



2022-04898 - PhD Position F/M Automated Reasoning for Set Theory

Type de contrat : CDD
Niveau de diplôme exigé : Bac + 5 ou équivalent
Fonction : Doctorant

Contexte et atouts du poste

Team
VeriDis, INRIA Nancy Grand-Est, <https://team.inria.fr/veridis/>

Contacts
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This PhD position is funded by the ANR project BLASST (Enhancing B Reasoners with SAT and SMT Techniques).

Mission confiée

Context

The B method is a formalism based on set theory that targets the development of software systems used in critical applications, subject to stringent certification requirements. It defines proof obligations that ensure the preservation of invariants or the correctness of refinements between models described at different levels of abstraction, and these proof obligations must be discharged for a model to be accepted as valid.

The application of the B method is supported by Atelier B, maintained by the Cleary company, a platform that contains several engines for automatic proof. In a recent experiment, among the roughly 77,000 proof obligations of a representative industrial development project, 64% were proved automatically, leaving 28,000 obligations to be proved by human interaction. Also, no significant feedback is provided in case an obligation cannot be proved. Given recent advances in automated theorem proving, we believe that the number of proof obligations that can be discharged automatically can be improved significantly, and that tools can help users by explaining why certain obligations cannot be proved.

The ANR project BLASST aims at bridging combinatorial and symbolic techniques in automatic theorem proving, in particular for proof obligations arising from models written in the B formalism. Work will be carried out on SAT-based techniques as well as on more expressive SMT formalisms. In both cases, encoding techniques, optimized resolution techniques, model generation, and lemma suggestion will be considered. Combining both lines of work, the expected scientific impact is a substantially higher degree of automation of solvers for expressive input languages by leveraging higher-order reasoning and enumerative instantiation over finite domains. The effectiveness of the techniques developed in the project will be evaluated by applying them to benchmark sets provided by the industrial partner.

BLASST brings together academic experts in automated reasoning techniques (CRIL, Inria Nancy, and the University of Liège) and the Cleary company, a leader in the application of formal methods to the design of critical systems, in a 4-year effort that aims to provide a breakthrough in formal verification applied to software design.

Principales activités

Project description

Automated deduction has made significant progress in recent years, including the development of efficient SAT and SMT solvers, and the extension of first-order deduction techniques to fragments of higher-order logic.

The core objective of the thesis is to make these advancements available for system developments in the B method. Concretely, we believe that higher-order logic allows for a much more direct encoding of proof obligations expressed in a language of set theory than existing translations to first-order logic. This should be beneficial for developing specific instantiation techniques that can recognize frequent patterns that arise in B specifications, significantly raising the degree of automation.

A second objective of the thesis is the design of techniques for constructing counter-models in order to provide feedback when a proof fails. Since B models written for industrial developments often contain restrictions to finite-state domains, a stronger integration of SAT solving, beyond just handling the propositional structure of formulas, appears to be beneficial for this objective, as well as for proofs by enumeration.

The thesis will be carried out at the Inria research center in Nancy, France, in close collaboration with the partners of the BLASST project. The expected starting date is September 1 or October 1, 2022, but a later starting date can be agreed upon.

Compétences

Required qualifications

The candidate must hold (or be about to obtain) a Master degree in computer science. Candidates should have solid knowledge in mathematical logic and preferably in automated reasoning techniques. Experience with formal methods such as B, Alloy, TLA+ or Z would be a plus. The candidate should have mastered a mainstream programming language such as C++, Java or OCaml.

Language

English or French

Avantages

Informations générales

- **Thème/Domaine** : Preuves et vérification
- **Ville** : Villers lès Nancy
- **Centre Inria** : CRI Nancy - Grand Est
- **Date de prise de fonction souhaitée** : 2022-10-01
- **Durée de contrat** : 3 ans
- **Date limite pour postuler** : 2023-01-31

Contacts

- **Equipe Inria** : VERIDIS
- **Directeur de thèse** :
Merz Stephan / Stephan.Merz@loria.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3500 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 180 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

Application deadline

June 30, 2022 (Midnight Paris time)

How to apply

Upload your application on jobs.inria.fr in a single pdf or zip file, and send it as well by email to stephan.merz@loria.fr. Your file should contain the following documents:

- Your CV.
- A cover/motivation letter describing your interest in this topic.
- A short (max one page) description of your Master thesis (or equivalent) or of the work in progress if not yet completed.
- Your degree certificates and transcripts for Bachelor and Master (or the last 5 years).
- Master thesis (or equivalent) if it is already completed and publications if any (it is not expected that you have any). Only the web links to these documents are preferable, if possible.

In addition, one recommendation letter from the person who supervises(d) your Master thesis (or research project or internship) should be sent directly by his/her author to stephan.merz@loria.fr.

Applications are to be sent as soon as possible. Informal enquiries about the position are welcome by email to stephan.merz@loria.fr and sophie.tourret@loria.fr.

Consignes pour postuler

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Rémunération

Salary: 1982€ gross/month for 1st and 2nd year. 2085€ gross/month for 3rd year.

Monthly salary after taxes : around 1596,05€ for 1st and 2nd year. 1678,99€ for 3rd year

recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.