Short-Term Scientific Mission Grant
- APPLICATION FORM[1] -

Action number: CA20111

Applicant name: José Espírito Santo

Details of the STSM

Title: Coinductive proof search for inhabitation of quantitative types

Start and end date: 21/05/2023 to 27/05/2023

Goals of the STSM

To apply the coinductive proof search methodology [1], developed before for simple types, to proof systems with quantitative types, that is, non-idempotent intersection types.

Working Plan

Description of the work to be carried out by the applicant.

We plan to start with the type system N for call-by-name lambda calculus [2]. We anticipate some questions to be addressed:

a) Coinductive proof search was developed for proof systems obeying the focusing discipline [1,3]. How well does it cope with programs written in more liberal syntaxes?

b) If we want to move to a call-by-value language, should we restart the study, or should we attempt a unifying approach, as in [2]?

[1] J. Espírito Santo, R. Matthes, L. Pinto, A coinductive approach to proof search through typed lambda-calculi, Annals of Pure and Applied Logic, vol. 172(10), 2021

[1] This form is part of the application for a grant to visit a host organisation located in a different country than the country of affiliation. It is submitted to the COST Action MC via e-COST. The Grant Awarding Coordinator coordinates the evaluation on behalf of the Action MC and informs the Grant Holder of the result of the evaluation for issuing the Grant Letter.

[2] V. Arrial, G. Guerrieri, D. Kesner, Quantitative inhabitation for different lambda calculi in a unifying framework, Proc. ACM Programming Languages, Vol 7 (POPL), 2023

[3] J. Espírito Santo, R. Matthes, L. Pinto, Coinductive Proof Search for Polarized Logic with Applications to Full Intuitionistic Propositional Logic, Proc. 26th International Conference on Types for Proofs and Programs, LIPICS vol. 188, 2020

Expected outputs and contribution to the Action MoU objectives and deliverables.

The main expected result for the mission is a decision procedure for the inhabitation problem relative to the type system N with quantitative types for call-by-name lambda-calculus, obtained according to the methodology of coinductive proof search.

This STSM will directly contribute to the objectives of WG3 on program verification, specifically to the task "strengthen traditional techniques for program verification" mentioned on pg. 15 of the MoU. The foundation of our work is type theory and its double reading as a theory about proofs of propositions, and about programs meeting specifications. Specifically, the problem of searching for the inhabitants of a proposition may be read as a problem of program synthesis. Our contribution to the strengthening of verification techniques is twofold. First, because we propose to deal with specifications written with quantitative types, as opposed to the qualitative types employed in mainstream verification, logics and tools (this is also an indirect contribution to the general goal of boosting the usability of proof systems). Second, because we intend to apply a methodology developed for proof search to a problem of program verification (this kind of transfer at the theoretical level is beneficial for the goal of interoperability of proof systems).