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ABSTRACTS

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Contents

Plenary lectures

nth Order Surfaces with $(n-2)$-ple Straigth Line

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We define the transformation of 3-dimensional projective space into itself, i.e. $(n+2)-$degree inversion, where corresponding points lie on the rays of 1st order and nth class congruences C_n^1 [1] and are conjugate with respect to quadric Ψ. It is shown that this inversion transforms a staight line into the space curve of the order $n+2$ and a plane into the surface of the order $n+2$ which contains n-ple straight line [2]. Some properties of these surfaces (the number of simple straight lines and the number of pinch points on n-ple line) are shown.

In 3-dimensional Euclidean space we show that $(n+2)-$degree inversion with respect to any sphere with center P transforms the plane at infinity into the pedal surface of congruence C_n^1 with respect to pole P.

For special congruence C_4^1 (directing lines are Viviani's curve and a straight line which cut it into two points, where one of them is the double point of Viviani's curve) we derived 6th order surfaces (sextics) with quadruple line and classified them according to the number and kind of singular points.

For visualizations we used the programs *Mathematica* and *webMathematica*. We present the new version *Mathematica 6* which brings a revolution in the concept of interactive computing and visualization [3].

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Bäcklund Transformations for Pseudospherical Surfaces in the Galilean Space

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Study of surfaces for which a non-trivial relation between their Gaussian and mean curvature holds is a classical problem of the Euclidean differential geometry introduced by Julius Weingarten in 1861. As a special case of these surfaces, surfaces of constant Gaussian curvature (CGC) and constant mean curvature (CMC) appear. Moreover, it is well-known that surfaces with negative Gaussian curvature (pseudospherical surfaces) are connected to the Sine-Gordon equation. This equation plays very important role in the soliton theory.

In projective-metric spaces the analogous problem can be treated. Surfaces with negative Gaussian curvatures in the Galilean space are connected to the Klein-Gordon equation. In order to further investigate pseudospherical surfaces, we establish the line congruence with two pseudospherical surfaces as focal surfaces.

Über die Trabantkurven der Kegelschnitten

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Seien in der Ebene ein beliebiger Kegelschnitt c und ein beliebiger Punkt P als der Pol gegeben. Dem Paar (c, P) ordnet man verschiedene Trabantkurven zu. Es sind: polar reziproke Kurve, Inversionskurve, negative Fußpunktkurve, Äquidistantkurve usw. Solche Kurven wurden konstruiert und eine zur anderen in Zusammenhang gebracht. Aus der Konstruktion schließt man dass die Äquidistantkurve mit einer anderen Trabantkurve zusammenfällt. Man betrachtet weiter die Hüllkurve der Kegelschnittnormalen und beweißt, dass diese Hüllkurve mit der Kurve aller Krümmungszentren des gegebenen Kegelschnittes koinzidiert.

Key words: Trabantkurve, Fußpunktkurve, negative Fußpunktkurve, Dualkurve, polar-reziproke Kurve, Homotetie.

Fractions, Fractals and other Geometric Miniatures

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During my long life I came in contact with a lot of interesting problems involving projective geometry, the Golden Section, non euclidean geometry and some mathematical disciplines. I always found that, when a proof made a certain theorem "obvious", a process of reflection started and lead to new questions and points of view, which finally made the original problem not at all obvious. Here curiosity starts again: Where does the original topic belong to? What will be an adequate proof for it? Is it worthy to be taught to students?

The latter question is crucial: If being honest, we had to admit that most of our scientific results are only sort of etudes. While it is accepted that an instrumentalist of any level has to play etudes, the public expects and acknowledges only 100% hardcore results of scientist, results to gain lead and money. Therefore we often have to lie when applying for grants and support for our beloved topics. The lecture will take the simple number theoretical problem of Deschauer (2007) and an incidence geometric theorem of Ebisui (2007) as starting point and connect them with other geometric theorems involving fractals, spherical geometry, and projective geometry and the Golden Mean.

Contributed talks

Immersions and Embeddings

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All smooth manifolds can be smoothly embedded in Euclidean spaces. This justifies our habit of visualizing manifolds as subsets of $\mathbb{R}^n$.

To prove this, we use analysis in $\mathbb{R}^n$ to construct a "local" solution, and then use partitions of unity to piece together the local solutions into a global one.

First we show how any smooth map into $\mathbb{R}^n$ can be perturbed slightly to be an immersion, and then show how to perturb the immersion to be injective.

Key words: smooth manifold, immersion, embedding, embedded submanifold

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Forms and Systems

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This presentation deals with one of the meeting points of natural sciences and fine art and discusses the mathematical background and geometrical aspects of some interesting Tamás F.Farkass graphics. The artistic repetition of planar figures in a symmetric manner provides us with a fresh insight on how geometry interrelates with other fields of life.

An Oblique Elliptic Hyperboloid of One Sheet - Task Setting and Constructive Procedure

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An oblique elliptic hyperboloid of one sheet can be spatially defined by twice using three mutually by-passing straight lines. These six straight lines are directrices of two systems generatrices of this surface area. Directrices of one system generatrices intersect directrices of another system of generatrices forming an spatial hexagon.

The carrier of this spatial hexagon could be four-sided, six-sided (regular or irregular) prism, or four-sided, six-sided truncated pyramid, providing that each directrices of one system generatrices intersect all three directrices of another system generatrices.

In a case of four-sided prism or six-sided truncated pyramid, six prism edges of four diagonals of their sides and two prism edges, define edges of directrices hexagon. In a case of six-sided prism or six-sided truncated pyramid, the edges of directrices hexagon are defined by diagonals of its six sides.

The construction of this surface begins with projection where at least one of directrices from any system of generatrices can be seen as point. After drawing projections of generatrices of the surface areas in desired number, one determines points of intersection with projections of directrices transferring them in corresponding space on directrices. Connecting corresponding points between directrices of one systems generatrices and than connecting corresponding points between directrices of second systems generatrices, we obtain both systems of generatrices of one an oblique elliptic hyperboloid of one sheet.

Key words: An oblique elliptic hyperboloid of one sheet, spatial hexagon, carrier for directrices, projection of directrix seen as a point

On some Inequalities of Jensen-McShane's Type on a Rectangle and Applications

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The work presents refined results proven in [1] and [2]. Regarding geometrical features, inequality sequence was obtained including McShane generalization of Jensen's inequality for convex functions defined on a rectangle. Consequently, some inequalities of the Hadamard and Lupaş types were refined. In addition, Petrović inequality for the two-variable case is presented.

Key words: Convex functions, Linear functionals, Jensen's inequality, McShane generalization of Jensen's inequality, Hadamard's inequality, Lupaş type inequality, Petrović's inequaliy

MSC 2000: 26D15, 26D99

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Square and Circle with Identical Areas - Contribution to Approximate Constructions

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Often considered geometrical problem of *squaring the circle* is actual in intention to find the most precise constructive method of determination relation between square and circle with identical areas.

Research is based on analysis of series of circles and corresponding squares, with identical areas, in order to construct size of squares edge (a), with area a^2, for taken radius of circle (r), with area $r^2\pi$, if $a^2 = r^2\pi$.

The result is group of principles and relations refered to: angular relations (of mutual elements of circle and square; radius and half-perimeter of circle; half-perimeter of circle and square - mutually), similarity - homotethy and its application in constructing procedure. Three approximate geometrical constructions applicable in theory and practice were made.

Precision is in rank of Kohanskys (Polish mathematician) construction of half - perimeter of circle, used as basic element for analysis of mutual relations of half perimeters of circles and squares with identical areas.

This is an empiric research supported with possibilities of program tools of Auto CAD software for: drawing precision, measurements of lengths and areas (in a constructing procedure and solution control) and options for 2D rotation tasks.

Key words. angular relations, "construction of Kohansky", homotethy of plain and space

Secondary Structures and Polygon Dissections

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Various problems of polygon dissection have attracted much attention during last two and a half centuries, giving rise to many classical combinatorial sequences, such as, e. g., Catalan, Schroöder, and Narayana numbers. In most of such problems it is required that the dissecting diagonals do not cross in the polygon interior. By imposing a stronger condition that the diagonals are not allowed to cross neither in vertices, we get an interesting variant of the dissection problem which, to the best of our knowledge, received no attention so far. We present here an explicit solution to this problem, obtained by using some recent results on enumeration of secondary structures.

Short Introduction to Spatial Ability Tests

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In our presentation we will give a short introduction into spatial ability tests.

First, a few words about these questions:

What is the definition of spatial ability?

What is the relationship between spatial ability and intelligence?

How many factors does spatial ability have?

What kind of spatial ability tests exist?

(For example: surface development test, cube comparison, 2D mental rotation test, paper form board, MRT, MCT.)

After this we will pan out about Mental Cutting Test (MCT) and our result in MCT research at our university. Mental Cutting Test is one of the most widely used evaluation method for spatial abilities. We present an analysis of MCT results of first-year engineering students, with special emphasis on gender differences and compared with international results.

Virtual Spaces in Photography

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Photography literally means to depict light. In geometry, light rays are simply intersected with a projection plane, and idealized photography is considered as a simple central projection. Instead, we define photographic projection in a quite different manner: The Space in front of the camera is transformed via a complex lens system into a virtual 3D-space collinear to Euclidean space by means of a so-called Elation. Light rays are split up and bundled again in space points and image points, and we can represent them as "conic fibers" through the diaphragm of the lens system. The art of photography is now to create the best possible cross section of this virtual fiber space. This unusual concept allows to explain perceptions like blurring, focal length of lens systems, depth of sharpness etc. in a quite natural way.

Flexible Surface Design

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Given an arbitrary tesselation of a surface you can ask for a similar mesh with different properties. This means e.g. to improve the uniformity of the tesselation, without changing the shape of the mesh. Or to give the surface elasticity to change its shape, where the border lines or parts of it may be fixed or manipulated. Another approach is to design the surface under given constraints, like preserving the length of all or a subset of edges or alternatively to influence the behaviour of the angles between adjacent edges. The presented algorithm is a modification of the earlier algorithm by Fruchterman et al., which is the basis for a manifold real time design tool.

The Generalized Gergonne Point and Beyond

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The well-known center of the triangle is the intersection of three cevians defined by the touching points of the inscribed circle. This point is generalized by Konečny and others ([1], [2]) applying circles concentric to the inscribed circle (see Figure 1). Here we show some interesting results on further generalizations of this idea considering inscribed ellipses (as in [3]) and ellipses (especially circles) concentric to the inscribed ones.

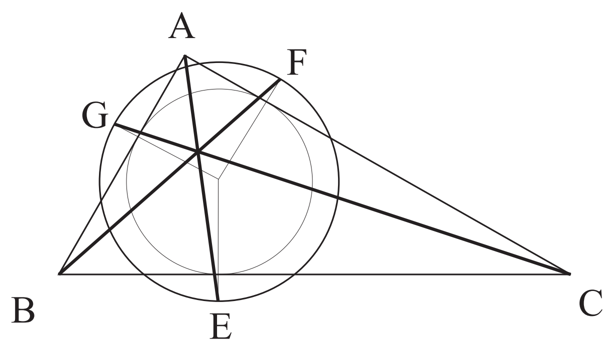

Figure 1: lines AE, BF and CG are also concurrent for circles concentric to the inscribed circle

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Elementare Beweise von Sätzen mit Anwendung der Modelle der hyperbolischen Geometrie

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Wir geben einfache Beweise für einige Probleme der elementaren hyperbolischen Geometrie mit Anwendung der Modelle der hyperbolischen Geometrie. Unsere Method ist, dass wir einen Punkt irgendeiner Figur in den speziellen Punkt des Modells transformieren.

Anaglyph Stereograms

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This work is dedicated to the investigations of the invariants and mutual relations of anaglyph stereograms as one of the possible and very effective procedures and techniques for direct presentation of three-dimensional space.

Since the anaglyph stereograms basically represent two interrelated central projections whose features and invariants derive from the theory of collinear fields in general, this work shows the definitions and basic invariants of the fields of general and perspective collineation.

This work also consists of those investigations that are made on a pair of images in the central projection obtained from two viewpoint projection centers whose mutual distance has a special proportion comparing to a size of the distance. Based on the previously obtained results, the new constructive-graphic procedures of anaglyph image were shown.

In addition, the essence of anaglyph techniques along with the methods of creating the anaglyph stereograms were presented followed by corresponding techniques of the binocular stereoscopic illusion of the tree-dimensional space.

Key words: anaglyph, affinity, collineation, perspectivity, stereograms

Descriptive Geometry in the Art of Painting - Geometry in the Icons, Space in the Icons

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Students don't learn Descriptive Geometry in all secondary school in Hungary.

In a secondary school where the students learn Descriptive Geometry for two years, during the first 12 lessons they study the History of Descriptive Geometry. It is included in the syllabus.

But if you don't know anything about Descriptive Geometry, it is difficult to speak about its History. For example: if you don't know anything about Mathematics you don't understand its History either. This is a contradiction.

I would like to resolve this problem with a new method.

Let's have a look at the History of Visual Representation through fine arts products - paintings and graphics. In this way we get as far as the exact attain the exact rendering of Descriptive Geometry at University.

I'll give a scheme, how the students can attain the topics with this method and how we can integrate it for example in arts in secondary school.

One of this themes is how the space is presented in the icons.

Why are icons interesting?

Maybe the iconpainting is the only line of the art, which has hardly changed for centuries. Iconpainters apprenticed their profession by copying, so the structure and architectural elements of pictures descended in the same form.

The special universe, that we can see in icons, is an unusual rendering. It is called reversed perspective.

I'll show you some icons, and sketches, which demonstrate the reversed perspective. Finally, we'll look at some examples of copying icons and some impossible views, which we can find if we have a closer look at the icons.

Some Golden Structures in GS-quasigroup

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GS-guasigroup is defined as an idempotent quasigroup which satisfies the mutually equivalent identities $a(ab \cdot c) \cdot c = b$, $a \cdot (a \cdot bc)c = b$. Some interesting geometric concepts can be defined in a general GS-quasigroup. The geometrical representation of the introduced concepts and relations between them will be given in the GS-quasigroup $C\left(\frac{1}{2}\left(1+\sqrt{5}\right)\right)$.

Geometry and the Architecture of Jože Plečnik

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This year we celebrate the 50^{th} anniversary of death of the Slovenian most famous architect Jože Plečnik. Nowadays we can admire his architecture not only in Slovenia but also in many central European towns: Prague, Beograd, Vareš and in some Croatian places: Zagreb, Osijek, Brijuni and Dalmatia. His architecture has given a city of Ljubljana charming character. Although he was thought to be a successor of a prominent Vienna's architect Otto Wagner, later he has developed his own architecture style based on the antique and renaissance architecture, but with the strong interaction and support of local architecture characteristics.

The buildings of the famous architects quite often have a special spirit. It is said that they are unique and "everlasting". And what gives the spirit to the building and what makes the quality differences between one building and another? The analyses of well-known architecture show that the composition is that thing that gives the spirit to the building. Architect Plečnik's church of St. Michael on the Ljubljana's moor is one of his latest and most precious works. The architecture critics say that is one of the pearl of his work. Through the composition analyses we want to show the role of geometry in this creation.

Dynamic Analysis of Raster Images and its Use in Transportation Engineering

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The application of computer graphic methods, particularly dynamic analysis of images such as automatic vehicle classification (AVC), automatic vehicle identification (AVI) thru automatic license plate recognition (LPR), automatic incident and accident detection (AID), monitoring and characterization of linear traffic flows (road traffic) or stochastic traffic movements (pedestrian movements, ski slopes) etc. is widely spread in the transportation engineering and is gaining in importance.

On the other hand, a classical way to present and express vector based technical information, like construction of projections, shading, design of curves etc., is still required in the engineering practice and the classical contents of descriptive geometry is still needed. The conversion from raster image into vectorised objects is an extremely important process in the transportation engineering practice (pattern recognition, character recognition, recognition of objects, assessment of object movements etc.)

Study programs in European faculties providing education for transportation engineers were analyzed and it was concluded that separate lectures are offered in:

- descriptive geometry and technical drawing (with a predominantly vector approach),
- computing, informatics and computer graphics (with a predominantly raster graphic approach).

In the article, a new model for an integrated education of traffic engineers uniting geometric and graphic contents is presented.

On the Crystal-growing Ratio

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Considering a vertex of a regular mosaic in the hyperbolic space, we create belts around it, then we examine the limit of the ratio of the volumes of two successive belts. This limit is called the crystal-growing ratio of the mosaic.

In the lecture we determine the crystal-growing ratios and other limits specified to the regular mosaics in a general way for almost all the 3- and 4-dimensional regular mosaics in the hyperbolic space. We also show that the appropriate limits are equal in the cases of dual mosaics.

Key words: hyperbolic geometry, hyperbolic mosaics.

The Role of Geometry in the Identification and Motivation of Mathematically Talented Children in Primary School

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After empirical research the paper discusses about the Role of Geometry in the identification mathematically talented children at primary school. An empirical research is conducted including 247 pupils, age 10, selected from different elementary schools in Osijek, Croatia.

Key words: Teaching of geometry, mathematically talented children

Istraživanja u sklopu bolonjskog procesa

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Početak primjene bolonjskog procesa zahtijeva istraživanja u provedbi. Reforma nosi željenu modernizaciju studija ali novosti treba pažljivo uvoditi, ispitujući rezultate. U ovom radu prikazani su rezultati istraživanja utjecaja reforme na geometrijske kolegije Građevinskog fakulteta u Rijeci.

Već davno prije reforme, u nastavi geometrijskih kolegija na GF Rijeka prisutan je stalan proces unapređivanja i praćenja razvoja kvalitete, unutar fakulteta, kao proces iznutra ("bottom-up"). Uporaba računala u nastavi uvođena je od 1988. Jedna anketa provedena 2004, u vrijeme pripreme reforme, pokazala je da 60% studenata Mongeovu *Deskriptivnu geometriju* smatra potrebnom, u kombinaciji s CAD-om.

Zapaža se sindrom:
Kolegij koji je bio prije "Bolonje" metodički razrađen, u skladu s "bolonjskim procesom", imao najveću prolaznost i najviši prosjek ocjena, primjenom reforme gubi uvjete za kvalitetno funkcioniranje i mora tražiti nove metode.
Reformski proces odozgo ("top-down") donio je drastičnu restrikciju geometrijskih kolegija i zahtjevnu prvu godinu studija, s kolokvijima iz gotovo svih kolegija. Predviđeno je aktivnije ponašanje studenata, bitno drugačije nego ranije. U toj situaciji postavljaju se zaista mnoga pitanja: Što se događa s kvalitetom (nastave, studentskog angažmana i rezultata) u reformi? Na kojim kolegijima će ona porasti a koji će biti oštećeni i onemogućeni u razvoju? Što treba poduzeti? Koliko su studenti spremni prihvatiti ponašanje koje reforma predviđa u smislu samostalnog, redovitog studiranja a koliko namjeravaju kampanjski raditi ili juriti za uvjetima? Što se definira kao kvaliteta obrazovanja na sveučilištu i kako je mjeriti? Što sve predstavlja povratnu informaciju "student's feedback" i što je mjerodavno za koji aspekt obrazovanja? Što mogu a što ne mogu pokazati ankete, u kojima studenti ocjenjuju nastavu ili nastavnika a nisu osposobljeni za to? Koliko je moguće postići operativni nivo znanja i sposobnosti studenata u novim uvjetima da budu u stanju kreativno rješavati nove probleme u struci? Njeguju li fakulteti kulturu kvalitete stvarno ili deklarativno?

U cilju praćenja studenata od samog početka studiranja, uspjeh studenata ocjenjujem svaki tjedan. Na sveučilišnom studiju provela sam 2006/07 uvodnu i završnu anketa za *Konstruktivnu geometriju.* Prvoj je pristupilo cca 90% studenata a drugoj cca 50%. Ispitano je očekivanje, planiranje i rad studenata, razlozi neredovitosti, dobre i loše strane okruženja u kojem se nalaze na našem fakultetu. Iako većina pohađa nastavu i želi redovito raditi, ističe se problem da se ne stignu pripremiti (42%). Smanjenje fonda sati aktivne nastave nije povećalo kvalitetu studentovog učenja. Dan za učenje (bez nastave) većina koristi za nešto drugo.

Provedena je i anketa kojom studenti procjenjuju nastavu. Ona pokazuje ustvari prosjek dojmova koje studenti imaju u vrijeme anketiranja. Nastavnik, ocjenjujući studente, dijelom ocjenjuje i sebe, ali studenti, ocjenjujući nastavu, velikim dijelom ocjenjuju sebe.

Za izborni kolegij 2. semestra *Inženjerska geometrija u CAD-u* pokazalo se: ako kolegij nema ocjene, studenti rade samo minimalno. Elektronički kolokvij ima teorijska pitanja i konkretan geometrijski zadatak na računalu. Provedba je kompliciranija nego za klasični kolokvij. Dolazi se do zaključka: Izbornim kolegijem na računalu ne može se nadoknaditi ukinuti obvezni geometrijski kolegij u drugom semestru. Budući inženjeri slabije će vladati geometrijom u 3D.

Remarks on Ruled Surfaces with Constant Parameter of Distribution

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A first order invariant of ruled surfaces of E_3 is the so-called *parameter of distribution* d in a generator. It is defined as the limit of the quotient of the distance and the angle of the generator and its neighbour. Ruled surfaces with constant parameter of distribution are of special interest and have been studied by many authors. H. Brauner could prove that the only nontrivial cubic ruled surface with constant parameter of distribution in E_3 is a special type of a Cayley surface.

The paper is devoted to the investigations of these problems for higher dimensions. We will determine all cubic ruled surfaces of E_n with constant parameter of distribution. Surprisingly, there is one (unexpected) class of such surfaces way beyond the 3−dimensional Cayley surface case.

Key words: Ruled surfaces of E_4, constant parameter of distribution

AMS Classification: 53 A 05

Classification of Central Axonometric Mappings

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The degenerated projective, or so called *central-axonometric* mapping of the space to the plane can be given by the images of the origin, the unit-points and the infinite points of the axes of the Cartesian coordinate system, using homogeneous coordinates:

$$\kappa : \phi : (O; E_1, E_2, E_3, U_{1\infty}, U_{2\infty}, U_{3\infty}) \mapsto \phi^c : (O^c; E_1^c, E_2^c, E_3^c, U_1^c, U_2^c, U_3^c).$$

This mapping between the protectively embedded Euclidian spaces $\mathbb{P}^3 \to \mathbb{P}^2$ can be written by a 3×4 type real matrix as a linear mapping $\mathbb{E}^4 \to \mathbb{E}^3$, or in $\mathbb{P}^3 \to \mathbb{P}^3$ case with a 4×4 type matrix, rank 3. In general this mapping is not a central projection, however, the kernel of the mapping holds as a center. Using the following notes, $O^c = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, $E_i^c = \begin{bmatrix} x_i^c \\ y_i^c \end{bmatrix}$, $U_i^c = \begin{bmatrix} \delta_i^c x_i^c \\ \delta_i^c y_i^c \end{bmatrix}$, $i = 1, 2, 3$, the matrix of the mapping is the following:

$$\mathbf{A} = \begin{bmatrix} \frac{\delta_1}{\delta_1-1}x_1 & \frac{\delta_2}{\delta_2-1}x_2 & \frac{\delta_3}{\delta_3-1}x_3 & 0 \\ \frac{\delta_1}{\delta_1-1}y_1 & \frac{\delta_2}{\delta_2-1}y_2 & \frac{\delta_3}{\delta_3-1}y_3 & 0 \\ \frac{\delta_1}{\delta_1-1}z_1 & \frac{\delta_2}{\delta_2-1}z_2 & \frac{\delta_3}{\delta_3-1}z_3 & 0 \\ \frac{\delta_1}{\delta_1-1} & \frac{\delta_2}{\delta_2-1} & \frac{\delta_3}{\delta_3-1} & 1 \end{bmatrix}.$$

In this paper we will classify this type of mappings. This classification is based on the Jordan-form of the matrix $\mathbf{A}$. The two main classes are: 1. real eigenvalues; 2. complex conjugate eigenvalues. We will illustrate some special unusual cases with a mapping of a cube as an example.

Modelling Ross Business Rules in UML

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R. Ross introduced new method in information systems modelling business rules based on dates about enterprise. System anylists describe enterprise in terms of the structure of the data those enterprise use. Frequently they are not articulated until it is time to convert them into program code.

Ross method of modelling business rules enables modeling blocks which could be connect in big systems, and easy to change if necessary.

On the other side, many computer modelars work in UML- Universal Modelling Language. UML has been already implemented in many CASE tools and has interfaces for them. UML posseses specific object programming encapsulation, hidding information, polimorphism.

In this paper we try Ross business rules express with UML diagrams and try to compare the same rule in Ross and in UML graphic representation.

About the Focus and the Median of a Non Tangential Quadrilateral in Isotropic Plane

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Non tangential quadrilaterals in the isotropic plane are given in this talk. A quadrilateral is called standard if a parabola with the equation $x = y^2$ is inscribed in it. The properties of the standard quadrilateral related to a focus and a median of the quadrilateral are presented.

Key words: isotropic plane, non tangential quadrilateral, parabola, focus, median.

Elements of the Non-Euclidean Geometry in the Education

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The geometry in the school is euclidean traditionally. Is that so? Or does the syllabus contain the elements of the non-euclidean geometries?

In this presentation we deal with simple problems, theorems which are correct in the euclidean, spherical and hyperbolic geometry.

This problems may be help to understand the non-euclidean geometries later.

New Visualization Methods in Radiology

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Our team's aim was to extend the traditional orthogonal system in the visualization of the CT and MRI images. We have introduced a new slice type called oblique. This new slice with the traditional three directions (axial, coronal and sagittal) forms a more complex montage. We can display these slices in a spatial model for the radiologist. This helps to make a better diagnosis. Furthermore, we integrated the different fiber model visualization techniques into the spatial model.

Adaptive Mesh Subdivision for Radiosity

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Radiosity is a well known method for global illumination which is well suited for the generation of photorealistic images for interiors with area light sources. The method requires a discrete representation of the surface elements and high computation times. The visual accuracy of the results and computational efficiency of the method strongly depends on the discretization of the mesh. Therefore many methods have been proposed in order to adaptively refine the mesh.

Adaptive mesh subdivision poses two major questions: what subdivision criteria should be chosen and how should the mesh be subdivided. This paper reviews the problems associated with adaptive subdivision of triangular meshes in general and proposes a method particularly with regard to radiosity.

Enhancement of the Fiber Tracking

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Our aim is to examine and refine the well documented fiber tracking techniques such as SLT and Q-Ball imaging and to develop new methods. Comprehensive tests were applied according to speed and quality (cross direction fibers). Developing parallel methods is essential for dual or quad CPUs and GPUs having more processing units. The results show that the methods can be massively parallelized and the gain is significant.

The further developing goal is to make the fibers visualization more realistic and efficient by using particle systems.

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