Povzetek

V diplomskem delu bomo spoznali del teoretičnega ozadja pri oblikovanju s pomočjo računalnika. Najprej bomo predstavili baricentrične koordinate, afine preslikave, linearno interpolacijo in razcvet. S pomočjo Bernsteinovih polinomov bomo definirali Bézierove krivulje, ki danes predstavljajo glavno orodje v CAGD oblikovanju. Poleg osnovnih lastnosti Bézierovih krivulj si bomo ogledali še višanje stopnje, nato pa še povezavo med de Casteljauovim algoritmom in odvajanjem ter de Casteljauovim algoritmom in razcvetom Bézierove krivulje.

V tretjem poglavju bomo Bézierove krivulje razširili do Bézierovih ploskev iz tenzorskega produkta. Ogledali si bomo de Casteljauov algoritem za tenzorske ploskve, višanje stopnje in odvajanje. Nekaj besed bomo namenili tudi preslikavi razcveta na ploskvah, nato pa še normalnim vektorjem na ploskve.

Nadaljevali bomo s konstrukcijo in uporabo polinomskih krp. Posebej bomo omenili Coonsove in translacijske ploskve. Podrobneje si bomo pogledali tudi interpolacijo in aproksimacijo s tenzorskimi ploskvami po metodi najmanjših kvadratov.

V petem poglavju se bomo posvetili trikotnim Bézierovim krpam. Tudi te bomo definirali s pomočjo Bernsteinovih polinomov. Ogledali si bomo de Casteljauov algoritem za trikotne krpe, računanje smernega vektorja, nekaj besed pa namenili še višanju stopnje.

Zadnje poglavje bomo namenili geometrijski zveznosti sestavljenih ploskev. Podrobneje bomo spoznali pojem G^1 zveznosti na primerih dveh trikotnih krp, dveh tenzorskih krp ter trikotne krpe s tenzorsko.

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Ključne besede: CAGD, baricentrične koordinate, Bézierove krivulje, Bézierove ploskve, trikotne krpe, geometrijska zveznost.

Abstract

In this work we will introduce some important theoretical concepts of computer aided geometric design (CAGD). In the first chapter we will represent barycentric coordinates, affine map, linear interpolation and blossom. Using Bernstein polynomials we will define the basic tool for CAGD known as Bézier curves. Some of their properties, degree elevation and very important algorithm, called the de Casteljau algorithm, will be introduced.

In the third chapter Bézier curves will be expanded on Bézier tensor product patches. Again, we will present the de Castljau algorithm and degree elevation and derive formulas for computing derivatives for these patches. The blossom of surfaces and normal vectors will be briefly outlined.

Next chapter will be about construction of polynomial patches, in particular Coons and translational patches. Interpolation and least square approximation for tensor product patches will also be represented.

The fifth chapter will be about triangular Bézier patches, that will also be defined by using Bernstein polynomials. We will not bypass the de Casteljau algorithm for triangular patches. The concept of degree elevation and directional derivative will be represented.

In the end we will get familliar with geometric G^1 continuity for surfaces. In particular, different configurations of G^1 continuity between triangular and rectangular patches will be discussed.

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Keywords: CAGD, barycentric coordinates, Bézier curves, Bézier surfaces, triangular patches, geometric continuity.

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