Soap films help to solve mathematical problems

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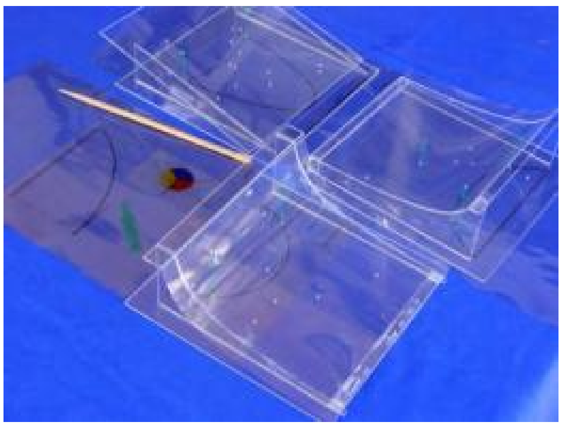

Soap films help to solve mathematical problems. Credit: Criado et al.

Soap bubbles and films have always fascinated children and adults, but they can also serve to solve complex mathematical calculations. This is shown by a study carried out by two professors at the University of Malaga (Spain), who have succeeded in solving classic problems using just such an innovative procedure.

"With the aid of soap films we have solved variational mathematical problems, which appear in the formulation of many physical problems", explains Carlos Criado, professor at the University of Málaga, speaking to SINC. Together with his colleague Nieves Álamo, he has just published his work in the *American Journal of Physics*.

Soap films always adopt the shape which minimises their elastic energy, and therefore their area, so that they turn out to be ideal in the calculus of variations, "where we look for a function that minimises a certain quantity (depending on the function)", adds the researcher.

"Of course there are other ways to solve variational problems, but it turns out to be surprising, fun and educative to obtain soap films in the shape of brachistochrones, catenaries and semicircles", Criado emphasises.

The professor offers the example of the famous problem of the brachistochrone curve. What shape must a wire be in order that a ball travels down it from one end to the other (at a different height) as rapidly as possible? The answer is the brachistochrone (from the Greek brachistos, the shortest, and cronos, time), the curve of fastest descent.

New methods for old problems

The mathematician Johann Bernoulli found the answer centuries ago when he realised that it was a cycloid (the curve described by a point on a circle rolling along a line). That was the origin of the calculus of variations, which was also used in other classic problems, like that of the catenary (the shape of a chain suspended by its endpoints) and the isoperimetric curve (a curve which maximises the area it encloses).

The study shows that these calculations may be related to Plateau's problem, that is, to find the shape adopted by a soap film under certain boundary restrictions. Besides, the researchers show how to design the experiments, constraining the soap films between two surfaces in such a way as to obtain the appropriate curves.

More information: C. Criado y N. Alamo. "Solving the brachistochrone and other variational problems with soap films".

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