We consider the following formulas:

$$\text{Lin} = (p \to q) \vee (q \to p), \qquad D = \forall x(P(x) \vee q) \to (\forall x P(x) \vee q),$$

$$\text{Wel}_1 = \exists x(\exists y P(y) \to P(x)), \qquad \text{Wel}_2 = \exists x(P(x) \to \forall y P(y)).$$

Note that $D \in [H + \text{Wel}_2]$, but $D \notin [H + \text{Wel}_1]$.

THEOREM. *Let L be any recursively axiomatizable intermediate predicate logic between* $[H + \text{Lin} + \text{Wel}_1] \cap [H + \text{Lin} + \text{Wel}_2]$ *and* $[H + \text{Lin} + \text{Wel}_1 + \text{Wel}_2]$. *Then L is KB-incomplete.*

COROLLARY. *The predicate logics* $[H + \text{Lin} + \text{Wel}_1 + \text{Wel}_2]$, $[H + \text{Lin} + \text{Wel}_1 + D]$, *and* $[H + \text{Lin} + \text{Wel}_i]$ *for* $i = 1, 2$ *are KB-incomplete.*

Incompleteness of these logics with respect to the usual Kripke semantics K was mentioned in [2]. The semantics of Kripke bundles KB is in fact stronger than K (see [1]).

REFERENCES

[1] V. B. SHEHTMAN and D. P. SKVORTSOV, *Semantics of nonclassical first-order predicate logics*, ***Mathematical logic (proceedings of Heyting '88)*** (P. Petkov, editor), Plenum Press, New York, 1990, pp. 105–116.

[2] D. P. SKVORTSOV, *On axiomatizability of some intermediate predicate logics (summary)*, ***Reports on Mathematical Logic***, vol. 22 (1988), pp. 115–116.

ŽELJKO SOKOLOVIĆ (with ANAND PILLAY), *Superstable differential fields.*
Mathematical Institute, Belgrade, Yugoslavia.
Department of Mathematics, University of Notre Dame, Notre Dame, Indiana 46556.

E. Kolchin has developed a Galois theory for so-called strongly normal extensions. Using his method of associating an algebraic group for these extensions, we will indicate how to prove:

THEOREM. *A nontrivial superstable differential field has no proper strongly normal extensions.*

SERGEI V. SOLOVIEV, *λ-terms with functional symbols and closed categories.*
Leningrad Institute for Informatics and Automation, Academy of Sciences of the USSR, 199178 Leningrad, USSR.

There are various applications of weak systems of λ-calculus (or weak systems of natural deduction). In particular, they are very useful for representing the maps in free closed categories (see [1] and [2]). A more general case is also interesting: when a free closed category on a nonfree category is considered. We shall deal with a free symmetric monoidal closed category $C(V)$ on a nonfree symmetric monoidal category V. As in [1] and [2], there exists an isomorphism τ between morphisms in $C(V)$ and λ-terms of some weak system $T_{C(V)}$. Here $T_{C(V)}$ is the system in the language with functional systems corresponding to the morphisms of V. Also as in [1] and [2], on $T_{C(V)}$ we can define the equivalence relation $\equiv$ such that $f = g$ in $C(V)$ iff $\tau(f) \equiv \tau(g)$. In the case when V is the symmetric monoidal category of permutations a deciding algorithm for $\equiv$ is obtained using normalization in $T_{C(V)}$.

REFERENCES

[1] G. E. MINTS, *Closed categories and proof theory*, ***Zapiski Nauchnykh Seminarov Leningradskogo Otdeleniya Matematicheskogo Instituta im. V. A. Steklova Akademii Nauk SSSR (LOMI)***, vol. 68 (1977), pp. 83–114; English translation, ***Journal of Soviet Mathematics***, vol. 15 (1981), pp. 45–62.

[2] A. A. BABAEV, *Equality of morphisms in closed categories.* **I, *Izvestiya Akademii Nauk Azerbaĭdzhanskoĭ SSR, Seriya Fiziko-Tekhnicheskikh i Matematicheskikh Nauk***, vol. 2 (1981), no. 1, pp. 3–10. (Russian)

AN. A. MUCHNIK AND S. F. SOPRUNOV, *Decidability of monadic theories of countable structures and of their classes.*
Institute of New Technologies, 113587 Moscow, USSR.

We consider countable graphs of bounded degree, and assume that a numbering of edges going out from each node is fixed. Such a graph determines a first-order structure. The universe of this structure is the set of all nodes. The ith binary relation corresponds to the ith edge. We are interested in whether the monadic theory (MT) or weak monadic theory (WMT) of such a structure is decidable. We say that monadic (weak monadic) structure S is *undecidable by nature* if any class of structures (having the same signature) which includes S has an undecidable MT (WMT).

A graph is called m-deducible if one can divide it into two parts, then divide each of them into two parts, and so on (the division process terminates when a part contains only one node) in such a way that the number of boundary edges for each part is less then m.

THEOREM 1. *A countable graph G is m-deducible for some m iff for some m each finite subgraph of G is m-deducible.*

THEOREM 2. *A plane square lattice is not m-deducible for any m.*

THEOREM 3. *The monadic structure of a graph G is undecidable by nature iff graph G is not m-deducible for any m.*

It is well known that for any unary predicate P the MT of the structure $\langle N;', P\rangle$ is m-reducible to its WMT.

THEOREM 4. *There exists a unary predicate P on the binary tree T_2 (with successor functions t_0 and t_1) such that the WMT of $\langle T_2; t_0, t_1, P\rangle$ is decidable but its MT is undecidable.*

THEOREM 5. *If $\succ$ is a well-ordering on a binary tree T_2, then the weak monadic structure $\langle T_2; t_0, t_1, \succ\rangle$ is undecidable by nature.*

OTMAR SPINAS, *Inner product spaces in an iterated forcing model.*
Mathematisches Institut, Universität Zürich, 8001 Zürich, Switzerland.

In [B, G], [Sp] and [Ba, Sp] it has been shown that the existence of a symmetric bilinear form on an uncountable-dimensional vector space E over a finite or countable field, sharing the property

$$(**) \qquad \text{(for all subspaces } U \subseteq E)\dim U \geq \aleph_0 \rightarrow \dim U^{\perp} \leq \aleph_0$$

is independent of ZFC.

(**)-spaces exist under CH (see [B, G]) or in a model obtained by adjoining uncountably many Cohen reals.

(**)-spaces do not exist if $\mathfrak{p} > \aleph_1$ holds, where $\mathfrak{p}$ is the Rothberger cardinal $\min\{|\mathscr{F}|: \mathscr{F} \subseteq \mathscr{P}(\omega)$ has the finite intersection property and no infinite almost-intersection$\}$.

The question remained open whether under the condition $\mathfrak{p} = \aleph_1$ (**)-spaces always exist. We give a negative answer. By iterated forcing we construct a model where $\mathfrak{p} = \aleph_1$ and there exist no (**)-spaces.

REFERENCES

[B, G] W. BAUR and H. GROSS, *Strange inner product spaces*, ***Commentarii Mathematici Helvetici***, vol. 52 (1977) pp. 491–495.

[Ba, Sp] JAMES BAUMGARTNER and OTMAR SPINAS, *Consistency and independence proofs in quadratic form theory*, this JOURNAL, vol. 56 (1991) (to appear).

[Sp] OTMAR SPINAS, ***Konsistenz- und Unabhängigkeitsresultate in der Theorie der quadratischen Formen***, Ph.D. Thesis, Universität Zürich, Zürich, 1989.

JAN HRIC AND PETR ŠTĚPÁNEK, *Remarks on logical operational semantics of PROLOG.*
Department of Computer Science, Charles University, 118 00 Prague, Czechoslovakia.

An algebraic framework for semantics of programming languages was recently proposed by Y. Gurevich [1988]. His approach is based on finite structures that evolve in time in the same way as real computers do. These structures are called *dynamic algebras* and allow us to give an operational semantics for real programming languages, in particular for the procedural ones. It was an open problem whether it is possible to describe in the same way the semantics of nonprocedural languages, especially of the PROLOG language based on the idea of logic programming.

In his pioneering paper, E. Börger [1990] described dynamic algebras giving a logical operational semantics for full PROLOG. In this paper, we shall attempt to give an operational logic semantics for PROLOG with a more specific description of unification as an essential part of resolution steps in PROLOG computations. Our aim is twofold: first we get a more concise description of computation and answer substitutions, and second, we get a more transparent description of terms and of built-in predicates of PROLOG that handle terms. We hope that we get this still on a reasonable level of abstraction that is not tied to a specific implementation.