Automated Production of Readable Proofs for Theorems in Euclidean Geometry — proverGCLC & GeoThms

Pedro Quaresma
Department of Mathematics
University of Coimbra, Portugal
&
Predrag Janičić
Faculty of Mathematics
University of Belgrade, Serbia & Montenegro

Proofs in Euclidean Geometry can be synthetic proofs, i.e., traditional proofs, or algebraic proofs. For the latter, a geometric construction is expressed in terms of some algebraic quantities and then some property related to the construction is proved by algebraic methods.

The algebraic approach proved already to be very successful — from the quantifier elimination method of Tarski, to the Wu's method and the Gröbner Basis method, many, very efficient, provers have been developed. All these methods don't reflect the constructive nature of the problems, are unrelated to any geometric method, and the proofs have only a yes/no conclusion.

A traditional geometric proof reflects the constructive nature of the problem, uses geometric methods and it is human readable. The automatization of the area method by Chou et. al. gives us the possibility of developing efficient provers capable of producing short and readable proofs for many geometric theorems.

In this talk, we will present the area method and an implementation of it, the *proverGCLC*, a prover under development, but already capable of proving many complex geometric theorems. We also present *GeoThms* — a data base of geometric theorems aiming to provide a common repository of theorems and proofs in the area of constructive problems in Euclidean Geometry. This theorem prover and this database, together with dynamic geometry programs, such as GCLC or Eukleides, will constitute a framework for describing geometry constructions, visualising them, storing and searching them, proving properties about constructions, studying geometry, etc.