

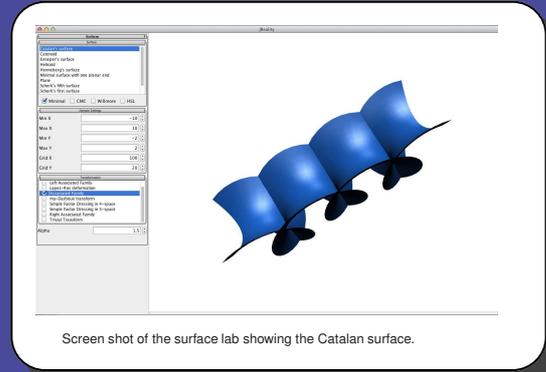
# GEOMETRY AND VISUALISATION IN THE VISLAB

Visual Intelligence Lab

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## Surface Theory

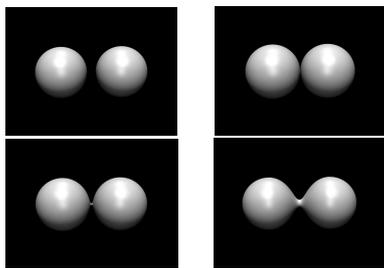
We study surface classes given by curvature properties, for example surfaces with constant mean curvature. Often these surface classes are given as minimisers (or critical points) of an energy functional. Physical examples include soap films and soap bubbles. Although surfaces in 3-space have been studied extensively, due to the underlying hard-to-solve PDEs, many questions on the geometry and classification of surfaces in various surface classes are still open. The surface lab provides a tool to experiment with surfaces and to visually investigate examples and their transformations.



Screen shot of the surface lab showing the Catalan surface.

## Applications

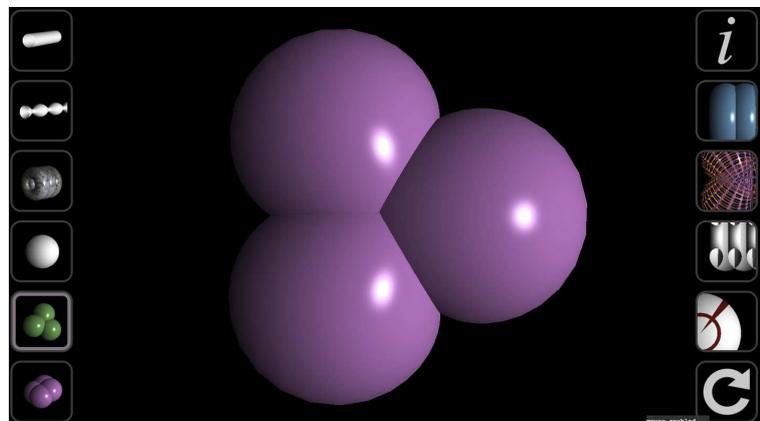
Visualisation plays an important role in science and engineering. A current joint project with A. Hudson, Dept of Chemistry, and PhD student L. Collard aims at visualising the coalescence of aerosols. In recent work by Hudson, the viscosity and surface tension of single aerosol droplets (with diameters from 1 to 10  $\mu\text{m}$ ) can be measured across an unprecedented dynamic range. The approach is based on monitoring oscillations in shape on the surface of a single aerosol droplet isolated in an optical trap. These oscillations appear on a composite droplet following the coalescence of two smaller droplets, and their amplitude and frequency are measured by recording the time-dependent intensity of elastic-scattered light. The technique will now be exploited to lead to a better understand of topics in environmental science.



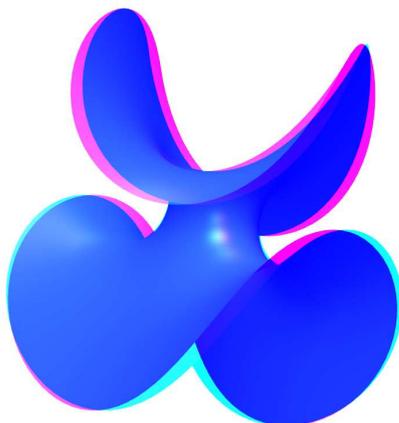
Do aerosols develop handles when merging?

## Teaching

In modules like "Curves and Surfaces" the VisLab provides tools to study basic properties of curves and surfaces. Physical models have always been used in the study of mathematical objects – with modern technologies students have access to a wider range of models and can use computational tools to experiment, to look inside the objects and to have a 3D view of geometrical objects.



Student project by P. Dedmon (supervised by K. Leschke): Soap bubbles, based on touchscreen viewer at GeometrieWerkstatt Tübingen.



3D image of the twisted Enneper surface, created by using the surface lab.

## Outreach

Soap films and soap bubbles are physical examples of important surfaces classes, the minimal and constant mean curvature surfaces. Visitors can have a close look at these surfaces by using the touchscreen computer and 3D projections to get a hands-on experience on mathematical properties and symmetries, as well as a deeper insight in the beauty of the subject.