Title:	Structural aspects of planar braid groups
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Abstract:	Artin braid groups are celebrated objects which appear in and affix several areas of mathemat- ics and theoretical physics. A geometric interpretation given by Artin in his pioneering work in the 1920s, which captures the behaviour of intertwined strings in the Euclidean 3-space, has led to a deeply rooted connection with links in the 3-space. Since then the theory has been ramified by topologists and algebraists both. This naturally leads to a question of how the strings would intertwine if considered on a plane, and how it can be signified algebraically. The thesis explores this direction and presents a detailed investigation of structural aspects of planar braid groups and their (higher genus) virtual analogues. Study of certain isotopy classes of a finite collection of immersed circles (called doodles on surfaces) without triple or higher intersections on closed oriented surfaces is considered as a planar analogue of virtual knot theory with the genus zero case corresponding to the classical knot theory. In the case of doodles on the 2-sphere, the role of groups is played by a class of right-angled Coxeter groups called twin groups. For the higher genus case in the virtual setting, the role of groups is played by a new class of groups called virtual twin groups. We give a topological description of virtual twin groups and establish Alexander and Markov theorems for oriented virtual doodles. This paves a way for constructing invariants for doodles on surfaces. We investigate structural aspects of (pure) virtual twin groups in detail. More precisely, we obtain a presentation of the pure virtual twin group and deduce that it is an irreducible right-angled Artin group. We then prove that pure virtual twin groups can be written as iterated semidirect products of infinite rank free groups. Consequently, it follows that pure virtual twin groups have trivial centers, which confirms a well-known conjecture about triviality of centers of irreducible non-spherical Artin groups. We also compute the automorphism group of pure virtual twin groups in full generality and give applications to twisted conjugacy. We investigate the conjugacy problem in twin groups and derive a formula for the number of conjugacy classes of involutions, which, quite interestingly, is related to the well-known Fibonacci sequence. We also investigate z-classes in twin groups and derive a recursive formula for the number of z-classes of involutions. Finally, we determine automorphism groups of twin groups and give applications to twisted conjugacy
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