

ESF short visit grant: scientific report

Gregor Jerše and Neža Mramor-Kosta

The Faculty of Computer and Information Science
University of Ljubljana
Ljubljana, Slovenia

{gregor.jerse,neza.mramor}@fri.uni-lj.si

October 14, 2013

There is a strong research cooperation between Gregor Jerše and Neža Mramor Kosta from the Faculty of Computer and Information Science, University of Ljubljana and the topology research group at the Mathematics department of the Universidad de Sevilla, which lasts already for several years on the topic of discrete Morse theory and has resulted in a number of joint research results. The topology group in Sevilla specializes in dealing with discrete vector fields on infinite simplicial complexes ([2], [1]). Our collaboration resulted in one published paper [4] and several papers which are still work in progress. The goal of this visit was joint work on a paper with working title *Discrete Morse theory through Matching theory* which connects discrete gradient vector fields on infinite locally finite simplicial complexes with matching theory on infinite graphs, a topic which was first researched in [5].

During the visit we have thoroughly rewritten the paper and added some new results on canceling in infinite complexes, in particular from the point of view of Morse matchings on the Hasse diagram. New implications on the topological side have been found and new the results concerning optimizing discrete Morse functions by canceling have been expanded and improved. The results have been to a great extent written up and we expect that a final version of the paper will be ready within a month.

We find that the visit has been very constructive and the paper under work has been substantially improved due to the possibility of working together. We are planning further collaboration with the host institution, especially

with José A. Vilches Alarcón, who is planning to make a short visit to Ljubljana next spring.

References

- [1] R. Ayala, L.M. Fernández, J.A. Vilches, Discrete Morse inequalities on infinite graphs, *The Electronic Journal of Combinatorics*, <http://eudml.org/doc/117502> .
- [2] R. Ayala, L.M. Fernández, J.A. Vilches, Morse inequalities on certain infinite 2-complexes, *Glasg. Math. J.* **49** (2) (2007), 155–165.
- [3] R. Ayala, D. Fernández-Ternero and J.A. Vilches, A graph-theoretical approach to cancelling critical elements, *Electron. Notes Discrete Math.* **37** (2011), 285–290.
- [4] R. Ayala, N. Mramor-Kosta, G. Jerše and J. Vilches. Discrete gradient fields on infinite complexes. *Discrete Contin. Dyn. Syst. Ser. A* **30** (3) (2011), 623–639.
- [5] M. K. Chari, On discrete Morse functions and combinatorial decompositions, *Discrete Math.* **217** (1–3) (2000), 101–113.