DOCTORAL (PHD) STUDIES

COURSE UNIT DESCRIPTION

Course unit title	Scientific areas	Faculty	Institute, department
Applications of classical geometry in surface modeling	Informatics (N 009)	Faculty of Mathematics and Informatics	Institute of Computer Science

Study method	Number of credits	Study method	Number of credits
Lectures	2 (autumn)	Consultations	2
Individual works	3	Seminars	

Summary

The course contains a brief survey of various classical geometries and their applications in surface modeling.

Main topics:
1. Fundamentals of affine and projective geometry. Linear primitives, polygons and polyhedrons. Transformations in plane and space. Rotations in space and quaternions.
2. Elements of computational geometry: convexity, convex hull, Voronoi diagrams and Delaunay triangulations.
3. Curves and surfaces: their implicit and parametric equations. Primitive surfaces. Bezier curves and surfaces. Spherical Bezier curves and rational parameterization of spheres.
4. Dupin cyclides as generalization of natural primitive surfaces. Parametrization of Dupin cyclides using quaternionic-Bezier formulas and their implicitization.
5. Geometric algebra as the generalization of quaternions. The conformal model of Euclidean and pseudo-Euclidean geometry. Spherical Voronoi diagrams in space and their applications for simulation of surfaces and channels in biomolecules.

Doctoral project: to model surfaces with certain properties using suitable classical geometry methods.

Main literature
1. D. Marsh, Applied Geometry for Computer Graphics and CAD, Springer, 2005.
2. G. Farin, Curves and Surfaces for CAGD. A Practical Guide, Academic Press, 1995
3. C. Doran, Geometric algebra 2015, *http://geometry.mrao.cam.ac.uk/2015/10/geometric-algebra-2015/*

Lecturer(s) (name, surname)	Scientific degree	Main publications
Rimvydas Krasauskas	dr.	http://www.elaba.mb.vu.lt/mif/?aut=Rimvydas+Krasauskas
Severinas Zubė	dr.	http://www.elaba.mb.vu.lt/mif/?aut=Severinas+Zubė
Kęstutis Karčiauskas	dr.	http://www.elaba.mb.vu.lt/mif/?aut=Kęstutis+Karčiauskas