Journée d'équipe ANEDP 2023-2024

Rapport sur les contributions

https://indico.math.cnrs.fr/e/janedp2023-2024

ID de Contribution: **1** Type: **Non spécifié**

Mot du chef d'équipe

jeudi 1 février 2024 09:25 (5 minutes)

ID de Contribution: **2** Type: **Non spécifié**

Solving singular integral equations with orthogonal rational functions

jeudi 1 février 2024 09:30 (45 minutes)

Nous proposons une nouvelle méthode pour calculer la mesure d'équilibre dans un problème théorie du potentiel logarithmique avec champ externe et support dans une union finie d'intervalles disjoints. Une reformulation du problème conduit à la résolution d'un système d'équations intégrales avec noyau singulier de Cauchy. On propose une méthode spectrale utilisant des fonctions rationnelles orthogonales pour résoudre ce problème, avec un choix optimal des pôles qui permet de diminuer le degré des approximants et donc la dimension des calculs. Une analyse d'erreur est donnée, ainsi que quelques exemples numériques.

Orateur: MATOS, Ana C. (Univ. de Lille)

ID de Contribution: **3** Type: **Non spécifié**

Traveling-waves for a quasilinear Schrödinger equation

jeudi 1 février 2024 10:35 (45 minutes)

We consider a defocusing quasilinear nonlinear Schrödinger equation in dimension one with nonzero conditions at infinity. The talk aims to present the classification of the traveling-wave solutions of this equation in terms of two parameters: the strength of the quasilinear term and the speed of the wave.
With access to the theory of ODEs, we found multiple branches of solutions coexisting in the same region of parameters:
A branch of breather-type solution common to the semilinear case and to other nonlinear dispersive PDEs arising in fluid mechanics; but also branches of localized solutions with lower regularity, on which we will provide some properties and illustrations.
In a second time, we will address the stability of breather-type solutions which are minimizers of the energy at fixed momentum.

Auteur principal: LE QUINIOU, Erwan (Université de Lille)

Orateur: LE QUINIOU, Erwan (Université de Lille)

ID de Contribution: **4** Type: **Non spécifié**

Lagrangian discretization for crowd motions with congestion

jeudi 1 février 2024 11:20 (45 minutes)

In this talk, I will focus on two models for crowd motion, which minimize an energy featuring a term penalizing high values for the density of the crowd during the motion. Due to the presence of this term, numerical computations of such minimizing motions is usually carried out in a "Eulerian" way, approximating the density of the crowd with piecewise simple functions. These dicretizations have the issue of not inheriting the mass conservation property verified by the distribution of the crowd during the motion, which characterizes the continuity of its trajectory and some non-trivial adaptations of the dynamical constraints are required. A way to circumvent these issues is to do the discretization in a "Lagrangian" way, as a finite number of individual trajectories. This does require some adaptations on the density penalization, which very naturally involve the semi-discrete formulation of Optimal Transport. This however yields a problem which is no more constrained and for which I will give guarantees of convergence of the minimizing trajectories to those for the initial problem. I will also illustrate these properties with numerical examples for both models.

Orateur: SARRAZIN, Clément (Inria, Univ. de Lille)

ID de Contribution: **5** Type: **Non spécifié**

A Vlasov-Fokker-Planck equation for electron beams

jeudi 1 février 2024 14:45 (45 minutes)

In the storage ring of a synchrotron, the radiation produced by the electron beam is a powerful light source, which can be used in various scientific experiments. In this talk, I will present a model which describes the longitudinal dynamics of a relativistic electron bunch in this kind of particle accelerator. It consists in a Vlasov-Fokker-Planck equation with non-symmetric self-consistent interactions. I will discuss the derivation of the model as well as its well-posedness, regularity and long-term behavior of solutions.

Orateur: HERDA, Maxime (Inria, Univ. Lille)

ID de Contribution: **6** Type: **Non spécifié**

Towards a Mesh-Invariant Auto-Encoder

jeudi 1 février 2024 15:30 (45 minutes)

Auto-Encoders are a kind of Neural Networks that work as a non-linear generalization of a Principal Component Analysis (PCA), and have many successful uses (uniformization of data, compression, statistical studies, even data generation), especially in the cases of images. However, applying them to meshes of surfaces in 3D is much harder, both because of a general lack of data compared to pictures, and because the space of meshes is not a vector space unless restricted to those that have the exact same underlying graph topology.

We propose an Auto-Encoder model that is robust with respect to a change of mesh (and, more generally, continuous with respect to the Hausdorff distance), and introduce a type of metric using varifolds that allows training on data with varying topology.

This is a work by my PhD student, Thomas Besnier (CRIStAL), Mohamed Daoudi (CRIStAL), Emery Pierson (Polytechnique) and myself.

Orateur: ARGUILLERE, Sylvain (CNRS Hauts-de-France, Laboratoire Paul Painlevé)