

Anita PAWLAK - JAKUBOWSKA
 Silesian University of Technology
 Geometry and Engineering Graphics Centre
 ul. Krzywoustego 7 44-100 Gliwice
 tel./ fax: 0-32 237 26 58, e-mail: anita.pawlak@polsl.pl

MODELING OF NURBS SURFACES BASED ON SELECTED COMPUTER PROGRAMS

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The latest construction materials and technologies allow creative thinking about forms of building objects. It results in the desire to strive for shapes which have not been used in construction enterprises so far. By means of computer tools, virtual realizations of ideas and concepts of modern architectural visions become possible.

Modern architectural object should chime with the landscape and become its part. In order to fulfill that requirement the form of a building should relate to the shapes which occur in nature. Their structure is based on complex shapes, so called NURBS, whose geometric model can be achieved by means of computer programs.

Contemporary architecture and construction is usually defined by regular solids. Such polyhedral shapes as orthogonal, prism or pyramid can be given as examples. Also shapes defined by surfaces of second degree or quadrics belong to this category, with such examples as cylinders, cones, ellipsoids, paraboloids, hyperboloids or toruses. A modern form usually presents various versions of mutual compilation of those shapes. Attempts to break this tendency can be seen in Gaudi, Gherry or Calatrava and they were treated as extreme because of incorporation of any shapes, which can be defined as NURBS.



Fig. 1 The design model of Cleveland Clinic building in Las Vegas realized in 2009, designed by architect Frank Gehry.

Nature is determined by curves and curvilinear surfaces with very rare lines and right angles. Therefore, why regular forms are used in architecture and constructing when in natural environment they are so exceptional to be found? The answer can be found in technology of constructing objects. The shapes which have been invented by a man are easier to map since they do not imply any complex constructional, technological or material solutions.

Modern computer aided designing programs offer possibility to generate objects of NURBS type with the freedom of creating architectural visions. They are used for creating space models and animation in computer games and pictures for cinematography. Currently, wide choice of programs for 3D modeling is available and with suitable tools it is possible to combine geometry of shape and architectural dimension.



Fig. 2 Geometric Construction of NURBS object consisting of a mesh and control points called nodes. Development in AutoCAD 2011.

There is a need to teach modelling in computer programs of complex forms of NURBS type. Getting to know their geometrical structure as well as the possibility to realize shapes based on them is necessary for any engineer. The shapes of curvilinear surfaces form the future of designing building objects.