

Creative Telescoping for the Canham Model in Genus 1

lundi 28 novembre 2022 16:45 (45 minutes)

The algorithmic method of Creative Telescoping turns out to be an extremely useful tool in experimental mathematics when dealing with concrete mathematical problems. As striking examples, it can be used to compute and prove automatically: a recurrence satisfied by any binomial sum (like the Apery numbers), the equality of two-period functions (in the sense of Kontsevich and Zagier), or a recurrence for the moments of a measure.

In this talk, I will explain some theories behind Creative Telescoping, and show how it can be applied in practice to a problem originating from biological physics. The problem concerns the shape of biomembranes, such as blood cells, and examines the uniqueness of the variational Helfrich problem in the case of genus 1 with a prescribed isoperimetric ratio. This question boils down to computing the surface area and volume of a projection of the Clifford torus in terms of Gaussian hypergeometric functions. We tackle this using Creative Telescoping and then prove that the rescaled ratio of these functions is monotonically increasing. The talk will be based on joint work with Alin Bostan and Thomas Yu.

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