

CS591_1: Selected Topics in Computer Graphics: Curves in Computer Geometric Modelling

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Computer geometric modelling is about storing and manipulating geometric objects/shapes which are in turn built using curves and surfaces. These structures/models are important in CAD/CAM and are widely used in many engineering fields.

The main focus of this course is to introduce students to the computational and mathematical representations of curves and equip them with computational tools to perform several standard operations and constructions on the curves.

Module 1: Motivation: Design of machines, automobiles, aircrafts, ships, buildings and structures. Basics of polynomials, Different bases serve different purposes. Interpolation vs approximation, Bernstein-Weierstrass theorem. [3 lectures]

Module 2: Bernstein base and its properties, Bezier curves and their properties. DeCasteljau algorithm, Algorithms for degree elevation, subdivision etc. [4 lectures]

Module 3: Curve operations: closet point computations, intersection computations: curves vs lines, curves vs planes, curves vs curves. A multi-dimensional Newton-Raphson framework, Curve-to-curve contact conditions etc. [4 lectures]

Module 4: Curve constructions: projection of curves, curvature basics, offset curves, self-intersection issues. [3 lectures]

Pre-requisite: linear algebra, basic calculus, data structures.

Audience: It should be accessible to UG students of 2nd year onwards and all PG students.

Local Co-ordinator: Jinesh Machchhar