« Exploring nonlinear phenomena in soft structures »
Master's Internship – Spring 2024 – Paris, France


Deformation of a soft beam [1].

Context. The laws of linear elasticity rely on the assumption that deformations should remain small. For conventional solids, this is usually true. For soft solids (polymers, rubbers, gels …) however, a moderate stress can induce a significant strain, meaning that nonlinear events are likely to occur.

Objectives. Thanks to optical detection methods, we will track nonlinear phenomena in simple flexible structures [1]. Starting from a soft beam undergoing a parametric forcing, we will look for signatures of instable behaviors [2]. Soft polymers can easily be molded in different shapes which will allow us to explore a variety of configurations. As a possible direction, one could load the elastic structure with iron magnetic particles in order to monitor its mechanical properties with an external magnetic field [3]. This system also provides a new platform to investigate nonlinear wave-wave interaction in the context of elastic fields [4].

Perspectives. Understanding the motion of soft structures is crucial for applications ranging from energy harvesting to soft robot's actuation. The implementation of a nonlinear self-propelled robot prototype will be considered.

Candidate Profile. We are looking for a highly motivated student with a background in Physics. The ideal candidate should have a strong interest in fundamental research, encompassing both experimental and theoretical modeling aspects.

Location. The internship will be hosted at the Matière & Systèmes Complexes Laboratory, Université Paris-Cité.

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References:
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[3] M. J. Wilson, A. Fuchs, and F. Gordaninejad, JAPS, 84 (2002).
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