

Weekly Tutorial: Real Algebraic Geometry

Kenneth R. Driessel

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Meeting Times: Thursday 11:15-12:15

Starting Date: Thursday, September 17

Room: 409 Lind Hall

Here is the aim of this tutorial: to provide a transition from elementary real algebraic geometry (represented, for example by Cox, Little and O'Shea (2005)) to more advanced topics in this area (represented, for example, by Basu, Pollack and Roy (2003)).

We shall mainly be interested in *semi-algebraic sets*. These are subsets of real n -space that are defined by a finite number of polynomial equations and polynomial inequalities.

One of the main results in this area is Tarski's theorem that the elementary theory of algebra and geometry is decidable. (See Tarski(1951).) In particular, whether a semi-algebraic set is non-empty is decidable. It also follows that every subset of real n -space definable by a first order formula is semi-algebraic.

Here are the prerequisites for this tutorial: a basic knowledge of linear algebra and the rudiments of a basic course in algebra through the definitions and basic properties of groups, rings and fields, and in topology through the elementary properties of closed, open, compact and connected sets.

This tutorial should be of interest to students and researchers in mathematics, computer science and engineering

References:

- Basu, S.; Pollack, R. and Roy, M-F. (2003) *Algorithms in Real Algebraic Geometry*, Springer.
- Cox, D.; Little, J. and O'Shea, D. (2005) *Ideals, Varieties, and Algorithms*, Springer.
- Tarski, A. (1951) *A decision method for elementary algebra and geometry*, Prepared for publication by J. C. C. McKinsey. University of California Press. Available at <http://perso.univ-renne1.fr/marie-francoise.roy/Tarski51.pdf>