



**Offre n°2025-08821**

## **PhD Position F/M Triangulating stratified spaces**

*Le descriptif de l'offre ci-dessous est en Anglais*

**Type de contrat :** CDD

**Niveau de diplôme exigé :** Bac + 5 ou équivalent

**Fonction :** Doctorant

### **A propos du centre ou de la direction fonctionnelle**

The Inria centre at Université Côte d'Azur includes 42 research teams and 9 support services. The centre's staff (about 500 people) is made up of scientists of different nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regional economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

### **Contexte et atouts du poste**

PhD-opening in the ANR StratMesh project

OVERVIEW AND CONTEXT:

We offer a 3-year paid PhD position without obligated teaching (it is optional) at the Inria centre Université Côte d'Azur within an ANR project on triangulating stratified spaces and applying these triangulations for the medial axis and symmetry set. This project is a joint project between us (Jean-Daniel Boissonnat and Mathijs Wintraecken, Datashape), the Inria teams GAMBLE (Nancy) and OURAGAN (Paris) and our partners in Nantes. The day-to-day supervision will be by Mathijs Wintraecken the 'directeur de these' will be Pierre Alliez of the Titane team (also at Inria centre Université Côte d'Azur).

#### CONTACT:

If you are interested in the position please contact me at mathijs.wintraecken ``at" inria.fr

#### STARTING DATE:

The starting date is negotiable, and preferably before 1st of March 2026. However, I hope to conduct the first round of interviews before summer 2025.

## Mission confiée

#### KEYWORDS:

Stratified spaces, Triangulating/Meshing, Manifold and stratification learning, Shape learning, Persistent homology/topological data analysis

#### SCIENTIFIC GOALS:

Manifolds are the generalizations of surfaces to arbitrary dimension, while stratified spaces consist of manifold pieces but can contain non-smooth ridges and singularities. These spaces occur naturally in many different fields ranging from mechanical engineering and numerical hydrodynamics to algebraic geometry. Moreover, triangulations or meshes (that is combinations of vertices, edges, triangles, etc. that correctly represent underlying space) of these spaces are needed for computations. In spite of the fact that stratified spaces are ubiquitous in physics, engineering and (applied) mathematics, little progress has been made on triangulations of these spaces beyond 3D and even in 3D many challenges remain.

The goal of the StratMesh project and this PhD-project is to triangulate a specific type of stratified spaces, namely those that are given by equations but in arbitrary dimension and codimension.

This is strongly connected with manifold learning or stratification learning, because triangulations allow us to represent a learned shape efficiently and in a way that is relatively straightforward to manipulate.

The medial axis and symmetry set are two examples of stratified space that are used in e.g. shape learning/recognition and shape segmentation. The medial axis lies in the centre of a shape and captures many aspects of its geometry and topology.

Formally it consists of the points in ambient space that do not have a unique closest point on the set itself. We'll apply the general theory and algorithms which we'll develop in the first part of the project to this context. If time allows, we'll use this in combination with topological data analysis (persistent homology techniques) to develop new shape descriptors. The part concerning shape descriptors will be in collaboration with Erin Chambers, University of Notre Dame, IN, USA.

#### REFERENCES:

Boissonnat, JD., Wintraecken, M. The Topological Correctness of PL Approximations of Isomanifolds. *Found Comput Math* 22, 967–1012 (2022). <https://doi.org/10.1007/s10208-021-09520-0>

Boissonnat, JD., Kachanovich, S., Wintraecken, M. Tracing Isomanifolds in  $\mathbb{R}^d$  in Time Polynomial in  $d$  using Coxeter–Freudenthal–Kuhn Triangulations, *SIAM Journal on Computing* 52, 452-486 (2023). <https://doi.org/10.1137/21M1412918> and <https://hal.science/hal-04083489/file/SIAMAuthor.pdf>

## Principales activités

Conduct research in the context of the PhD project, follow the literature and communicate the results of the research both in France and internationally.

## Compétences

There is some flexibility within the context of the project and the student could put his/her own accents on the research (in particular more or less implementation of algorithms can be negotiated). The ideal candidate would have some familiarity with at least two of the following (I would not expect a potential PhD student to be familiar with all, this is not a senior postdoc):

- Computational geometry, in particular meshing
- Differential geometry
- Computational topology
- Whitney stratified spaces
- Programming in C++
- (Differential) topology

## Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

## Rémunération

Duration: 36 months

Location: Sophia Antipolis, France

Gross Salary per month: 2200€ (2025)

## Informations générales

- **Thème/Domaine** : Algorithmique, calcul formel et cryptologie  
Calcul Scientifique (BAP E)
- **Ville** : Sophia Antipolis
- **Centre Inria** : [Centre Inria d'Université Côte d'Azur](#)
- **Date de prise de fonction souhaitée** : 2025-09-01
- **Durée de contrat** : 3 ans
- **Date limite pour postuler** : 2025-05-16

## Contacts

- **Équipe Inria** : [DATASHAPE](#)
- **Directeur de thèse** :  
Wintraecken Mathijs / [mathijs.wintraecken@inria.fr](mailto:mathijs.wintraecken@inria.fr)

## A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général

communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

## L'essentiel pour réussir

### REQUIREMENTS:

The candidate needs to have (or be close to completing) a Master's thesis in computer science, mathematics, or a closely related field. In exceptional circumstances students who followed a 4-year bachelor program will also be considered. The students need to be able to communicate clearly in English (both written and spoken). Basic knowledge of French may make some things easier in daily life, but is not required.

**Attention:** Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

## Consignes pour postuler

### Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

### Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.