**Topic 8 : Analysis of numerical simulations of SPDEs**

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**Laboratory** : Fédération de Mathématiques

This post-doctoral project aims at creating, analyzing, and simulating numerical schemes for stochastic partial differential equations. We will look at designing high order schemes in the case of non-globally Lipschitz nonlinearities.

In an ideal setting, these schemes could be able to catch asymptotic behavior like invariant measures.

We will study strong and weak convergence orders, both for temporal discretizations and for complete space-time discretizations in the spirit of [5] and [6]. We will try to generalize and improve the study of the regularity of the solution of Kolmogorov’s equations because the results of the current literature are not very optimal (especially in the case of multiplicative noises) (see [7]). Indeed, the loss of regularity and the lack of a priori estimates on these partial differential equations are the main difficulties in the development of high-order numerical schemes (see [1], [3] and [4] for first results).

The emphasis will be on non-explicit and non-tamed schemes, essentially for parabolic-type equations like Allen-Cahn (see [2]), Cahn-Hilliard, but also for FitzHugh-Nagumo or Burgers equations. The starting point will depend on the candidate’s knowledge of these equations.

The ideal candidate should have obtained a Ph.D. in applied mathematics, with a significant background in probability, analysis, and numerical simulations.

There will be a significant part consisting of phases of numerical tests of the proposed schemes. The current simulation codes are in FORTRAN, C, or Matlab, and the candidate should master these existing programs quickly.

He will have to develop a Multi-level Monte-Carlo framework and estimators of rare events to handle the statistical error induced by the schemes.

The post-doctoral fellow will be located at the “Federation de Mathematiques de CentraleSupelec” in Gif-sur-Yvette, and will be part of the SIMALIN team (“SIMulation ALeatoire en dimension INfinie”) led by L. Goudenege.

**References**


