Colóquio Interinstitucional

Modelos Estocásticos e Aplicações

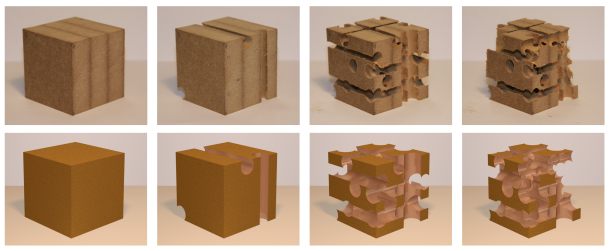
Quarta-feira, 16 de fevereiro de 2022

Programa

13:00 - 14:10 – **Marcelo R. Hilário (UFMG)**

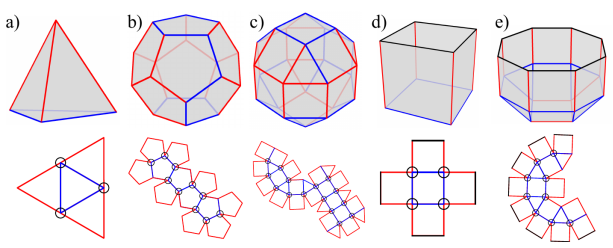
Percolation on the cubic lattice with lower dimensional disorder

Percolation on the Euclidean d-dimensional lattice has been studied for over sixty years and is still a fascinating source of interesting mathematical problems. The fact that this model undergoes a non-trivial phase transition is well-understood since the early studies in the Bernoulli setting, where the lattice is regular and there are no inhomogeneities on the parameters. One way to introduce random disorder is, for example, either passing to a dilute lattice where lower dimensional affine hyperplanes are removed or, alternately, introducing inhomogeneities on the parameter along such hyperplanes. In these situations, even to establish that non-trivial phase transition takes place may be a hard task. In this talk we review some recent results on this topic and discuss some open problems.



14:20 - 15:30 – **Nuno A. M. Araújo (Universidade de Lisboa)**

Kinetics of self-folding at the microscale



Three-dimensional shells can be synthesized from the spontaneous self-folding of two-dimensional templates of interconnected panels, called nets. To design self-folding, one first needs to identify what are the nets that fold into the desired structure. In principle, different nets can fold into the same three-dimensional structure. However, recent experiments and numerical simulations show that the stochastic nature of folding might lead to misfolding and so, the probability for a given net to fold into the desired structure (yield) depends strongly on the topology of the net and experimental conditions. Thus, the focus has been on identifying what are the optimal nets that maximize the yield. But, what about the folding time? For practical applications, it is not only critical to reduce misfolding but also to guarantee that folding occurs in due time. Here, we consider as a prototype the spontaneous folding of a pyramid. We find that the total folding time is a non-monotonic function of the number of faces, with a minimum for five faces. The motion of each face is consistent with a Brownian process and folding occurs through a sequence of irreversible binding events that close edges between pairs of faces. The first edge closing is well-described by a first-passage process in 2D, with a characteristic time that decays with the number of faces. By contrast, the subsequent edge closings are all first-passage processes in 1D and so the time of the last one grows logarithmically with the number of faces. It is the interplay between these two different sets of events that explains the non-monotonic behavior. Implications in the self-folding of more complex structures are discussed.

Local

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