

The project concerns a new direction of research in real algebraic geometry focusing on real functions that admit a rational representation. A function is said to admit a rational representation if it is equal to the quotient of two polynomial functions on the set where the denominator of the quotient is different from zero. Of particular interest are functions of such a type that are, in addition, continuous or differentiable on the entire domain. One can develop the geometry of rational functions in parallel to the standard real algebraic geometry. Along the way new unexpected phenomena are encountered. Furthermore, the geometry of rational functions is particularly well-suited to study relationships between topological and algebraic-geometric properties of various objects. Research in this area has already attracted the attention of the mathematical community and was presented by the Principal Investigator, together with Krzysztof Kurdyka, as an invited lecture at the International Congress of Mathematicians 2018 in Rio de Janeiro. Many challenging problems remain open and will be investigated in this project. The study will be extended on real functions that admit a meromorphic representation. This will not be a routine undertaking due to differences between polynomials and analytic functions. The purpose is to develop the geometry of real meromorphic functions that satisfy appropriate additional conditions. Little has been done so far in the meromorphic case.

The methods of real algebraic and analytic geometry will play the major role. The techniques specific to the geometry of real rational functions will be refined and perfected.

It is expected that the results obtained in this project will be published in high quality international journals. They also will be presented at international conferences and seminars. The project will create new opportunities to involve young mathematicians in research.