2019-01498 - Post-Doctoral Research Visit F/M PostDoc Campaign 2019
Non-smooth modeling and simulation of block breakage processes during rockfall.

Type de contrat : CDD de la fonction publique
Niveau de diplôme exigé : Thèse ou équivalent
Fonction : Post-Doctorant

A propos du centre ou de la direction fonctionnelle
Grenoble Rhône-Alpes Research Center groups together a few less than 800 people in 35 research teams and 9 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

Contexte et atouts du poste
TRIPOP is a joint research team of Inria Grenoble Rhône-Alpes and of the Laboratoire Jean Kuntzmann and started in January 2018 as a follow up of the BIPOP team. The team is mainly concerned by the modeling, the simulation and the control of nonsmooth dynamical systems. Nonsmooth dynamics concerns the study of the time evolution of systems that are not smooth in the mathematical sense, i.e., systems that are characterized by a lack of differentiability, either of the mappings in theirs formulations, or of theirs solutions with respect to time. In mechanics, the main instances of nonsmooth dynamical systems are multibody systems with Signorini’s unilateral contact, set-valued (Coulomb-like) friction and impacts, or in continuum mechanics, ideal plasticity, fracture or damage. The members of the team have a long experience of nonsmooth dynamics modeling together with the development of simulation software. With the integration of Franck Bourrier as a new research member, a part of the activities of the theme is now focused in rockfall trajectory modeling and natural hazard mitigation.

Mission confiée
Rockfall is one of the most common natural hazards in mountainous regions. The assessment of this hazard, related with block detachment conditions and propagation, is essential for mitigation strategies that include hazard zones determination and protection structures design.

Block trajectory simulation models are routinely used for the quantitative assessment of rockfall hazard. In these models, one of the major difficulties is the development of physically consistent and field applicable approaches to model the interaction between the block and the natural terrain. The models either consider the block as a single material point or explicitly account for the fragment shape. The first approach, although largely empirical, has been extensively investigated and calibrated. Consequently, it is efficient for global hazard zoning purposes because of its reduced number of input parameters and its computational efficacy. However, it remains limited for a detailed analysis of the propagation process with the objective of designing protection structures. The second type of approaches, that explicitly accounts for the fragment shape, is either based on regularized Discrete Element Methods (DEM) or on nonsmooth contact dynamics methods. These approaches have not yet been extensively investigated and calibrated. They remain based on simple models of block interaction with the terrain that only partially integrate the energy dissipation processes. As a consequence, they remain almost not used in practice.

References

Principales activités
The objective of this post-doc is to improve the modeling of the dissipation processes occurring during the propagation of blocks through mountain slopes. These processes are related with momentum exchanges, friction at the interface, wave propagation through the soil, visco-plastic strains of the soil and the breakage of the rock. The novelty will consist in the development of contact laws with rolling friction, and with the integration of rock breakage due to impact.

The different phases of the post-doc will be:
Literature review. This review will focus on the modeling approaches potentially usable for the integration of the dissipation processes during the impact of a block on a soil, modeling of contact law with rolling friction and of block breakage.

Formulation and numerical implementation of a novel contact law integrating rolling friction in the framework of second-order cone complementarity.

Modeling of block breakage. The approach proposed will be based on the modeling of the block as an assembly of rigid or deformable tetrahedron linked by cohesive contact laws. The challenge relies on the implementation of relevant cohesive contact laws, able to reproduce at the macroscopic level the main fracture phenomena.

Compétences
The postdoc candidate should have competences in solid mechanics and numerical modeling. A strong theoretical background in solid mechanics is mandatory. Furthermore, the applicant must show a strong interest for software development in computational Mechanics. He also has to be motivated by applied research in collaboration with researchers from different disciplines. A good level of English and subsequent writing capacities are also requested.

Avantages
- 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
Gross salary: 2 653 Euros per month.

Informations générales
- Thème/Domaine : Optimisation et contrôle de systèmes dynamiques
- Calcul Scientifique (BAP E)
- Ville : Montbonnot
- Centre Inria : CRI Grenoble - Rhône-Alpes
- Date de prise de fonction souhaitée : 2019-10-01
- Durée de contrat : 1 an, 4 mois
- Date limite pour postuler : 2019-04-28

Contacts
- Equipe Inria : TRIPOP
- Recruteur : Acary Vincent / vincent.acary@inria.fr

A propos d'Inria
Inria, the institute national de recherche dédié aux sciences du numérique, promote the excellence scientific and le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3000 scientifiques pour relever les défis des sciences informatiques et mathématiques, souvent à l'interface d'autres disciplines. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 160 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.

Consignes pour postuler
Starting date: 1st October 2019, duration: 16 months.

Applicants should hold a PhD defended after 1st September 2017.

Applications have to be made on-line on the Inria web site before end of 28th April 2019.

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 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.