CONCUR Test-Of-Time Award 2021

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Abstract

This short article announces the recipients of the CONCUR Test-of-Time Award 2021.

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Category Invited Paper

1 Introduction

In 2020, the International Conference on Concurrency Theory (CONCUR) and the IFIP Working Group 1.8 on Concurrency Theory established the CONCUR Test-of-Time Award to recognize important achievements in concurrency theory that were published at the CONCUR conference and have stood the test of time. Starting with CONCUR 2024, an award event will take place every other year, and award one or two papers presented at CONCUR in the 4-year period from 20 to 17 years earlier.

During the present transient period two such award events are combined each year, going back in time even further. At CONCUR 2020, awards were given to papers presented at CONCUR during the period 1990–1995, the very first editions of this conference.

All papers published at CONCUR between 1994 and 1999 were eligible for this second installment of the award, which is presented at the 32nd International Conference on Concurrency Theory (CONCUR 2021). The conference is held on line from Paris, France, in the period 23–27 August 2021, with Serge Haddad and Daniele Varacca as chairs of the program committee. We had the honor to serve as members of the second CONCUR Test-of-Time Award Jury, and were asked to select one or two awardees for each of the periods 1994–1997 and 1996–1999.

After having made a shortlist of candidate award recipients and having thoroughly discussed their relative merits and impact on the CONCUR research community and beyond, we selected the four articles mentioned below for the award out of an abundance of excellent candidates.

2 The Award Winning Contributions

2.1 Period 1994–1997

- David Janin & Igor Walukiewicz: *On the Expressive Completeness of the Propositional mu-Calculus with Respect to Monadic Second Order Logic.* CONCUR 1996
  `https://doi.org/10.1007/3-540-61604-7_60`

  This seminal paper relates the expressive power of monadic second-order logic and the μ-calculus, showing that the bisimulation-closed formulas of monadic second-order logic are equivalent to the μ-calculus. This is a very deep and insightful result, providing a contribution of foundational nature to the field of logic and computation. The paper's insight was one of the central factors contributing to the role of the μ-calculus in model checking, where it provides the computational counterpart to logics for expressing system properties. The relation between logics and the μ-calculus, which can in great part be traced to this paper, has been an extremely fruitful one, with implications in algorithms for the verification and analysis of transition systems, probabilistic systems, timed systems, games, and more.

- Uwe Nestmann & Benjamin C. Pierce: *Decoding Choice Encodings* CONCUR 1996
  `https://doi.org/10.1007/3-540-61604-7_55`

  This paper makes major strides in the study of the expressiveness of process calculi. It shows that, in a completely distributed and asynchronous setting, input-guarded choice can be simulated by parallel composition. More precisely, the paper constructs a fully distributed and divergence-free encoding from the input-choice pi-calculus into the asynchronous pi-calculus. The correctness of this encoding is demonstrated by establishing a semantic equivalence between a process and its encoding, thereby satisfying and strengthening the common quality criterion of full abstraction. As semantic equivalence it employs the asynchronous version of coupled simulation, and illuminates the surprising versatility of this notion by showing how it avoids the introduction of divergence in the encoding. This work formalizes ideas stemming from the programming language Pict, and has been very influential in the area of expressiveness in concurrency.

2.2 Period 1996–1999

- Ahmed Bouajjani, Javier Esparza & Oded Maler: *Reachability Analysis of Pushdown Automata: Application to Model-checking* CONCUR 1997
  `https://doi.org/10.1007/3-540-63141-0_10`

  This is a breakthrough paper that opened the way for the analysis of pushdown automata via model-checking techniques. The paper proposes a general class of alternating pushdown systems and defines new model checking algorithms for these systems against both linear and branching-time properties. The basic idea is simple, yet extremely elegant: using (regular) automata as representations for sets of states of pushdown automata. The paper proceeds to show that the representation is closed with respect to Boolean operators, makes membership of states decidable, and crucially, makes the predecessor operator easily computable. The approach proposed in this paper is so neat and natural that it has become a standard reference in the field of verification of infinite-state systems.

- Rajeev Alur, Thomas A. Henzinger, Orna Kupferman & Moshe Y. Vardi: *Alternating Refinement Relations* CONCUR 1998
  https://doi.org/10.1007/BFb0055622
  This paper introduces refinement relations, based on simulation and trace containment, for games, modeled as alternating transition systems. Refinement relations had been a foundational notion in formal methods, and much more broadly, in the theory of computation. In the years leading up to this paper, it had become evident that games provided the natural model for open systems, which communicate and are reactive to their environment; this paper extends the notion of simulation and trace containment to games. While conceived in a formal-methods and verification setting, the paper turned out to have broad implications, as these game refinement relations have implications for strategies in general games, and are closely related to notions of subtyping in game theory and in dynamic typing. The extension of refinement relations to games was thus a fundamental tassel in the understanding of dynamic systems, finally being put into place.

3 Concluding Remark

Interviews with the award recipients, which give some information on the historical context that led them to develop their award-winning work and on their research philosophy, are conducted in the Process Algebra Diary, maintained by Luca Aceto at https://processalgebra.blogspot.com/.