



# Geometry of Möbius Transformations: Elliptic, Parabolic and Hyperbolic Actions of $SL_2(\mathbb{R})$

By Vladimir V. Kisil

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## Geometry of Möbius Transformations: Elliptic, Parabolic and Hyperbolic Actions of $SL_2(\mathbb{R})$ By Vladimir V. Kisil

This book is a unique exposition of rich and inspiring geometries associated with Möbius transformations of the hypercomplex plane. The presentation is self-contained and based on the structural properties of the group  $SL_2(\mathbb{R})$ . Starting from elementary facts in group theory, the author unveils surprising new results about the geometry of circles, parabolas and hyperbolas, using an approach based on the Erlangen programme of F Klein, who defined geometry as a study of invariants under a transitive group action.

The treatment of elliptic, parabolic and hyperbolic Möbius transformations is provided in a uniform way. This is possible due to an appropriate usage of complex, dual and double numbers which represent all non-isomorphic commutative associative two-dimensional algebras with unit. The hypercomplex numbers are in perfect correspondence with the three types of geometries concerned. Furthermore, connections with the physics of Minkowski and Galilean space-time are considered.

Readership: Undergraduate and graduate students in geometry and algebra.

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The treatment of elliptic, parabolic and hyperbolic Möbius transformations is provided in a uniform way. This is possible due to an appropriate usage of complex, dual and double numbers. They form three possible commutative associative two-dimensional algebras, which are in perfect correspondences with the three types of geometries concerned. Furthermore, connections with the physics of Minkowski and Galilean space-time are considered.

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