

Lebesgue measure and integration theory on arbitrary real closed fields

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Session: Real algebraic geometry, applications and related topics

We establish for the category of semialgebraic sets and functions on arbitrary real closed fields a full Lebesgue measure and integration theory such that the main results from the classical setting hold. The construction involves methods from model theory, o-minimal geometry, valuation theory and the theory of ordered abelian groups. We set up the construction in such a way that it is uniquely determined by data that can be formulated completely in terms of the given real closed field. We apply our integration theory to questions on semialgebraic geometry and analysis in the non-standard setting.