Isomorphisms of maps on the sphere
Abstract

For a class of objects with a well-defined isomorphism relation the
isomorphism problem asks to determine the algorithmic complexity of the
decision whether two given objects are, or are not, isomorphic. Theorems
by Steinitz (1916), Whitney (1933) and Mani (1971) show that the
isomorphism problems for polyhedra, for 3-connected planar graphs, and
for the spherical maps are closely related. In 1974, Hopcroft and Wong
investigated the complexity of the graph isomorphism problem for
polyhedral graphs. They published an extendended abstract giving a
sketch of an algorithm solving the problem in linear time.
Unfortunately, a paper contating full description of important details
together with proof was never published.

We describe a modied linear-time algorithm solving the isomorphism
problem for spherical maps based on the approach by Hopcroft and Wong.
We include a detailed description of the algorithm. Moreover, our
modied algorithm allows to determine (in linear time) the group of
orientation-preserving symmetries of a spherical map. By Mani's theorem
it is a discrete group of isometries of the sphere. Several
generalisations and applications will be discussed. Among others we are
able to generalise the algorithm to maps of genus g. In combination with
a recent result by Kawarabayashi, it proofs that the isomorphism problem
for graphs of genus g can be solved in a linear time.

This is a joint work with B. Mohar, K. Kawarabayashi, P. Klavik and P.
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