

A Log^* -Time Local MDS Approximation Scheme for Bounded Genus Graphs

Saeed Akhoondian Amiri
Stefan Schmid

Technische Universität Berlin
DISC 2016

Complexity of Dominating Set Problem in Classical and Local Model

- 1 Classical model : PTAS for planar graphs and graphs of excluded minor [Baker 1994, Grohe 2003].
- 2 Finding dominating sets locally is hard [Kuhn et al].
- 3 No deterministic local algorithm with approximation factor $7 - \epsilon$ for planar graphs in $O(1)$ communication rounds [Hilke et al.].
- 4 $O(1)$ -approximation in $O(1)$ -communication rounds for planar graphs [Lenzen et al.].
- 5 Fast distributed approximations in planar graphs [Czygrinow et al]

Our Progress On Distributed Dominating Sets Problem

First we extended Lenzen et al.'s result:

Amiri, Schmid, Siebertz PODC 2016

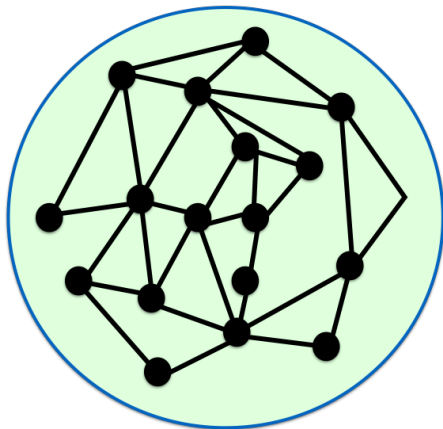
The minimum dominating set problem is constant factor approximable in graphs of bounded genus in the local model and using $O(1)$ communication rounds.

Then we generalised Czygrinow et al.'s result:

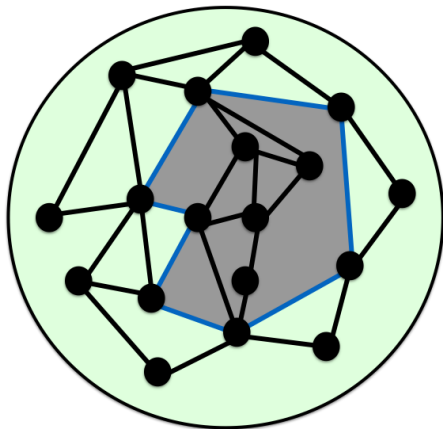
Amiri, Schmid BA at DISC 2016

The minimum dominating set problem admits $1 + \epsilon$ approximation algorithm in graphs of bounded genus in $O(\log^*|G|)$ communication rounds.

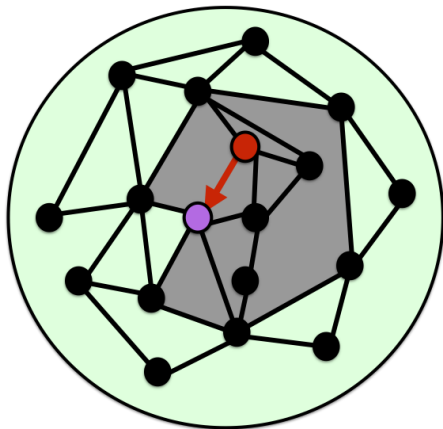
Observations and Challenges for Domset Problem in Bounded Genus Graphs



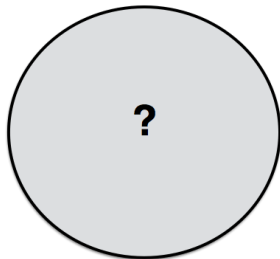
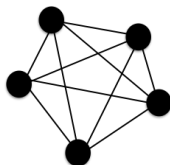
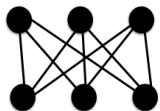
Observations and Challenges for Domset Problem in Bounded Genus Graphs



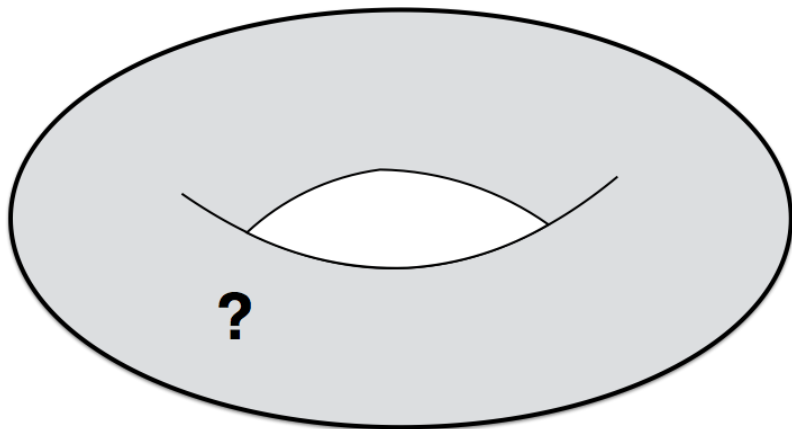
Observations and Challenges for Domset Problem in Bounded Genus Graphs



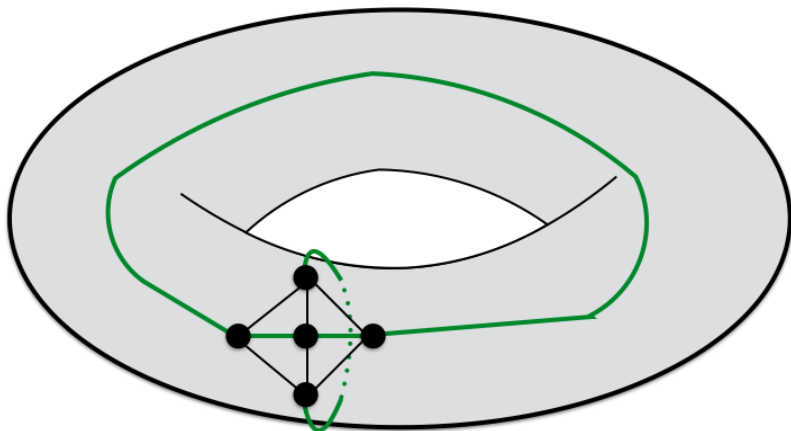
Observations and Challenges for Domset Problem in Bounded Genus Graphs



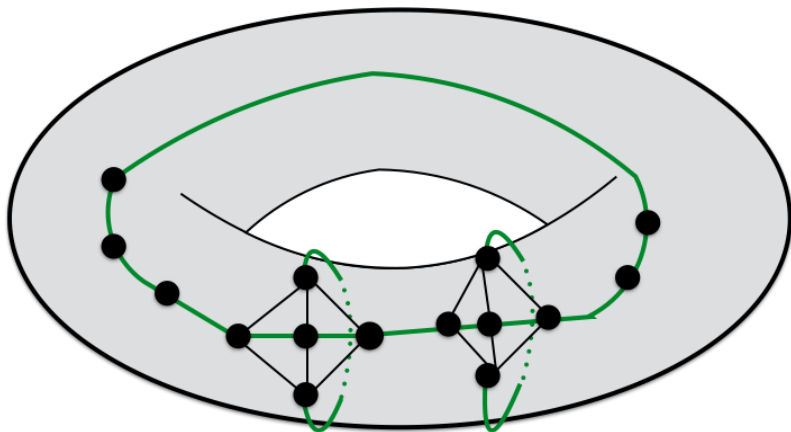
Observations and Challenges for Domset Problem in Bounded Genus Graphs



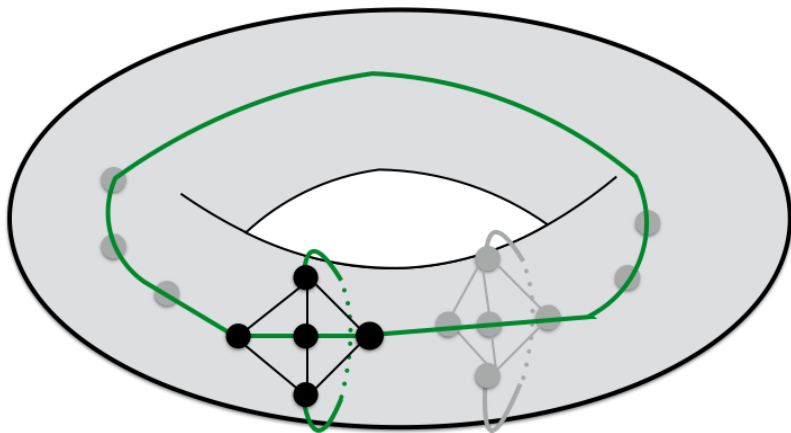
Observations and Challenges for Domset Problem in Bounded Genus Graphs



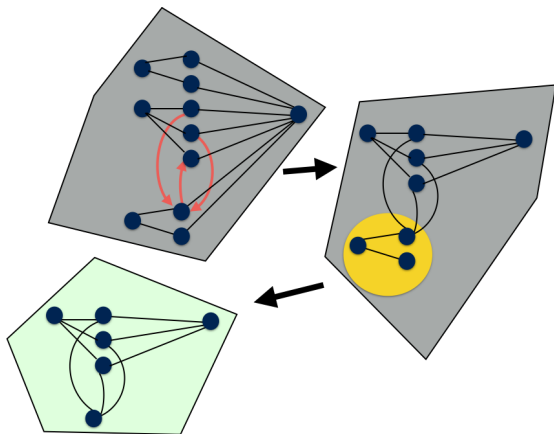
Observations and Challenges for Domset Problem in Bounded Genus Graphs



Observations and Challenges for Domset Problem in Bounded Genus Graphs



Observations and Challenges for Domset Problem in Bounded Genus Graphs



Observations at a Glance

- 1 Unlike planar graphs, not every simple cycle is a separator.
- 2 We cannot rely on non-contractible cycles. They can be long.
- 3 But there are not many disjoint $K_{3,3}$ models.
- 4 By a nice combinatorial argument (locally planar graphs) we can show that MDS is constant factor approximable in bounded genus graphs.
- 5 Having constant factor approximation and Czygrinow et al. [2008] forest decomposition in hand, with some modification and topological arguments we can show that MDS can be well approximated in graphs of bounded genus.
- 6 Basic technique for proving the latter bounds is similar to Baker's very early argument.
- 7 It is possible to show that MDS approximation algorithm is FO definable.

Thank you