Offre n°2025-08849

Post-Doctoral Research Visit F/M Multiscale numerical methods for nonlinear problems in geosciences

Le descriptif de l'offre ci-dessous est en Anglais

Niveau de diplôme exigé : Thèse ou équivalent

Fonction : Post-Doctorant

A propos du centre ou de la direction fonctionnelle

The Inria centre at Université Côte d'Azur includes 42 research teams and 9 support services. The centre's staff (about 500 people) is made up of scientists of di?erent nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regiona economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Contexte et atouts du poste

Every year Inria International Relations Department has a few postdoctoral positions in order to support Inria international collaborations.

This offer is part of the newly formed associate team GEM3 between the IPES research team (http://ipes.lncc.br/) at LNCC/Brazil and the Galets Project Team at

the Inria Center at Université Côte d'Azur. The associate team is focussed on development and analysis of multiscale numerical methods for elliptic and parabolic partial differential equations (PDEs) arising in surface and subsurface geophysics. Ranging from modeling floods in realistic urban environments to subsurface CO2 storage, the applications addressed by the associate team are characterized by their geometrical complexity and strong nonlinear couplings. This motivates our focus on multiscale discretization methods with a particular emphasis on the treatment of nonlinear problems.

The postdoctoral contract will have a duration of 12 to 24 months. The default start date is November 1st, 2025 and not later than January, 1st 2026. The postdoctoral fellow will be recruted by the Inria center at Université Côte d'Azur France but will be jointly supervised by French and Brazilian members of GEM3 team and will be expected to carry out multiple research visits to Brazil.

Mission confiée

Unlike the traditional finite element method, which relies on an explicitly given approximation space (typically piecewise polynomial), in multiscale numerical methods the approximation space is driven numerically by the PDE model, incorporating fine-scale details of the domain geometry and coefficient distribution. The multiscale methods developed by the associate team can be interpreted as approximate substructuring techniques, where the interiors of macro-cells are eliminated through a low-dimensional parametrization of either Neumann data (as in MHM [1,3]) or Dirichlet data (as in Trefftz methods [2]). Since the computation of the approximation basis is local to the coarse cells, multiscale numerical methods are highly parallelizable, which allows them to benefit from increasing computational facilities while keeping communications very low. Alternatively, multiscale basis functions can be “learned” using machine learning techniques, which makes multiscale methods even more accessible.

The research program of this postdoctoral program will focus on error analysis of multiscale numerical discretization methods for nonlinear problems, and their integration with domain decomposition and scientific machine learning approaches.

[1] Araya, R., Harder, C., Paredes, D., & Valentin, F. (2013). Multiscale hybrid-mixed method. SIAM Journal on Numerical Analysis, 51(6), 3505-3531.

[2] Boutilier, M., Brenner, K., & Dolean, V. (2024). Robust methods for multiscale coarse approximations of diffusion models in perforated domains. Applied Numerical Mathematics, 201, 561-578.

[3] Gomes, A. T. A., Pereira, W. S., & Valentin, F. (2023). The MHM method for linear elasticity on polytopal meshes. IMA Journal of Numerical Analysis, 43(4), 2265-2298.

Principales activités

- Conduct bibliographical reviews.
- Perform theoretical analysis of multiscale and domain decomposition methods.
- Implement multiscale and domain decomposition methods within an existing parallel framework.
- Design novel techniques combining scientific machine learning and multiscale numerical methods.
- Write and publish research articles.

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

Contract duration : 12 to 24 months

Rémunerating : 2 927€ gross/month

Informations générales

- **Ville :** Sophia Antipolis
- **Centre Inria :** Centre Inria d'Université Côte d'Azur
- **Date de prise de fonction souhaitée :** 2026-01-01
- **Durée de contrat :** 12 mois
- **Date limite pour postuler :** 2025-05-28

Contacts

- **Équipe Inria :** AT-SOP
- **Recruteur :**
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A propos d'Inria

Inria est l’institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 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 200 start-up. L'institut s'e?orce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

We are looking for candidates with a strong background in Numerical Analysis and Scientific Computing, including the design and analysis of discretization schemes, multiscale numerical methods, domain decomposition, multigrid solvers and preconditioners. Expertise in Scientific Machine Learning and a keen interest in complex real-world simulations are also very welcome.

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.

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 recrutement.

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