

MAT 435 Mathematical Methods in Computer Aided Geometric Design

Prerequisite	Calculus and Linear Algebra.
Course Objectives	Students are expected to understand (i) basic theoretical concept of curves and surfaces. (ii) be able to use a symbolic mathematical language software and implement these concepts in the software.
Catalogue Description	Mat 435 – Mathematical Methods in Computer Aided Geometric Design (4+0) . Introduction to parametric curves and surfaces, Bezier, B-spline and interpolation techniques.
Textbook	<i>G. Farin</i> , Curves and Surfaces for Computer Aided Geometric Design, Academic Press Publishing, 4 th edition, 1996.
References	1. <i>G.Farin, D. Hansford</i> Essentials of CAGD A.K. Peters Ltd., 2000.

Course Outline

1. How to use a symbolic language software

- 1.1 Numerical operations, expressions and functions.
- 1.2 Graphing functions and expressions.
- 1.3 Calculus, linear algebra, differentiation, combinatorial packages.
- 1.4 Loops and procedures 3 weeks.

2. Affine geometry

- 2.1 Vector spaces, affine spaces and affine maps 1.5 week

3. Bezier curves

- 3.1 De Casteljaun algorithm
- 3.2 Derivatives and Bernstein form.

3.3 Blossoms and degree elevation techniques

4.5 weeks.

4. Polynomial interpolation

4.1 Lagrange and divided difference form, Aitken's algorithm, Hermite form

2 weeks.

5. Bezier surfaces

5.1 de Casteljau algorithm, Bezier triangles, rectangles

1 week.

6. Spline curves

6.1 Smoothness, de Boor algorithm

6.2 B-splines and cubic B-splines

2 weeks.

Assessment One mid-term, one final exams and 2 software projects.