

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA20111

Grantee name: Horatiu Cheval

Details of the STSM

Title: Domain theory for program verification in Lean

Start and end date: 10/06/2024 to 15/06/2024

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

(max. 500 words)

I had daily meetings with Vlad Rusu and his collaborator David Nowak, during which we discussed our article “Formal definitions and proofs for partial (co)recursive functions” resulting from my previous STSM, which, at that time, required revisions in order to be published. We addressed the reviewer commentaries, producing the final version of our paper.

We also compared some technical differences between the Lean and Coq formalizations that we developed since the previous STSM, like in the use of typeclasses or of partial containers. We also discussed some potential future extensions of our work in formulating domain-theoretical encodings of coinductive types and partial (co)recursive functions to cover more cases, like mutual inductive-coinductive types. Furthermore, we went over future applications of our representation of while loops to define and reason about imperative programs.

Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described

¹This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

in this section.

(max. 500 words)

We wrote the final revised version of our paper “H. Cheval, D. Nowak and V. Rusu. Formal definitions and proofs for partial (co)recursive functions. Journal of Logical and Algebraic Methods in Programming, Vol. 141, 2024, doi.org/10.1016/j.jlamp.2024.100999”, which also appeared after the end of the STSM. We will continue our collaboration, trying to implement extensions of our approach to mutual inductive-coinductive types, particularly extending the notion of partial containers that we have previously introduced and used. We also have a partial Lean implementation of a user interface for defining coinductive types that we plan to continue working on.