Research Networking Programmes

Short Visit Grant ☒ or Exchange Visit Grant ☐

(please tick the relevant box)

Scientific Report

The scientific report (WORD or PDF file – maximum of eight A4 pages) should be submitted online within one month of the event. It will be published on the ESF website.

Proposal Title: GETCO conference and visit to Martin Raussen and Lisbeth Fajstrup

Application Reference N°: 7118

1) Purpose of the visit

The aim of the visit is to participate to the GETCO conference and to work with Martin Raussen and Lisbeth Fajstrup at Aalborg university. First, GETCO is a conference which focuses on applications of algebraic topology in computer science and data analysis. It is aimed at mathematicians and computer scientists working in or interested in these subjects. The aim of the conference is to exchange ideas and to initiate or expand research collaboration. So it is the perfect setting to learn from confirmed researchers of the field and to present the current work of my PhD thesis on directed homology. This will be followed by a week of collaboration with Martin Raussen and Lisbeth Fajstrup, the organizers of GETCO at Aalborg university. Indeed, my current research is based on the work of Martin and Lisbeth on trace spaces, cubical sets and directed analogue of topological spaces, to name a few. We will, therefore, share our thoughts on our common issues on the use of homological methods on geometric semantics of truly concurrent systems.

2) Description of the work carried out during the visit

During the first week of my stay took place the GETCO conference. This was the occasion to follow some presentations about the current issues in directed algebraic topology but also to present my current work of my PhD thesis thanks to a poster session, during which I was able to exchange thoughts with confirmed researchers.

The second week was dedicated to collaborate with Martin Raussen and Lisbeth Fajstrup, two of the organisers of the GETCO conference in Aalborg university. We organized meeting during which we presented our current issues or ideas on subjects we are instrested in and exchange our thoughts on it.

3) Description of the main results obtained

We investigate mainly three subjects :

- first, a triality between three well-known notions that appear in different fields : the trace space, space of directed paths modulo reparametrization, well-known in directed algebraic topology ; the configuration space, space of the configurations of a definite number of entities, for example, n particules in a space, well-known in physics and robotics ; the generalized moment angle complex, space constructed by glueing some space in a nice way, well-known in topology. We were interested in seeing trace spaces in a more compact/suitable way by proving that they are homotopically equivalent to some configuration space and generalized moment angle complex.
- second, a notion of bisimulation on Ab-valued functors that I introduced with my coauthors to compare natural systems of homology. This led us to a natural notion of dihomotopy equivalence, notion that is not so clear in directed algebraic topology, but fundamental for our future work.
- third, a counter-example to lots of intuitions we could have in the domain. This is intuitively a space which is formally without loop, but have a hidden loop. For example, this says that my results on a discrete natural homology cannot be generalized to any precubical set or that there are finitely presented non-looping spaces in which the category of components are not so easy to describe.

4) Future collaboration with host institution (if applicable)

We wish to continue our collaboration especially on the triality. We have a promising plan to prove this homotopy equivalence that may lead to new horizons on our study of trace spaces, but also of configuration spaces and generalized moment angle complexes.

5) **Projected publications / articles resulting or to result from the grant** ***(ESF must be acknowledged in publications resulting from the grantee's work in relation with the grant)***

6) Other comments (if any)