surfer

visualisation of algebraic surfaces

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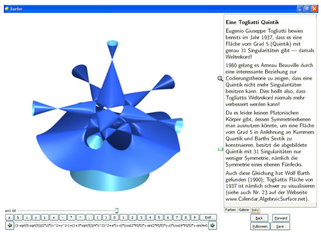

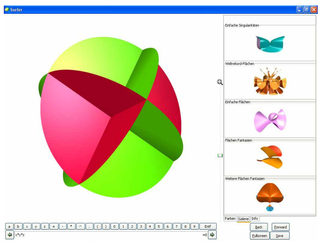

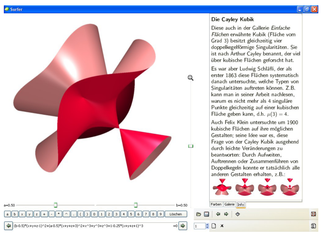

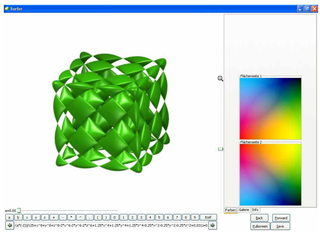

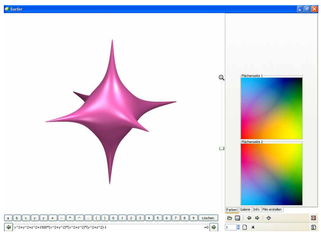

Download and contact
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SURFER team
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Programming: Henning Meyer (Linux version, Surf) and Christian Stussak (Windows conversion, Java version, Surf)
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SURFER is based on the SURF programme by Stephan Endrass et al.
(surf.sourceforge.net)

A project of the Mathematisches Forschungsinstitut Oberwolfach and the Technical University of Kaiserslautern, 2008-2010

Mathematisches Forschungsinstitut Oberwolfach

Wissenschaftsjahr 2008 Mathematik Alles, was zählt

SPONSORED BY THE Federal Ministry of Education and Research

Overview
SURFER is a programme to visualise real algebraic geometry in real time. The surfaces visualised are given by the zeros of a polynomial in 3 variables. SURFER is based on the SURF programme and was developed for the IMAGINARY exhibition created by the Mathematisches Forschungsinstitut Oberwolfach for the Year of Mathematics 2008 in Germany.

Brief instruction

1. Entry of the polynomial
The polynomial can be entered in the command line in the bottom left hand corner in three variables x, y and z. If the formula is syntactically incorrect (i.e.the computer thinks the expression is not a polynomial) a red exclamation mark (!) appears on the right hand side of the command line. The surface (the set of real zeros of the polynomial) is displayed immediately. Each surface is shown first in low resolution and then, after a short time for calculation, in high resolution.

2. Rotation of the surface
While holding down the left mouse button the surface can be rotated around its centre on the display window. During the rotation the surface is displayed in low resolution. After the surface has been rotated it is displayed in high resolution, after a short time for calculation.

3. Zooming
With the zoom bar (magnifying glass) on the right-most position of the display window you can zoom in or zoom out by changing the radius of the invisible sphere intersecting the surface. The surface is always displayed in the same overall size.

4. Entry of parameters
The parameters *a* and *b* can be used in the command line. A bar automatically appears to change the parameters between 0 and 1. The parameters can easily be shifted with the mouse. The changed surface is displayed immediately.

5. Colours
Under menu item "Colours" a specific colour can be assigned to the exterior or interior side of the surface. The colours are selected from a square of colours.

6. Gallery and information
Under menu item "Gallery" a great choice of surfaces is available to be viewed or to be changed by parameters. Many surfaces are provided with additional information which are indicated under menu item "Info" upon selection of a surface. The two little green arrows serve to select the next surface of the selected gallery.

7. Full screen
The button "Full Screen" (to the right of the green arrows) allows the switch into full screen which shows the window full screen sized. The full screen mode allows zooming, changing parameters and switching back to standard mode by clicking the button in the bottom right corner.

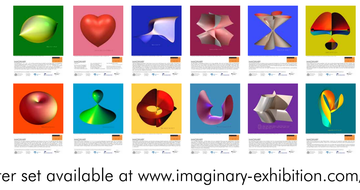
8. Save images
The "Save" button allows you to save the surface as an image (.png format). We will display interesting images on the IMAGINARY website and we invite you to submit your visualisation to our competition. For further details please see www.imaginary-exhibition.com.

9. Expert tips
Several surfaces: If you multiply two formulas f and g you get, by f*g=0, the unification of the two surfaces f=0 and g=0. (The new surface is singular along the section curve f=g=0); e.g. x*(x^2+y^2+z^2-1) =0 is the union of the plane with the sphere and that looks (within the bounding sphere) like Saturn with a ring.

Merging of components: If you subtract a constant from a formula f, say a, the surface f (x, y, z)=0 is disrupted due to f(x, y, z)-a=0, the singularities of f(x,y,z)=0 , in particular, are smoothed. If, for example, the union of two surfaces given as a product of f*g is disrupted by f*g-a the surface along the section curve is smoothed and the two components f=0 and g=0 merge into one component.

Section curves: If f=0 and g=0 are the formulas of two surfaces then f^2+g^2=0 is the formula of the section curve as this equation in its real figures is equal to f=g=0. The section curve will not be seen, though, because it is one-dimensional and the visualisation software cannot see it. The trick is to thicken the section curve by f^2+g^2-a assuming a small value of a thus making it visible.

10. Download and installation
The SURFER programme is available for free on the website www.imaginary-exhibition.com/surfer
It can be used for private or educational purposes.



Poster set available at www.imaginary-exhibition.com/poster