

Discrete Morse theory for moduli spaces of flexible polygons, or solitaire game on the circle

Gaiane Panina, St. Petersburg Department of Steklov Institute of Mathematics RAS (PDMI)

Robin Forman's discrete Morse theory is a very powerful technique (at least as powerful as the smooth Morse theory is): it allows to compute homologies, cup-product, Novikov homologies, develop Witten's deformation of the Laplacian, etc.

In the talk we demonstrate how it works: we build a perfect discrete Morse function on the moduli space of a flexible polygon.

The starting point of our construction is a cellulation of the moduli space of a planar polygonal n -linkage. Its cells are labeled by some cyclically ordered partitions of the set $[n]=\{1,\dots,n\}$. The number of cells is big: it exceeds the sum of Betti numbers very much.

The discrete perfect Morse function is constructed in two steps. On the first step, we introduce some natural pairing on the cell complex which substantially reduces the number of critical cells. However, this number is not yet minimal possible. On the second step we (following once again R. Forman) apply a path reversing technique (a discrete version of Milnor's "First Cancellation Theorem") which gives a perfect Morse function.

This is a joint work with Alena Zhukova, St. Petersburg State University.