Internship position 2024

(Possibility to pursue with a PhD project at Université Côte d'Azur)

Duration and period : 5-6 months (between February and September 2024).

Host Laboratory : CaliSto Team at Inria Sophia Antipolis - Méditerranée

Contact and supervision : Mireille Bossy

Expected profile : 2^{rd} year Master student in mathematics, with a background in stochastic analysis, SDEs theory. Stochastic modeling and numerical probability will be also appreciate.

Stochastic dynamics of particles interacting with surface

The CaliSto team at Inria is looking for a Master trainee, on the topics of stochastic analysis and probabilistic numerical analysis, motivated to pursue as a PhD candidate.

Context

The modeling of a turbulent flow, and of the particles transported in it, offers a vast field of investigation involving stochastic processes and stochastic differential equations (SDEs). These approaches are nowadays enriched and renewed to take into account more and more complex phenomena, extending and improving the existing computational methods in fluid mechanics, with multiple applications, both environmental and industrial.

By adopting an interdisciplinary approach, the CaliSto team develops original and coherent stochastic models in this field, based on two complementary points of view, combining statistical descriptions of turbulence (so-called mean fields, where only limited information is computed), and detailed approach, where the fine description of the phenomena is obtained from direct numerical simulations, allowing fundamental analysis on the instantaneous structures of the flow.

Topic description

This internship aims to delve into the modelling of the dynamics of particles transported in turbulent flows in the presence of a solid boundary. This surface significantly influences dynamics, as particles interact with it (collision), potentially concentrating and accumulating in its vicinity until remobilization occurs. Specifically, the phenomenon of particle accumulation on a surface exhibits memory, while resuspension is often characterized as intermittent.

Starting with a relatively simple model of particle transport and accumulation, governed by pure jump SDEs model, for instance, with possibly local (in time and space) distribution dependency, the goal is to conduct initial analyses on these proposed models. These analyses will explore some asymptotic scenarios (in time, in the number of particles transported) whose limits may be expressed using nonlinear PDEs.

This analysis may also encompass approximation aspects, numerical experiments, and the design of specific numerical methodologies.

Continuing this research in a Ph.D. program that extends this thematic is strongly encouraged.

To apply and/or obtain further information: mireille.bossy@inria.fr (please attach a detailed cv and master grades already available)