Sampling Method for Time Domain Inverse Scattering Problems

Niveau de diplôme exigé: Thèse ou équivalent
Fonction: Post-Doctorant

A propos du centre ou de la direction fonctionnelle

Located at the heart of the main national research and higher education cluster, member of the Université Paris Saclay, a major actor in the French Investments for the Future Programme (Idex, LabEx, IRT, EquipeX) and partner of the main establishments present on the plateau, the centre is particularly active in three major areas: data and knowledge; safety, security and reliability; modelling, simulation and optimisation (with priority given to energy).

The 450 researchers and engineers from Inria and its partners who work in the research centre's 31 teams, the 100 research support staff members, the high-level equipment at their disposal (image walls, high-performance computing clusters, sensor networks), and the privileged relationships with prestigious industrial partners, all make Inria Saclay Île-de-France a key research centre in the local landscape and one that is oriented towards Europe and the world.

Contexte et atouts du poste

A large part of our research activity is dedicated to the development of algorithms that solve the inverse scattering problem in its broad sense (with applications to a large number of areas ranging from non destructive testing to medical imaging), especially in cases when linearization approximations fail: i.e. roughly speaking when the non linearity of the inverse problem is sufficiently strong. This occurs as soon as the geometry of the unknown media generates non negligible multiple scattering effects (multiply-connected and closely spaces obstacles) or when the used frequency is in the so-called resonant region (wave-length comparable to the size of the sought medium). In this perspective we particularly developed so-called sampling methods. These methods are fast imaging solvers adapted to multi-static data (multiple receiver-transmitter pairs) at a fixed frequency. Even if they do not use any linearization of the forward model, they rely on computing the solutions to a set of linear problems of small size, that can be performed in a completely parallel procedure. The success of such approaches was their ability to provide a relatively quick algorithm for solving 3-D problems without any need for a priori knowledge on the physical parameters of the targets. These algorithms solve only the imaging problem, in the sense that only the geometrical information is provided (even though the material properties are not known). In order to increase the accuracy of these methods and their statistical stability with respect to perturbations of the background fluctuations, combining the use of multiple frequencies is usually beneficial (which has been demonstrated for linear approaches). Extension of sampling methods to time domain data was addressed in the past for the basic version of sampling methods that lacks sufficient strong. This occurs as soon as the geometry of the unknown media generates non negligible multiple scattering effects (multiply-connected and closely spaces obstacles) or when the used frequency is in the so-called resonant region (wave-length comparable to the size of the sought medium).

Mission confiée

The goal of this postdoc is to address theoretically and numerically the inverse scattering problem in time domain using the generalized version of the linear sampling method introduced by Audibert-Hadder in 2015.

Principales activités

- Study the behavior of the indicator function provided bu the generalized linear sampling method for time dependent data. In particular, extending the recent results by Cakoni-Hadder-Lechleiter 2018 to the case of point sources.
- Numerically validate the method of academic examples and study strategies to increase the speed based on sparse representations of the data.
- Explore the use of other choices of penalty terms than the one proposed in Cakoni-Hadder-Lechleiter 2018.
- Extend the methodology to handle the case of rough surfaces and/or periodic domains (with application to near field optics).

Informations générales

- Thème/Domaine: Schémas et simulations numériques
- Ville: PALAISEAU
- Centre Inria: CRI Saclay - Île-de-France
- Date de prise de fonction souhaitée: 01-11-2018
- Durée de contrat: 1 an, 4 mois
- Date limite pour postuler: 10-04-2018

Contacts

- Equipe Inria: DEFI
- Recruteur: Haddar Houssem / houssem.haddar@inria.fr

Conditions pour postuler

Applicants have to provide the following documents to be considered at the selection procedure:

- CV
- publication list and 2 representative publications (that you judge representative of your work)
- motivation letter (explaining why the selected topic, how do you think you can fit the topic, what are your motivations for the topic compared to your previous work, etc)
- 2 recommendation letters
- perspective of professional insertion after the post-doc

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.
Compétences
Solid background in functional analysis, numerical methods for partial differential equations and scientific programming. Experience in inverse and ill posed problems is a plus.

Avantages sociaux
- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

Rémunération
Monthly gross salary: **2,653 euros**