Postdoctoral Position in 2016

Inverse design of thin elastic rods and shells: An experimental and numerical study

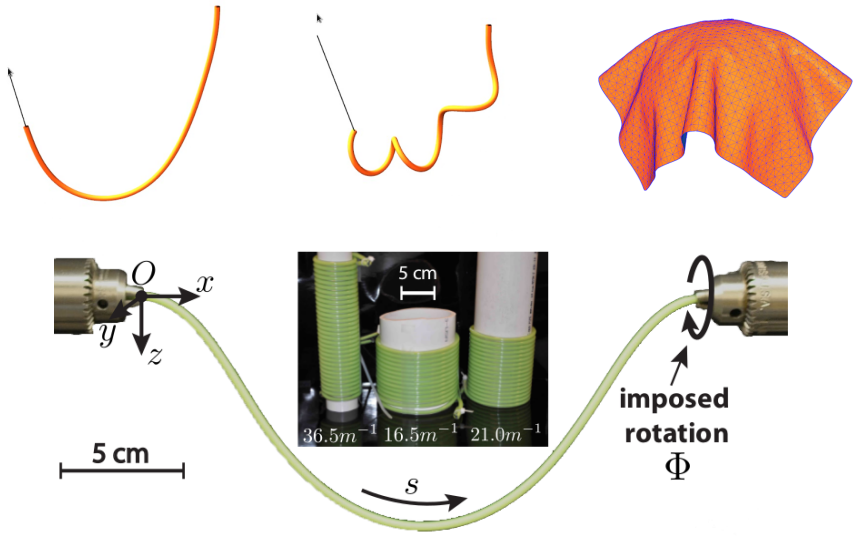

Figure 1: Top: Dynamic simulations of a straight and coiled thin elastic rods [1], and of an elastic shell subject to frictional contact. Bottom: Example of fabrication and experimental testing of coiled thin elastomeric rods [5].

Application Deadline: November 1, 2015

Hosting Laboratories: Inria Grenoble Rhône-Alpes (Laboratoire Jean Kuntzmann, BiPop team, `http://www.inrialpes.fr/bipop`) and Université Pierre et Marie Curie (Laboratoire Jean le Rond d'Alembert, MISES team, in Paris, `http://www.dalembert.upmc.fr/mises`)

Supervisors: Florence Bertails-Descoubes (Florence.Descoubes@inria.fr) and Arnaud Lazarus (Arnaud.Lazarus@upmc.fr)

General Topic: In the context of the GEM European project, we offer a (maximum) 3-years post-doc between two laboratories (Inria - Grenoble and UPMC - Paris) for bridging the gap between numerical models and experimental mechanics, on the topic of slender structures and frictional contact.

The goal of the GEM project is to design new computational methods and algorithms for identifying physical parameters of slender structures (thin elastic rods, plates and shells), only from the knowledge of their (observed) deformed shape as illustrated in Fig.1, either in a static or dynamic scenario. The role of the present post-doc offer will be twofold, as it will consist in:

1. Validating the theoretical framework that is currently developed at Inria for inversion, via real experimentation and possibly numerical simulation;

2. Designing new, non-invasive measurement protocols based on theoretical insights, in both static and dynamic scenarios.

To this aim, the post-doc will be in strong interaction between, on the one hand, Inria members of the GEM project (principal investigator: F. Bertails-Descoubes), where theories and inverse numerical models have already started to be developed [3, 4, 2], and on the other hand, the Université Pierre and Marie Curie in Paris (A. Lazarus) which holds a strong expertise in experimental mechanics, measurement and analysis of slender structures [5, 6].

About Inria: 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 BiPop team, located in Grenoble, at the heart of the French Alps (3 hours from Paris), is specialized in the numerical modeling and analysis of nonlinear and nonsmooth phenomena, including in particular multibodies subject to impact and frictional contact.

About the Université Pierre et Marie Curie, Paris 6: Pierre and Marie Curie University (abbreviated UPMC), also known as University of Paris VI (Paris 06), is a public research university located on the Jussieu Campus in the Latin Quarter of the 5th arrondissement of Paris, France.

UPMC is the largest scientific and medical complex in France, active in many fields of research with scope and achievements at the highest level, as demonstrated by the many awards regularly won by UPMC researchers, and the

many international partnerships it maintains across all five continents. Several university rankings have regularly put UPMC at the 1st place in France, and it has been ranked as one of the top universities in the world.

Jean Le Rond D'Alembert's Institute (abbreviated D'Alembert) is one of the 125 laboratories of UPMC and the largest Mechanics laboratory in the Parisian region with about a 100 permanent researchers. The goal of the Institute is to develop the field of continuum mechanics mainly by solving fundamental problems by the way of theoretical, numerical and experimental methods. Amongst the 5 teams of the Institute, the MISES group (approximately 15 permanent researchers) is the one focusing on the mechanics of solids and structures, with a particular interest in fracture mechanics, homogenization and multi scale theory for application in material sciences and the deformation of slender structures such as rods, plates and shells.

Funding and advantages: The post-doc will be entirely funded by the European project GEM coordinated by F. Bertails-Descoubes and managed by Inria, covering salary, traveling between Paris and Grenoble, and conference traveling.

Starting date and length

Duration: 12 months, renewable (up to 36 months).

Starting date: ideally, Spring 2016

Salary: starting from 2,620 euros gross monthly (about 2,115 euros net), possible increase according to international experience (Inria scale). Medical insurance is included.

Required Skills: Candidates must hold a PhD in any field among computing science / physics / mechanical engineering / mathematics. Strong background in either experimental mechanics or numerical analysis are required. Good programming skills in a language such as C/C++/python are desirable. A strong interest for inverse problems, measurements, numerical simulation and applications such as mechanical engineering, computer vision or computer graphics is highly desirable. Candidates should have a proven research track record, demonstrated by publications in peer-reviewed journals in one or more of the above areas. Self-motivation, excellent team-working, inter-personal, and presentational skills are highly desirable additional attributes. Though not mandatory, student supervising skills are also appreciated as the post-doc will have the opportunity to work on a common project including other post-docs, PhD and master students.

How to apply Candidates should apply electronically **before November 1, 2015** by sending an e-mail to both Florence.Descoubes@inria.fr and Arnaud.Lazarus@upmc.fr. Application should contain:

- a copy of the PhD diploma, together with reviewing and defense reports
- a cover letter outlining the motivations of the applicant

- a detailed CV of the applicant, including the publication list, scientific and computing skills, and interests.
- one or several reference letters provided (at least) by the PhD advisor(s), possibly also by an academic or industrial partner, or a scientific personality
- any other document that the applicant would like to bring attention to in her/his application.

Keywords: Experimental mechanics, inverse problems, mechanics of thin elastic rods, plates and shells, numerical analysis and simulation

References

[1] R. Casati and F. Bertails-Descoubes. Super space clothoids. *ACM Transactions on Graphics (Proc. ACM SIGGRAPH'13)*, 32(4):48:1–48:12, July 2013.

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[6] JT Miller, A Lazarus, B Audoly, and PM Reis. Shapes of a suspended curly hair. *Physical Review Letters*, 112(6):068103, 2014.