Ph-D thesis:

Topological defects and elastic properties of viral capsids

Biological viruses are molecular complexes mainly made of proteins and nucleic acids. The highly ordered structure associated to most viruses emerges spontaneously thanks to molecular self-assembly processes.

We study in our laboratory these processes using both experimental and theoretical tools. In particular, we are interested in modeling the influence of self-assembly architecture on its elastic properties. In our recent works, we deciphered the mechanics of viruses self-assembly and nano-indentation at a molecular level using coarse grained model of elasticity. These models were developed at constant architecture, and the necessary topological defects associated to this structure are not moving upon indentation.

The aim of the present Ph-D thesis is to develop analytical and numerical models being able to simulate various elastic response of thin shells (e.g. nanoindentation experiments, translocation across nano pores, guided self-assembly) in the presence of topological defect dynamics. These scenarii are important in order to understand correctly the relation between viral shape and its molecular structure under various biological conditions, such as virus migration within organisms.

From a more general perspective, several questions regarding defects dynamics and molecular self-assembly can be gathered consistently in order to propose a scientific program for a Ph-D work.

Keywords: thin shell elasticity, topological defects, molecular self-assembly, viruses

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2. L. Menou, M. Castelnovo « *Mechanical stress relaxation in molecular self-assembly* », Soft Matter, 15:6180, 2019.

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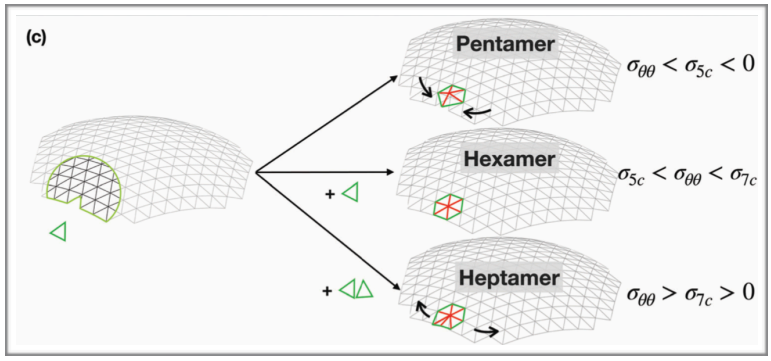

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