ABSTRACT

Master's diploma work consists of an introduction, four sections, concludes with a list of links 40 titles, three appendixes and contains 38 pictures. Full scope of the thesis is 89 pages, including a list of sources of 4 pages, appendixes – 14 pages.

Relevance of subject. Approach of modeling with meta-balls (implicit surfaces, blob meshes) lies in modeling of surfaces by merging (adding) of some set of spherical scalar fields (meta-balls). Extended modifications of method give an opportunity of using some different primitive fields as meta-cube, meta-ellipsoid etc. along with basic meta-spheres. This method is good for modeling organic objects, liquids, electrostatic phenomenons, some technological objects and other kinds of real world objects. The problem which considerably limits the potential of given method is fixity of meta-primitives set given to the user for modeling. This potential could be significantly developed by adding the ability of defining arbitrary meta-objects.

Research objective. The objective of masters dissertation is development of method for geometrical modeling using meta-objects to give the ability of analytically defining arbitrary meta-objects.

Following **research tasks** were set to reach this objective:

- perform an analytical research of existing blob meshes modeling method modifications;

- improve method for geometrical modeling using blob meshes by generalization of meta-object concept;

- develop a computer system of three-dimensional geometrical modeling based on described method and a document format which will describe three-dimensional geometrical models built using method based on meta-objects;

- explore practical profit and different modeling approaches using method based on meta-objects with help of developed modeling system and document format.

Subject of inquiry - computer technologies of three-dimensional geometric

modeling.

Subject of investigation – geometrical modeling of complex surfaces using meta-objects.

Methods of research. “Marching cubes” method was used to approximate three-dimensional surface. Mathematical models of arbitrary analytically defined meta-objects were described using translators theory. Geometrical modeling was used for pre-analysis of meta-objecs classes, statistical analysis for efficiency evaluation and for optimization.

Scientific novelty of obtained results. The most significant scientific results of this work are:

- improved method for geometrical modeling using meta-objects by generalization of meta-object definition;

- developed an efficient method for computing the scalar field consisting of analytically defined meta-objects;

- developed a method for programmatic generation of different geometric object instances of some class.

Practical significance of obtained results.

Proposed improvements of basic modeling method using blob meshes significantly extend methods abilities. Usage of those improvements can provide practical benefit to users of the basic method which include engineers, constructors, computer graphics designers and scientists. Developed cross-platform system of geometrical modeling using meta-objects can be used to complete practical tasks of three-dimensional geometric modeling as it supports functionality of exporting your models into Wavefront object format which gives an ability to load this model in majority of modern powerful systems of three-dimensional modeling.

Approbation of dissertation results. Terms of the work were reported and discussed on:

1. VII International scientific conference of graduate students, undergraduates, students of thermal engineering faculty of NTUU "KPI" (Kyiv, April 21-25, 2009).

2. VII International scientific conference “Geometric modeling and computer design”. (Odessa, April 21-23, 2010).

Publications. Scientific theses of work were published in two papers

1. Ivchenko O.I. Conformal maps using Schwartz-Cristoffel method / O.I. Ivchenko, N.M. Ausheva // Abstracts of 7th international scientific conference of graduate students, undergraduates, students of thermal engineering faculty of NTUU "KPI", Kyiv, April 21-25 2009,VAT « District Volodymyretska printing », 2009. – P.224.

2. Ausheva N.M. Geometrical modeling of complex surfaces with meta-objects / N.M. Ausheva, O.I. Ivhcenko // The Interdepartamental Collection of Proceedings “Applied Geometry and Graphics”, vol. 84, 2010. - P.79.

Keywords. IMPLICIT SURFACES, META-BALLS, BLOB MESHES, META-OBJECTS, “MARCHING CUBES” METHOD, REVERSE POLISH NOTATION.