



Assignment of bachelor's thesis

Title: NAC-colorings search: complexity and algorithms
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Instructions

A framework, which is a graph together with a realization of its vertices in the plane, is called flexible if it can be continuously deformed while maintaining the distances between adjacent vertices. It is known that a connected graph admits a flexible framework if and only if it has a so called NAC-coloring [1]. The existence of NAC-colorings is known to be NP-complete [2].

The tasks of the student are:

- Study the basics of rigidity theory, especially the existence of flexible realizations [1,2].
- Try to show that the existence of a NAC-coloring is NP-complete on graphs with maximum degree five.
- Design and implement an algorithm to find one/all NAC-colorings of a given graph and compare its performance with the FlexRiLoG package [3].

[1] G. Grasegger, J. Legerský, and J. Schicho. Graphs with Flexible Labelings. *Discrete & Computational Geometry*, pages 461–480, 2019.

[2] D. Garamvölgyi. Global rigidity of (quasi-)injective frameworks on the line. *Discrete Mathematics*, 345(2):112687, 2022. doi:10.1016/j.disc.2021.112687.

[3] G. Grasegger and J. Legerský. FlexRiLoG — A SageMath Package for Motions of Graphs. In A. M. Bigatti, J. Carette, J. H. Davenport, M. Joswig, and T. de Wolff, editors, *Mathematical Software – ICMS 2020*, volume 12097 of *Lecture Notes in Computer Science*, pages 442–450, 2020. doi:10.1007/978-3-030-52200-1_44.