2018-00233 - Post-doctorate (M/F) on Stochastic Control and Mean Field Games (MFG) with application to Biology

**Contract type:** Public service fixed-term contract  
**Level of qualifications required:** PhD or equivalent  
**Fonction:** Post-Doctoral Research Visit  
**Level of experience:** Recently graduated

---

**About Inria**

Inria, the French National Institute for computer science and applied mathematics, promotes “scientific excellence for technology transfer and society’. Graduates from the world’s top universities, Inria’s 2,700 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

---

**About the research centre or Inria department**

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.

---

**Context**

Established in 1967, Inria is the only public research body fully dedicated to computational sciences.

Combining computer sciences with mathematics, Inria’s 3,500 researchers strive to invent the digital technologies of the future. Educated at leading international universities, they creatively integrate basic research with applied research and dedicate themselves to solving real problems, collaborating with the main players in public and private research in France and abroad and transferring the fruits of their work to innovative companies.

The researchers at Inria published over 4,500 articles in 2013. They are behind over 300 active patents and 120 start-ups. The 172 project teams are distributed in eight research centers located throughout France.

The Post-doctorate will work at the Inria centre of Saclay. 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 Commands team is located in the Centre de mathématiques Appliquées, Ecole Polytechnique, and is dedicated to the optimization of dynamical systems, deterministic or stochastic and to the numerical algorithms for solving these problems. See the page: https://team.inria.fr/commands/

---

**Assignment**

The theory of stochastic processes and stochastic optimal control is an essential tool to analyze biological systems in a proper way. In some applications it is natural to have the dynamics and cost depend on the population density, which leads to a so-called Mean Field Game. The program consists in analyzing in which situations this does occur, and then in investigating the theoretical and numerical algorithms for solving these problems.
numerical tools to solve these problems.

The study will take advantage of the participation of the team to the Cosy [1] network, devoted to the optimal control of synthetic microbial communities.

References:

[1] IPL Cosy: project.inria.fr/iplcosy

Main activities

Analysis and development of tools for solving stochastic optimal control problems and mean field games, with applications to biological systems such as cell population management, bioreactors, microalgae growth.

Skills

Doctor in applied mathematics; knowledge of the numerical analysis of parabolic PDEs and if possible, their interpretation based on stochastic processes.

PhD defense not before 2016.

Benefits package

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

Remuneration

Monthly gross salary: 2653 euros