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Interaction of computability theory and computable algebra

Maximal sets and their complements, cohesive sets, play an important role in computability theory, especially in the study of the lattice of computably enumerable sets. Maximal sets are coatoms in its quotient lattice modulo finite sets. Similarly, maximal vector spaces play an important role in the study of the lattice of computably enumerable vector spaces, introduced by Metakides and Nerode in the 1970s. We use cohesive sets to define specific powers of algebraic structures, in particular, of computable fields. These powers of structures may not be elementary equivalent to the structures. We investigate definability and isomorphism properties of these powers, using a recent result by Koenigsmann about definability of the integers in the rationals. Then we draw conclusions about the quotient lattice of computably enumerable vector spaces modulo finite dimension, and about its automorphisms. The question about the number of automorphisms of this lattice has been open for thirty years. This is joint work with R. Dimitrov, R. Miller, and J. Mourad.