Hierarchic Superposition With Weak Abstraction and the Beagle Theorem Prover

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Many applications of automated deduction require reasoning in first-order logic modulo background theories, in particular some form of integer arithmetic. A major unsolved research challenge is to design theorem provers that are "reasonably complete" even in the presence of free function symbols ranging into a background theory sort. The earlier hierarchic superposition calculus of Bachmair, Ganzinger, and Waldmann [BGW94] already supports such symbols, but, not optimally. We have devised a new calculus, hierarchic superposition with weak abstraction, which rectifies this situation by introducing a novel form of clause abstraction, a core component in the hierarchic superposition calculus for transforming clauses into a form needed for internal operation [BW13]. Additionally, it includes a definition rule that is generally useful to find refutations more often, and, specifically, gives completeness for the clause logic fragment where all background-sorted terms are ground.

The talk provides an overview of the calculus, its implementation in the Beagle theorem prover and experiments with it.

References

[BGW94] Leo Bachmair, Harald Ganzinger, and Uwe Waldmann. Refutational theorem proving for hierachic first-order theories. *Appl. Algebra Eng. Commun. Comput*, 5:193–212, 1994.

[BW13] Peter Baumgartner and Uwe Waldmann. Hierarchic superposition with weak abstraction. In Maria Paola Bonacina, editor, *CADE-24 – The 24th International Conference on Automated Deduction*, volume 7898 of *Lecture Notes in Artificial Intelligence*, pages 39–57. Springer, 2013.

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