

Jeudi 27 juin 2024 à 10h30

Stef Graillat, Professeur des Universités - Sorbonne Université

Title: On a compensated Ehrlich-Aberth method for the accurate computation of all polynomial roots

Abstract : In this talk, we will use the complex compensated Horner's method to derive a compensated Ehrlich-Aberth method for the accurate computation of all roots of a polynomial. In particular, under suitable conditions, we will show that the limiting accuracy for the compensated Ehrlich-Aberth iterations is as accurate as if computed in twice the working precision and then rounded into the working precision. Moreover, we will present a running error bound for the complex compensated Horner's and use it to form robust stopping criteria for the compensated Ehrlich-Aberth iterations. Finally, extensive numerical experiments will illustrate that the backward and forward errors of the root approximations computed via the compensated Ehrlich-Aberth method are similar to those obtained with a quadruple precision implementation of the Ehrlich-Aberth method with a significant speed-up in terms of the computation time.

EXCEPTIONNELLEMENT Mardi 28 mai 2024 à 10h

Elena Gaburro, Associate Professor - University of Verona

Title: Structure preserving high order Lagrangian schemes for the solution of hyperbolic PDEs: from fluid-dynamics to astrophysics

Abstract : In this talk I will give an overview of my research activities which concerns the development of novel high order accurate nonlinear numerical methods for the solution of hyperbolic equations, with a wide range of applicability that includes fluid-dynamics, plasma flows and astrophysics. After a general introduction to explain the motivations and the difficulties of this field, I will concentrate on two topics which are central in my actual work. The first is the development of a particularly efficient and robust Arbitrary-Lagrangian-Eulerian framework on moving polygonal meshes with topology changes. The second involves the design of structure preserving techniques to guarantee the stability of the simulations of very complex models as the first order reformulation of the Euler-Einstein equations of general relativity.

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Jeudi 25 avril 2024 à 10h30

Mélanie Dreina, Doctorante, LAMPS, UPVD

Titre: Méthodes de réduction de dimensions pour des champs thermiques simulés

Résumé : Le but de ce travail est de comparer trois méthodes de réduction de données dans un contexte de transfert de chaleur. Nous nous plaçons dans le cas bien connu où nous observons des phénomènes instables dans le temps et l'espace. Plus précisément, nous nous intéressons à l'analyse en composantes principales (appelée dans le domaine de la mécanique des fluides la décomposition orthogonale aux valeurs propres ou POD), à la POD spectrale (SPOD), et à l'analyse en composantes principales dans le domaine des fréquences. Les méthodes POD et SPOD ont été proposées dans un contexte de mécanique des fluides, alors que la FPCA est nouvellement appliquée à ce domaine. Ainsi, dans ce travail, nous proposons une discussion sur la capacité de la méthode FPCA à se positionner dans une analyse physique multi-échelle.

Mots-clés: Simulation numérique directe, Analyse en composantes principales, Séries chronologiques, Stationnarité, Mesure aléatoire, Analyse spectrale, Champ thermique

Jeudi 28 mars 2024 à 10h30

Zhizhuo Zhang, Visiting Ph.D. student, School of Mathematics, Southeast University, China

Title: Multi-Layer Elastic Contact System and its Finite Element Algorithm Design

Abstract : Multi-layer contact system is an important type of physical model in engineering mechanics, which has key and broad application prospects in the study of mechanical response of pavement. Therefore, starting from the research background of pavement mechanics, the research motivation and the construction of mathematical models of multi-layer elastic systems will be introduced. Then, important theorems such as the existence and uniqueness of the theoretical solution and the convergence of the finite element numerical solution in this system will be elaborated, which form the theoretical basis for related research. Moreover, based on different design ideas, two algorithms that can solve the contact system, namely the mixed finite element method and the layer decomposition method, will be proposed and introduced. Finally, the results of numerical experiments will verify the effectiveness of the two types of algorithms and the accuracy of related theoretical results.

Jeudi 14 mars 2024 à 10h30

Stéphane Mussard, Professeur, Université de Nîmes, UPR CHROME

Title: Machine learning in generalized convex spaces

Abstract : Generalized convex spaces (Briec and Horvath (2004)) provide a flexible structure for analyzing data, whether for supervised or unsupervised methods. We particularly show that principal component analysis provides a higher degree of compression with robustness against outliers. We also show that discriminant analysis offers better performance and more robustness compared to classical discriminant analysis, on particular for image classification.

Jeudi 8 février 2024 à 10h30

José-Gregorio GOMEZ-GARCIA Chargé d'enseignement et de recherche à l'ENSAI Rennes

Title: Return level surfaces for non-stationary spatio-temporal processes

Abstract : In the spatio-temporal framework, we extend the return level concept, usually defined pointwise, to spatial surfaces. A period P return level surface is a surface that is exceeded by a spatio-temporal process simultaneously everywhere in the study domain with probability $1/P$. By analogy with the univariate theory of excesses above a threshold, we use the recent results on convergence of I -excesses of regularly varying processes to I -Pareto processes for spatial exceedances defined by a risk function I over the study domain. We use these results to simulate exceedances of the process under study, once marginal and dependence parameters have been estimated and derive the return level surface empirically from these simulations. We investigate the case of non-stationary spatio-temporal processes by modeling the temporal tail distribution as the product of a stationary tail distribution and a trend temporal function. Then we express the period P return level as the Expected Number of Exceedances during period P according to the non-stationary distribution function. The methodology is experienced on simulations of stationary and non-stationary max-stable processes and climate data for Burkina-Faso and France. In a climate change context, it provides spatial scenarios of potential future extreme temperature or precipitation surfaces over the country. Joint work with Liliane Bel (AgroParisTech) and Béwentaoré Sawadogo (Université Joseph Ki-Zerbo, Burkina Faso).

Jeudi 25 janvier 2024 **EXCEPTIONNELLEMENT à 14h00**

Frank Jourdan, Professeur en Mécanique, Université de Montpellier 2

Titre : Etude du comportement mécanique et fonctionnel des stents

Résumé : La chirurgie endovasculaire a connu un essor spectaculaire dans le traitement de certaines pathologies cardiovasculaires. Cette progression est principalement due au caractère mini invasif de l'intervention, réduisant ainsi le risque de morbidité. La présentation se concentrera sur les dispositifs endovasculaires de type "stents". Il s'agit de structures grillagées déployables, s'apposant sur les parois vasculaires. Différents types de stents, traitant des pathologies telles que les AVC ou les dissections aortiques, seront étudiés, à la fois d'un point de vue de leur comportement mécanique que fonctionnel. Une attention particulière sera portée sur les propriétés matérielles des stents en alliages à mémoire de forme, mais aussi sur l'importance de l'aspect structurel de ces implants. La présentation s'appuiera sur des travaux médicaux, expérimentaux et numériques.

Jeudi 11 janvier 2024 à 10h30

Meryeme Hassouna, ATER (Carcassonne), LAMPS - UPVD

Titre: Modélisation mathématique avec les équations différentielles fractionnaires en épidémiologie

Résumé

Jeudi 7 décembre 2023 à 10h30

Adina Velcescu, MCF, LAMPS - UPVD

Titre: Spectroscopie du chloroforme : passé, présent, avenir

Résumé : Le chloroforme, de formule chimique CHCl_3 est un liquide incolore, très volatil, ayant une odeur plaisante. Utilisé dans le passé comme anesthésique, il est désormais largement employé comme solvant dans l'industrie chimique. C'est d'ailleurs la raison pour laquelle la majorité des études spectroscopiques lui ayant été consacrées ont été réalisées en phase liquide. Nous aborderons cependant, lors de cet exposé, l'étude spectroscopique à haute résolution du CHCl_3 en phase gazeuse. Nous verrons à cette occasion les nombreuses difficultés, tant théoriques que pratiques, soulevées par la spectroscopie de cette molécule.

Jeudi 23 novembre 2023 à 10h30

Nahuel Soprano Loto, POSTDOC, LAAS - Toulouse

Title: Stochastic matching and online matching algorithms

Abstract : In this talk, we will delve into two distinct models that originate from different backgrounds: stochastic matching models and online matching algorithms. Stochastic matching models are models in which items arrive in the system in a random fashion. The system works as an environment to put them in contact. Pairs of items present in the system can be matched based on a predefined compatibility structure between them, and once a matching occurs, the involved items leave the system. The problem behind is to schedule these matchings in order to optimize some performance criteria. In our case, this criteria will be stability, that is the property that prevents accumulation of items in the system. In the second context, online stochastic matching, the word 'matching' refers to something different. Given a graph, a matching is a subset of edges without extreme vertices in common. It is a classical problem to find large matchings in graphs. A new perspective, mainly motivated in internet applications, is to study online algorithms, that are the kind of algorithms that have to make decisions 'on the fly', or as the graph is discovered. We will focus on the case in which the underlying graph is random. We will explain how these two contexts are related, and show how the understanding of one context can help to the understanding of the second one.

This work is based on the following papers:

[1] M. Jonckheere, P. Moyal, C. Ramírez, and N. Soprano-Loto. Generalized Max-Weight Policies in Stochastic Matching. Stochastic Systems 2023 13:1, 40-58

[2] N. Soprano-Loto, M. Jonckheere, P. Moyal. Online matching for the multiclass stochastic block model. arXiv:2303.15374, 2023.

Jeudi 9 novembre 2023 à 10h30

Walter Briec, Pr, LAMPS - UPVD

Title: Remarks on some Limit Geometric Properties of related to an Idempotent and Non-Associative Algebraic Structure

Abstract: This presentation analyses the geometric properties of an idempotent and non-associative algebraic structure which extends the Max-Times semi-ring. This algebraic structure is useful for analyzing systems of Max-Times and Max-Plus equations (using an appropriate notion of non-associative determinant). We consider a related ultrametric distance and show that it implies, among other things, an analogue of the Pythagorean relation. To that end, we propose a suitable notion of right angle between two vectors and analyse a trigonometric like concept related to the Tshebishev unit ball. Along this line, we study the possible implications of these properties for the complex plane. We give the algebraic definition of a line passing through two points which turns out to be the Painleve-Peano-Kuratowski limit on a sequence of generalized lines. We show that this definition implies some particular geometric properties; in particular two distinct parallel lines (in some sense) can have an infinite number of common points.

Jeudi 26 octobre 2023 **exceptionnellement à 11h00**

Domingo Tarzia, Pr, VP Recherche Universidad Austral and CONICET - Argentina LAMPS - UPVD

Title: Optimal Control Problems for Elliptic Hemivariational Inequalities

Abstract

Jeudi 5 octobre 2023 à 10h30

Florent Nacry, MCF, LAMPS - UPVD

Titre: Distance la plus éloignée et forte convexité

Résumé: Dans cet exposé, nous ferons un tour d'horizon des propriétés de la fonction « distance la plus éloignée » d'un point à une partie d'un espace de Banach. Nous étudierons dans un second temps une classe d'ensembles disposant d'un comportement remarquable vis-à-vis de cette distance et des points la réalisant.

Jeudi 21 septembre 2023 à 10h30

El-Medhi El Arar, Doctorant, LiParad - Université de Versailles Saint-Quentin-en-Yvelines

Title: Bounds on Non-Linear Errors for Variance Computation with Stochastic Rounding

Abstract: Stochastic Rounding (SR) mode is a probabilistic rounding mode: an inexact computation is rounded to the next smaller or larger floating-point number with probability depending on the distances to those numbers. We investigate non-linear errors using SR in variance computation algorithms. We estimate the forward error of computations under SR through two methods: 1 a bound of the variance and Bienaymé–Chebyshev inequality, 2 martingales and Azuma–Hoeffding inequality. We examine two algorithms, "textbook" and "two-pass", both with non-linear errors. We show that they have probabilistic bounds under SR in $\mathcal{O}(\sqrt{n}u)$ instead of $\mathcal{O}(nu)$ for the deterministic bounds.