2018-00689 - Postdoc Position / Concentration inequalities for quasi-ergodic theorems [S]

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

Contexte et atouts du poste

Team
TOSCA, INRIA Nancy Grand-Est  
https://team.inria.fr/tosca/

Contacts
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This PhD project is proposed for Inria Subvention funding (https://www.inria.fr/recherches/jeuneschercheurs/etre-post-doctorant/mode-demploi).

Mission confiée

Context
The post-doc position will take place in the TOSCA team of Inria Nancy -- Grand Est and the laboratory of Mathematics of Université de Lorraine, Institut Elie Cartan de Lorraine (IECL).

Absorbed Markov processes are ubiquitous in a wide range of application domains, including populations dynamics (ecology, evolution, population genetics) where absorption corresponds to extinction, metastable dynamics, where one is interested on the exit time/position of an attracting subdomains (e.g. in molecular dynamics), and more generally in the study of transitory behaviours of stochastic systems (e.g. for problems of reliability, survival...).

The state of the system before absorption may be characterized by a so-called quasi-stationary distribution (QSD), which extends the notion of stationary distribution to absorbed processes. Up to now, most of the studies on QSD focus on their existence and uniqueness, and on large time convergence of conditional distributions, mostly based on spectral methods [4].

Recently, we developed general probabilistic criteria for exponential convergence of conditional distributions of absorbed processes to QSDs based on coupling techniques [1,3] and quasi-ergodic theorems [2]. Several methodological approaches developed in the classical context of stationary (non-absorbed) processes, including functional / concentration inequalities, ergodic central limit theorems, approximation of stationary distributions, do not adapt to the absorbed case. The post-doctoral project focuses on some of the open questions that arise from the extension of these methods.

Bibliography
**Principales activités**

**Project description**

The postdoctoral work will focus on two main issues.

The first one concerns central-limit theorem and functional / concentration inequalities for quasi-ergodic theorems. Up to now, the most advanced results in the literature only deal with first-order convergence [2,5]. Such results are important to quantify the fluctuations around the quasi-stationary distribution of absorbed processes. The results obtained here should significantly impact the second part of the project.

The second one concerns the general topic of continuity of QSD with respect to the parameters of the underlying stochastic process. More specifically, the post-doctoral fellow will focus on three problems. First, Euler scheme approximations of diffusions absorbed at the boundary of a domain, with applications to molecular dynamics. Second, diffusion approximations of birth-death processes, with applications to population genetics. Third, stochastic processes with adaptive cutoff on the absorption rate, with applications to non-classical Markov Chain Monte Carlo methods.

The postdoctoral fellow will also study the numerical validation and implications of these results, using particle approximation schemes for nonlinear PDEs [4].

The postdoctoral results will be the object of publications in peer-reviewed international journals and of communications in international conferences of the field. This work will pave the way to future collaborations with specialists both of numerical methods and of functional inequalities methods for the convergence to equilibrium of Markov processes.

**Compétences**

**Required qualifications**

PhD thesis in probability theory / stochastic processes.

Specific expertise on the ergodicity of Markov processes are welcome.

**Language**

French or English.

**Avantages sociaux**

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Sports facilities

**Rémunération**

Salary: 2653€ gross/month

**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.