

REPORT ON SHORT VISIT 5432 ESF-RNP-ACAT

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1. PURPOSE OF THE VISIT

The main purpose of my 4 days visit to the Faculty of Mathematics, Informatics and Mechanics at Warsaw University was to continue ongoing collaboration with Dr. Krzysztof Ziemiański. Ziemiański had visited Dr. Fajstrup and me at Aalborg a year ago, mainly to report on his findings in the article *A cubical model for path spaces in d -simplicial complexes* that has meanwhile appeared in *Topology Appl.* 159 (2012), 2127 – 2145 (with acknowledgement of ESF-support). This visit was the start of a collaboration between Ziemiański and me that we wished to carry on “face to face”.

2. DESCRIPTION OF THE WORK CARRIED OUT DURING THE VISIT

To start with, I gave a 90 minutes talk entitled Spaces of directed paths as simplicial complexes at the Algebraic Topology Seminar at Warsaw University. On the last day of my stay, I had the pleasure to follow a talk by prof. Józef Przytycki in that seminar.

The remaining part of my visit was occupied by two activities:

- a revision of the draft of a joint paper with Ziemiański (Sections 3 and 5)
- discussions about several new topics of common scientific interest (Section 3).

3. DESCRIPTION OF THE MAIN RESULTS OBTAINED

We went through a draft of a joint article entitled *Homology of spaces of directed paths on Euclidean cubical complexes* and implemented a long list of improvements and corrections of small errors. The draft is now almost final and will be submitted very soon.

The remaining time was spent on discussions of various topics of common interest. The last of them seems to be new and interesting; it came up as a side result of discussions on different topics:

- The algorithm describing a combinatorial/topological model of path spaces (execution spaces for concurrently running programs) from my paper *Simplicial models of trace spaces* consumes in many cases too much time and/or memory. We discussed various ways to structure the information in a more economical way hopefully leading to both a better understanding and to much faster algorithms.
- We started to investigate path spaces on directed spaces modelled on cubical (rather than pre-cubical) sets, allowing for degeneracies. Results seem to be in range, at least in the most simple cases.

- The models considered so far do not take advantage of various *arities* of semaphore mutex models. Translated into mathematical terms, one needs to understand, first of all, spaces of directed paths on *skeleta* (of various dimensions) of cubes. We carried out investigations of several examples suggesting results based on recursive methods.

4. FUTURE COLLABORATION WITH HOST INSTITUTION

Ziemiański and I will certainly carry on our current collaboration; our competencies supplement each other well. Apart from electronic contact, several conferences this year will allow us to devote a little time to join research efforts. Concerning the last item in Section 3, we plan to involve also Dr. Ottosen from Aalborg University (currently working in Copenhagen) who has started to work on path spaces for semaphore mutex models.

Dr. Ziemiański told me that he plans to invite my colleague Dr. Fajstrup from Aalborg University to visit him at Warsaw University in the near future in order to follow up on subjects of common interest.

5. PROJECTED PUBLICATIONS

As mentioned in Section 2 and 3, we plan to submit a joint paper *Homology of spaces of directed paths on Euclidean cubical complexes* to a mathematical journal in the near future (deadline: end of March 2013). ESF support will be duly acknowledged in the paper.

We are optimistic that the discussions carried out in Warsaw will lead to further research publications in the future.

6. OTHER COMMENT

The collaboration between Dr. Ziemiański and me would have been much more difficult to establish without the support from the ESF-ACAT network that we are really very grateful for.

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