Six Decades of Automated Reasoning: Papers in Memory of Larry Wos

Foreword

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This issue collects papers written in memory of the late Larry Wos, exceptional scientist and charismatic leader during six decades of research in automated reasoning. Larry Wos was one of the founders of the field of automated reasoning, and he was the founder and the first editor-in-chief of the Journal of Automated Reasoning.

The first paper in the issue, entitled "Larry Wos - Visions of Automated Reasoning," by Michael Beeson, Michael Kinyon, Geoff Sutcliffe, and myself, offers a well-rounded portrait of Larry, covering his research in both the theory and the applications of automated theorem proving, his impact as leader and organizer, and his unique personality, for which the saying "He was larger than life" could not be more appropriate.

My second contribution to the issue, entitled "Set of Support, Demodulation, Paramodulation: A Historical Perspective," is a survey that traces the evolution of three fundamental concepts in theorem proving from Larry's seminal papers in the 1960s to the present: strategies to organize the inferences, inference rules for equational replacement, and inference rules that generate equations from equations in order to compensate the limitations that automation imposes on equational replacement. By retracing the paths that led to the solution of the Wos–Robinson conjecture on the completeness of paramodulation—ultimately settled by Jieh Hsiang and Michaël Rusinowitch—or by recollecting the history of the merger of resolution-based theorem proving and Knuth–Bendix completion, which culminated in the superposition calculus by Leo Bachmair and the late Harald Ganzinger, this paper takes the reader along for one of the most fascinating journeys in the history of computer science.

After delving into the history of demodulation/simplification and paramodulation/superposition, the reader could not be better prepared to appreciate the third article, entitled "A Comprehensive Framework for Saturation Theorem Proving," and authored by Uwe Waldmann, Sophie Tourret, Simon Robillard, and Jasmin Blanchette. This is a milestone paper that advances the systematization of saturation-based theorem proving with a new theoretical framework, treating for the first time in a unified manner the redundancy crite-

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ria behind demodulation/simplification and behind subsumption, an inference rule whose importance was often underlined by Larry Wos.

The fourth paper on "Making Higher-Order Superposition Work" would have been Larry's favorite, given Larry's relentless enthusiasm for the implementation of inference rules and search strategies in efficient theorem provers. Authors Petar Vukmirović, Alexander Bentkamp, Jasmin Blanchette, Simon Cruanes, Visa Nummelin, and Sophie Tourret illustrate the challenge of implementing effectively and efficiently the principle of λ-superposition for automated theorem proving in higher-order logic. The brilliant and practical solutions, devised by the authors for the many difficult problems posed by this challenge, enabled the state-of-the-art Zipperposition theorem prover to win the annual CASC competition for theorem provers in the higher-order category.

As President of the Association for Automated Reasoning, Larry Wos wrote articles for a column in the AAR Newsletter, that he dedicated to present challenge problems for automated theorem provers. In the fifth paper of the issue, entitled "A Wos Challenge Met," author Robert Veroff shows how to apply the Prover9 theorem prover, by the late William W. McCune—long-time collaborator and friend of Larry Wos—to solve one of these challenges. There is no better way to honor Larry, considering how he was delighted in analyzing and improving computer proofs.

And there is no better way to conclude this issue than with a reflection on Larry Wos' last words on theorem proving. Larry sent to AAR Newsletter editor Sophie Tourret an unfinished manuscript that after discussion between Larry and Sophie would have become the next installment of the President's column. Christoph Weidenbach and Sophie Tourret reconstructed and completed excerpts from this manuscript, providing historical context and discussing the relevance of Larry's final remarks for contemporary research in automated reasoning. Thanks to their careful and insightful work, the readers will be able to attack once more a Wos challenge with their theorem provers.

Heartfelt thanks go to all the people who made this special issue possible, including JAR editor-in-chief Jasmin Blanchette, who supported this project throughout, JAR associate editor Cezary Kaliszyk, who edited the papers of which I am author or co-author, Geoff Sutcliffe, who gave the initial impulse to the idea of writing in memory of Larry Wos, CADE president Christoph Weidenbach, who also supported the initiative, all authors of papers in the special issue, and all anonymous reviewers, whose dedication to the precious, obscure work of reviewing journal manuscripts deserves much gratitude.

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(Lead Guest Editor of the Special Issue)