigorously refereed according to the standard of the journal.

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