Manuel Bodirsky
Homogeneous Structures, Ramsey Theory, and Constraint Satisfaction

One way of studying a relational structure is to investigate functions which are related to that structure and which leave certain aspects of the structure invariant. Examples are the automorphism group, the self-embedding monoid, the endomorphism monoid, or the polymorphism clone of a structure. Such functions can be particularly well understood when the relational structure has a first-order definition in a homogeneous relational structure which is totally ordered and has the Ramsey property. This is because in this situation, Ramsey theory provides the combinatorial tool for analyzing these functions – in a certain sense, it allows to represent such functions by functions on finite sets.

This is a survey of results in model theory and theoretical computer science obtained recently in cooperation with Michael Pinsker. In model theory, we approach the problem of classifying the reducts of ordered homogeneous Ramsey structures, and certain decidability questions connected with such reducts. In theoretical computer science, we use the same combinatorial methods in order to classify the computational complexity for various classes of infinite-domain constraint satisfaction problems. While the first set of applications is obviously of an infinitary character, the second set concerns genuinely finitary problems – their unifying feature is that the same tools from Ramsey theory are used in their solution.