The Ackermann Award 2006

S. Abramsky, E. Grädel, and J. Makowsky

Members of EACSL Jury for the Ackermann Award

The second Ackermann Award is presented at this CSL’06. Eligible for the 2006 Ackermann Award were PhD dissertations in topics specified by the EACSL and LICS conferences, which were formally accepted as PhD theses at a university or equivalent institution between 1.1.2004 and 31.12.2005. The jury received 14 nominations for the Ackermann Award 2006. The candidates came from 10 different nationalities from Europe, the Middle East and India, and received their PhDs in 9 different countries in Europe, Israel and North America.

The topics covered the full range of Logic and Computer Science as represented by the LICS and CSL Conferences. All the submissions were of very high standard and contained outstanding results in their particular domain. The jury decided finally, to give for the year 2006 two awards, one for work on the model theory of hybrid logics - modal logics extended with nominals, and one for work on mathematical structures arising in the theory of coalgebras and providing semantics for recursive specifications. The 2006 Ackermann Award winners are, in alphabetical order,

– Balder ten Cate from the Netherlands, for his thesis
  Model Theory for Extended Modal Languages,
  issued by Amsterdam University, The Netherlands, in 2005
  Supervisor: Johan van Benthem

– Stefan Milius from Germany, for his thesis
  Coalgebras, Monads and Semantics,
  issued by the Technical University of Braunschweig, Germany, in 2005
  Supervisor: Jiří Adámek

The Jury wishes to congratulate the recipients of the Ackermann Award for their outstanding work and wishes them a successful continuation of their career.

The Jury wishes also to encourage all the remaining candidates to continue their excellent work and hopes to see more of their work in the future.

Balder Ten Cate

Citation. Balder ten Cate receives the 2006 Ackermann Award of the European Association of Computer Science Logic (EACSL) for his thesis

Model Theory for Extended Modal Languages,

in which he substantially advanced our understanding of model theoretic and computational aspects of extensions of modal logic and their use in computer science.
**Background of the thesis.** Modal logics are of fundamental importance in many branches of computer science. They allow to tailor logical formalisms so that they combine the expressive power needed in particular applications with good algorithmic and model-theoretic properties. A fundamental feature of modal logics is their invariance under notions of behavioural equivalence such as bisimulation. Well-known and fundamental results in the model theory of modal logic reveal that propositional modal logic is equivalent to the bisimulation-invariant fragment of first-order logic, and that an analogous relationship holds for the modal $\mu$-calculus and monadic second-order logic.

In many applications, it is necessary or at least convenient to extend modal logics with nominals (i.e., constants for naming elements of the underlying structure) and operators to handle them. These logics are called hybrid logics and they relate to, say, first-order logic with constants in the same way as basic modal logics relate to purely relational first-order logic. Balder ten Cate’s thesis is mainly a mathematical investigation into hybrid logics and other extended modal logics. It encompasses a wide range of topics in the analysis of extended modal logics, covering many new results on fundamental model theoretic features of hybrid logics and other more expressive modal logics, and puts these results into a wider framework of abstract modal model theory. For instance, the celebrated Goldblatt-Thomason Theorem states that a first-order formula defines a modally definable frame class if, and only if, it is preserved under taking generated subframes, disjoint unions and bounded morphic images, and its negation is preserved under taking ultrafilter extensions. Many results in ten Cate’s thesis are motivated by the question whether similar characterisations can be given for the frame classes definable in extended modal logics, such as hybrid logics or modal logic with propositional quantifiers.

Abstract model theory studies model theoretic properties of logics on a general, abstract level. A fundamental result in this context is Lindström’s Theorem stating that no proper extension of first-order logic has both the compactness and the Löwenheim-Skolem property. Abstract model theory has been successful in providing a unifying perspective of model-theoretic properties of logics, typically of powerful extensions of first-order logic, but it does not really cover aspects of computational logics. A more general perspective of ten Cate’s work is to contribute to the development of an abstract model theory for computational logics, devoted to logics that arise in computer science, and to those properties that are relevant for their computational applications.

**Ten Cate’s thesis.** The thesis, entitled *Model Theory for Extended Modal Languages* is written with great lucidity and sophistication. It develops the abstract model theory of hybrid languages in the spectrum running from the basic modal language to full first-order logic. The results of the thesis are too numerous to enumerate them, so let us just mention a few highlights.

- A systematic frame-definability theory for hybrid languages is developed, including Goldblatt-Thomason style characterizations. This is a highly non-trivial enterprise in terms of model-theoretic proof techniques, and new frame constructions.