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International Doctorate in Civil and Environmental Engineering

Department of Civil and Environmental Engineering
University of Florence, Italy

Call for applications for a PhD position on

Isogeometric analysis-based models for shape changing structures with applications to patient-tailored stents

The PhD research activity will be carried out within the project “A new efficient and accurate isogeometric analysis approach to the simulation of shape-changing artery stents—towards patient-tailored 4D printed stents (ISOSTent4D)”. The project, carried out in collaboration with DIEF and DMSC of the University of Florence (Italy) in the framework of the Tuscany Health Ecosystem THE, aims to develop an innovative process to simulate, optimize and print (4D Printing) patient-tailored cardiovascular stents. Recent computational techniques based on isogeometric analysis (IGA) turned out to be, for a given accuracy level, exceptionally faster than existing methodologies based on the standard finite element method in simulating the structural behaviour of such systems. In this context, the objective of the research is to develop an efficient computational model based on isogeometric analysis (IGA) for structural systems with complex geometries (see, e.g., Figure 1) able to simulate the shape-changing process (see, e.g., Figure 2) required for the personalization of the devices. In particular, the research focus will be placed on modelling thermo-responsive shape memory materials, geometrical nonlinearities, complex geometry reconstruction, and identification of suitable 4D Printing technologies.

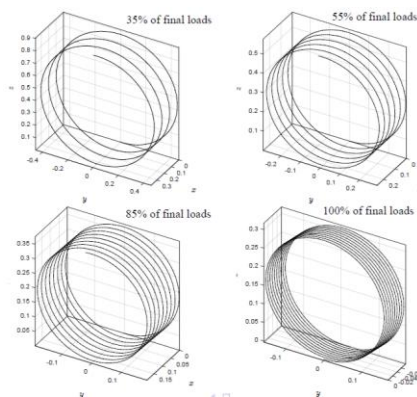


Figure 1. Simulation of a complex deformation using an IGA model.

[Marino, E. (2016), *Isogeometric collocation for three-dimensional geometrically exact shear-deformable beams*. CMAME, 307, 383-410].



Figure 2. Printed lattices after morphing into spherical caps. [Boley, J. W. et al. (2019), *Shape-shifting structured lattices via multimaterial 4D printing*. PNAS, 116(42), 20856-20862].

How to apply

1. Applications can be submitted online at https://sol.unifi.it/domdottpnrr/login_en.jsp. The deadline for applications is **November 10th, 2022, 12:00 (Italian time)**.
2. After registration, candidates will have to select the doctorate “International Doctorate in Civil and Environmental Engineering” and the scholarship “Isogeometric analysis-based models for shape changing structures with applications to patient-tailored stents”.
3. For the complete details on how to apply and the full admission requirements please refer to the page <https://www.unifi.it/p12246.html> and to document **Annex 1 - Call for applications**.

Qualification requirements

- A master's degree (or equivalent) in engineering, mathematics, physics, material science or similar disciplines. (The complete description of admission requirements is reported in **Annex 1 - Call for applications**).
- A strong background in solid and structural mechanics.
- Experience with scientific computing and programming.
- Excellent English language skills (written and spoken).

What we offer

- A 3-year scholarship with the contract starting on January 1st, 2023.
- Extra funds supporting mobility and a scholarship increase of 50% during the period abroad.
- A joint/double PhD title with a foreign university.
- At least 9 months of research stay at the foreign university.
- An attractive international work environment in a highly committed young team.

For additional information, please contact

- **Enzo Marino** (enzo.marino@unifi.it) for scientific related questions
- **INDICEE Secretariat** (dott-dicea@unifi.it) for administrative issues

Main web page for the PhD position: <https://www.unifi.it/p12246.html>. More information on the International Doctorate in Civil and Environmental Engineering (INDICEE) at the University of Florence can be found here <https://www.indicee.unifi.it/>.