jReality

virtual worlds of mathematics

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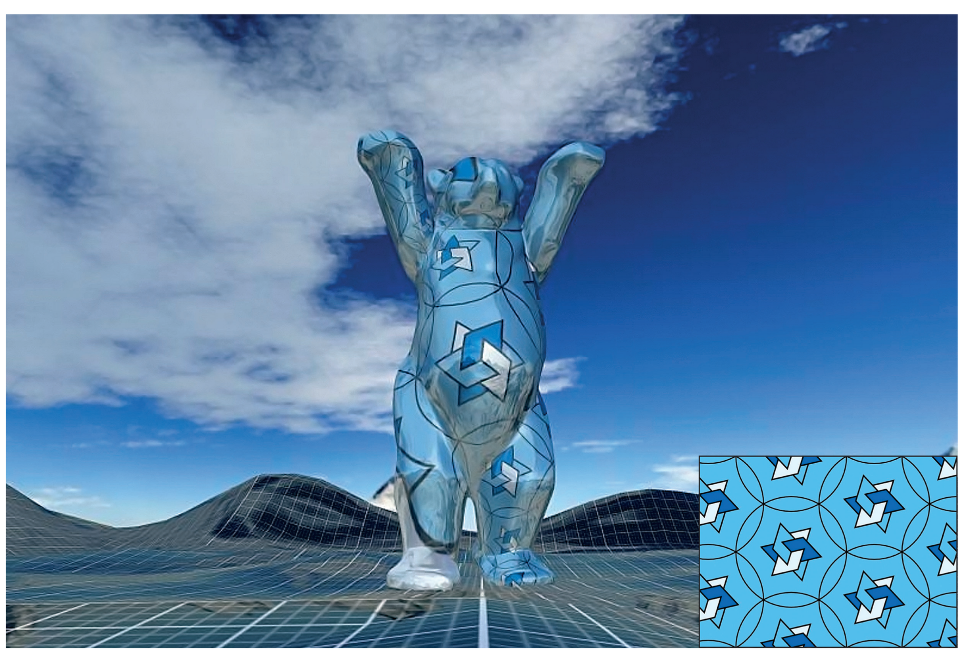
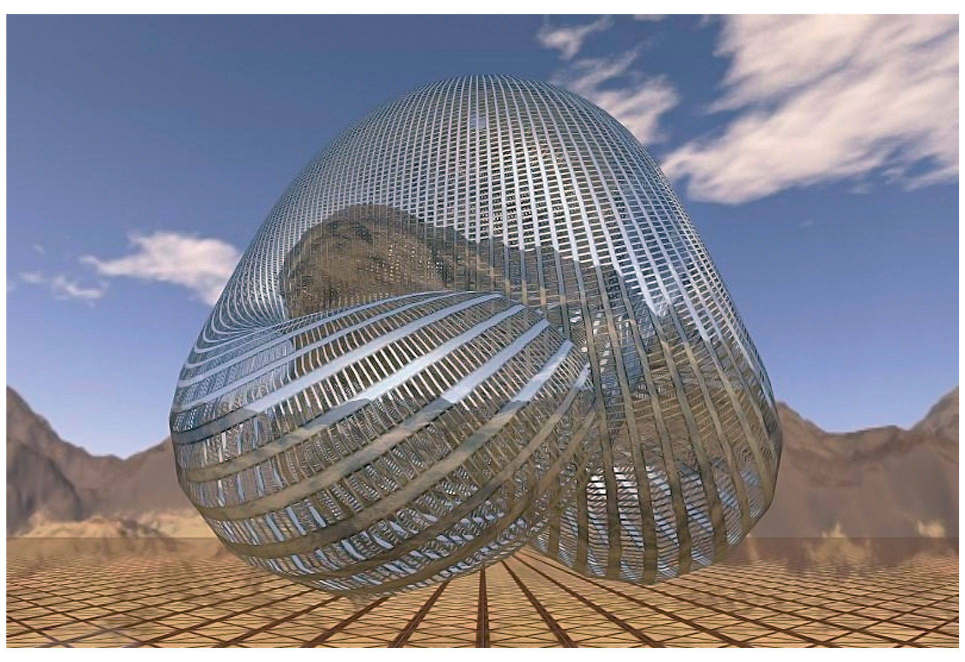


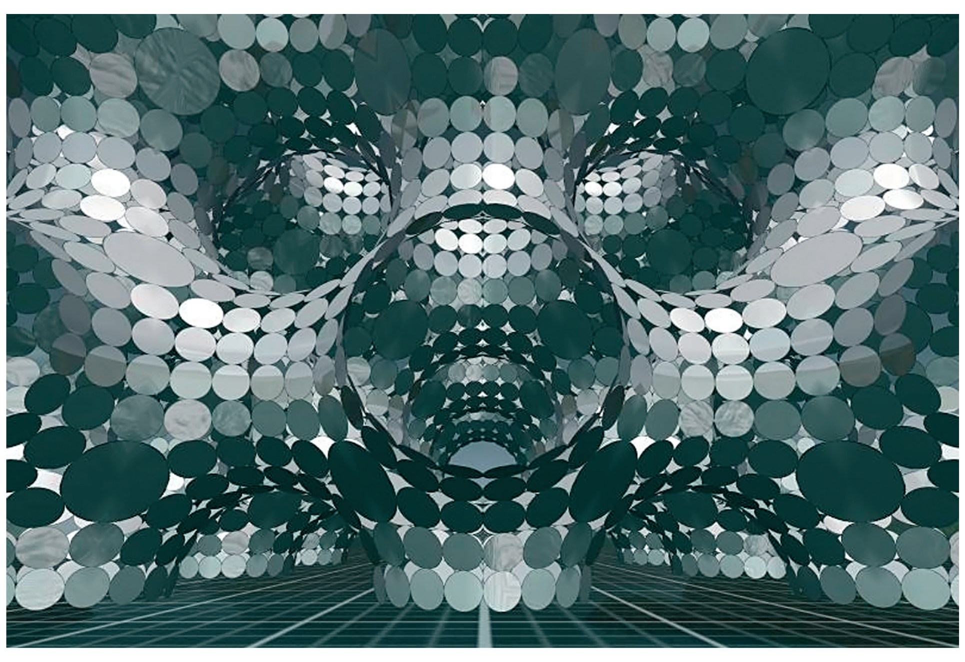
Matheon bear

The sculpture of the Matheon Bear stands in front of the Maths building of the TU Berlin. The bear is interesting from a mathematical point of view, because of the pattern painted on it. The periodic pattern of circles and Matheon logos filling the plane forms the basis. The mathematical challenge was to apply this pattern such that the forms distorted as little as possible. Actually, you can see that all of the angles appearing in the pattern also appear on the bear. We can say that the image of the pattern on the bear is "conformal".



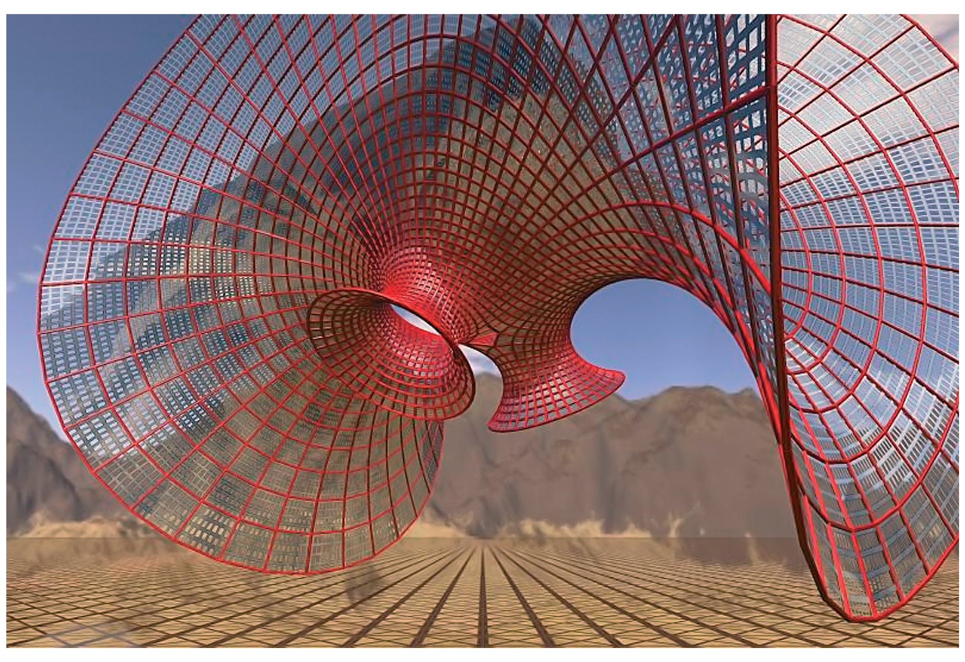
Boy surface

The Boy surface is generated by adding a Moebius strip with a disk attached to its boundaries to a closed surface. The fact that this is made possible at all was proved by Werner Boy in 1903. The Boy surface intersects itself, but otherwise looks smooth in each of its points. The version shown here is characterized by its mean curvature being as small as possible, i.e. it has "no unnecessary bumps". You see, therefore the most "beautiful" possible realization of the Boy surface in a mathematically precise sense. This is a parametrization of the Boy surface by Robert Bryant and Robert Kusner.



Schwarz minimal surface

Minimal surfaces are surfaces that have the curvature features of physical soap films. The copy illustrated here was found by Karl Hermann Amandus Schwarz in the 19th century and periodically fills the entire space in the manner of a crystal grid. What you see here is, strictly speaking, not at all a smooth surface, but consists of many circular disks contacting each other in a certain way. Such "discretizations" of smooth surfaces have recently played an important part in architecture, if the question is to create curved surfaces from flat elements.

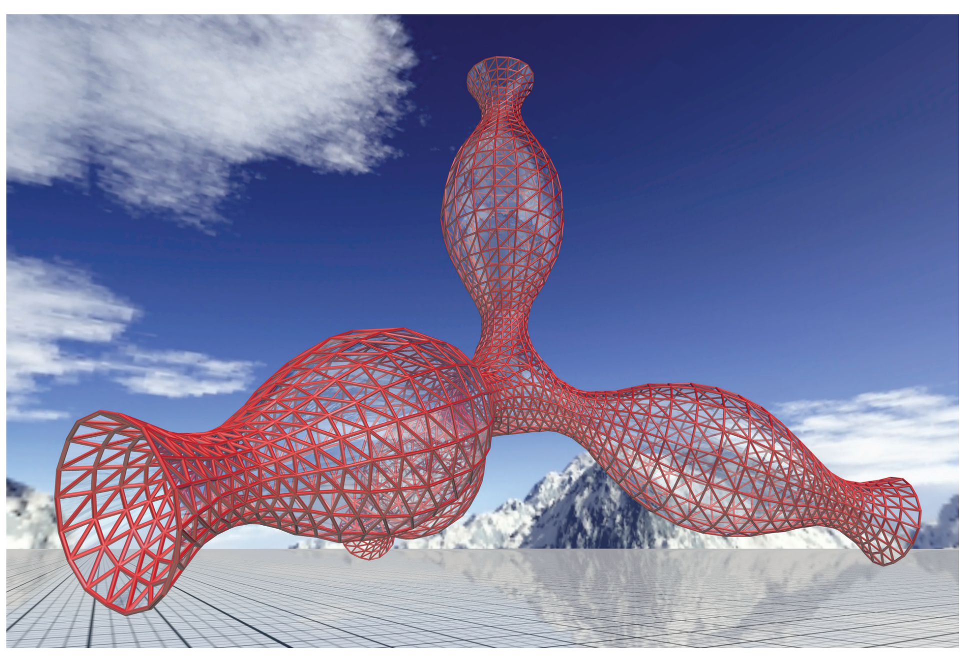


Minimal surfaces site

Here, you see a so-called Enneper surface onto which two (downwards turning) duct-shaped outgrowths were grafted. The fine art of creating minimal surfaces is to construct minimal surfaces which, without boundaries, extend towards infinity without self-intersection. The first requirement is met, here. The piece shown of the whole surface can be continued indefinitely. But very soon self-intersections occur. In this respect, this surface may well be taken from the apprenticeship workshop of a minimal surfaces constructor, but it is beautiful all the same.

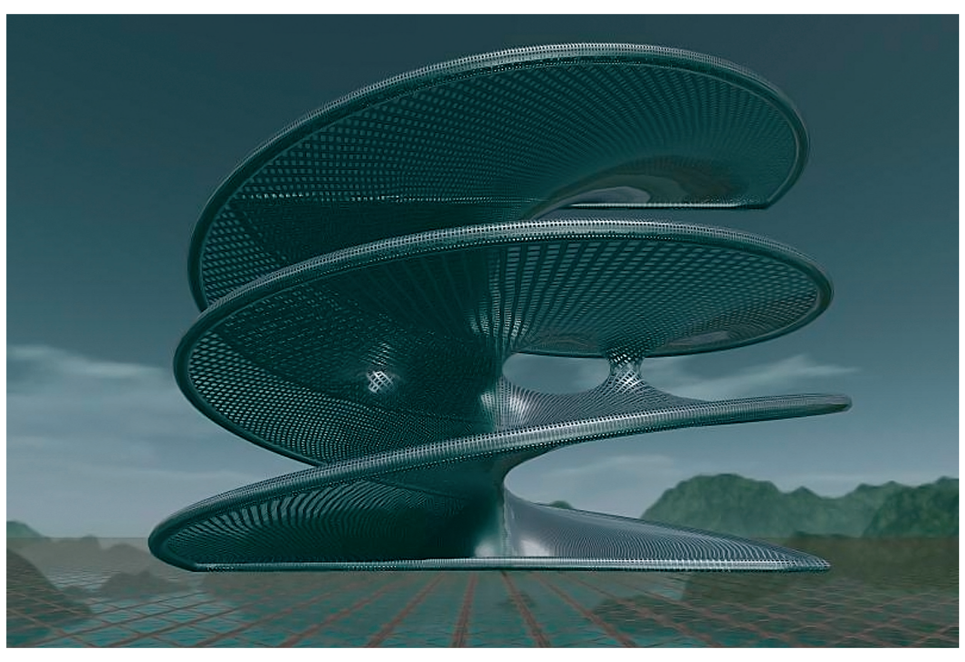
Willmore torus

Soap films consist of a material which resists being stretched. However, you can bend it in any direction with no effort. Willmore surfaces, in contrast, consist of a material which does not resist stretches, but develops elastic counter force against bending. What you see here is a piece of a closed torus with the Willmore feature, which was found by Matthias Heil on the basis of a theory of Babich and Bobenko.



Tetranoid

The Tetranoid is part of a class of surfaces that have the curvature features of soap bubbles. In mathematical terms this reads: The Tetranoid has a constant mean curvature. The four "legs" of the Tetranoid in reality keep on going to infinity. The existence of the Tetranoid (just like the existence of similar surfaces with arbitrary symmetry based on platonic bodies) was demonstrated by Nicholas Schmitt; he also calculated the surface.

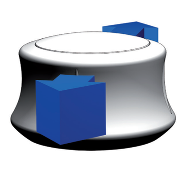


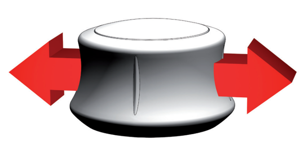
Helikoid with handles

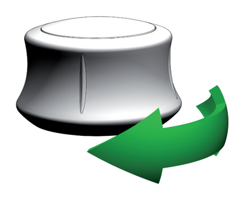
One of the best known minimal surfaces is the Helicoid which you will recognise from spiral staircases and car park ramps. It is, indeed, possible to connect different levels of the Helikoid with each other without destroying the minimal surface feature or making the surface intersect itself. This connecting piece is called a "handle" in mathematical terminology. Depending on where you are such a handle looks like a hole in the floor or ceiling, or like a column connecting the levels. This surface with two handles was found and calculated by Markus Schmies.

Guidance and control

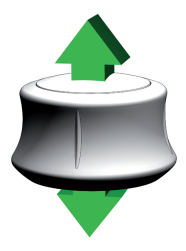
Explore the figures searching for particular points such as corners, intersections, chambers or holes.
You can even throw little balls at the figures!


Run ahead and back


Run sidewards


Turn to the left/right


Look up/down


Jump/fly

The buttons enable you to switch between the figures and throw balls

Concept and design
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jreality
This application has been created with jreality.
www.jreality.de

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Mathematik für Schlüsseltechnologien

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Wissenschaftsjahr 2008
Mathematik
Alles, was zählt

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung