

## Short-Term Scientific Mission Grant - APPLICATION FORM<sup>1</sup> -

**Action number: CA20111**

**Applicant name: Horatiu Cheval**

### **Details of the STSM**

Title: Domain theory for program verification in Lean

Start and end date: 04/09/2023 to 10/09/2023

### **Goals of the STSM**

Purpose and summary of the STSM.

*(max.200 word)*

Both Dr. Rusu and I are members of the Working Group 3, having an interest in interactive theorem proving for program verification. My main expertise here is in Lean, while Dr. Rusu is an expert in the Coq proof assistant. The goal of this STSM is to discuss and start the implementation in Lean of a library for partial order theory and domain theory with applications to program verification, building on work Dr. Rusu and his collaborators have done in Coq. This is intended to contribute to deliverable D8 of WG3: Technique for syntax-semantics interface for program verification with/without type systems.

### **Working Plan**

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

*(max.500 word)*

We will discuss the work that Dr. Rusu and his team at INRIA have done using Coq in relation to the described goal of the STSM. With the help of his experience in the field, we will also begin working on a Lean implementation of partial order theory and domain theory for program verification, aiming to best exploit the features that distinguish Lean from Coq. In particular, Lean supports a rich metaprogramming framework but lacks coinductive types, and as such, the domain theory library we will implement, combined with these metaprogramming capabilities shall provide a way to introduce coinductives in Lean, which are useful for program verification, especially for reasoning about nonterminating programs.

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

Main expected results and their contribution to the progress towards the Action objectives (either

<sup>1</sup> 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.

research coordination and/or capacity building objectives) and deliverables.

*(max. 500 words)*

The STSM will provide the start of a collaboration with Dr. Rusu in the field of interactive theorem proving for program verification, in particular in the formalization of partial order theory and domain theory in Lean. Furthermore, the library we will implement will be used for creating a framework for defining coinductive types and reasoning about nonterminating programs in Lean. This will contribute to deliverable D8: Technique for syntax-semantics interface for program verification with/without type systems.