



25th National and 2nd International Scientific Conference

moNGeometrija

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Faculty of Architecture in Belgrade

Faculty of Mechanical Engineering in Belgrade

Faculty of Civil Engineering in Belgrade

Faculty of Forestry in Belgrade

Faculty of Transport and Traffic Engineering in Belgrade

Faculty of Applied Arts in Belgrade

**25th National and 2nd International
Scientific Conference**

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Faculty of Forestry, Belgrade
Faculty of Transport and Traffic Engineering, Belgrade
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Topics

Theoretical geometry, exposed by synthetical or analytical methodology:

- * Descriptive and constructive geometry
- * Projective geometry
- * Central projection, Perspective and Restitution
- * Cartography
- * Theory of Polyhedra
- * Fractal geometry

Geometry and Graphics applied in Engineering and Architecture:

- * Engineering graphics
- * Computational geometry (algorithms, computer modeling of abstract geometrical objects, structures, procedures and operations)
- * Computer Aided Design and Drafting; Geometric and Solid Modeling; Product Modeling; Image Synthesis; Pattern Recognition; Digital Image Processing; Graphics Standards; Scientific and Technical Visualization
- * Kinematics Geometry and Mechanisms
- * Applications of Polyhedra theory
- * Fractals
- * Computational restitution
- * Stereoscopy and Stereography
- * Virtual reality

Geometry applied in Visual Arts and Design:

- * Theory and application of Visual Aesthetics
- * Geometrical and mathematical criteria of Aesthetic values
- * Perception and meaning of colors
- * Geometrical forms applied in Visual Arts
- * Optical illusions and its applications

History of Geometry:

- * Famous scientist and their contribution
- * Origin, derivation and development of particular geometrical branches
- * History of geometrical education

Education and didactics:

- * Descriptive Geometry and Graphics Education, including the Reform of Education
- * Education Technology Research
- * Multimedia Educational Software Development
- * Virtual Reality Educational Systems
- * Educational Software Development Tools Research and so on

CONFERENCE SCHEDULE

Thursday, 24.June 2010. Faculty of Mechanical Engineering, Belgrade, Room 513		
Time	Presenter	Paper Title
10:00 -11:00 FME	Arrival, Registration	Cocktail
11:00- 11:30	OPENING CEREMONY	
11:30 -11:45	Coffe/ Tea break	
11:45 -13:30	Assembly of SUGIG	
13:30 – 15:00	Lunch Break	
Chair	Prof. Miodrag Nestorovic, PhD	Plenary Lectures
15:00 -15:30	Hellmuth Stachel (Austria)	RECONSTRUCTING VERMEER'S PERSPECTIVE IN 'THE ART OF PAINTING'
15:30 -16:00	George Zlokovic (Serbia)	ANALYSIS AND GENERATION OF COMPLEX SPHERICAL NETWORKS BASED ON OCTAHEDRAL AND ICOSAHEDRAL SYMMETRY GROUPS
16:00 – 16:30	Dvoretzky Alexander (Ukraine) Maksimenko Olexander	INTERNAL DYNAMICS OF SCULPTURE
16:30 – 17:00	Dvoretzky Alexander (Ukraine) Tetiana Denysova	THE REFLECTED ENERGY MAP
17:00 -17:30	Cofee break	

Thursday, 24.June 2010. Faculty of Mechanical Engineering, Belgrade, Room 513		
Time	Presenter	Paper Title
Chair	Prof. Branislav Popkonstantinovic, PhD	Scientific Program
17:30 -17:45	Natasha Kirilova Danailova (Bulgaria) Venzislav Dakov Radulov	FUNDAMENTAL MATRIX IN EPIPOLAR GEOMETRY
17:45 -18:00	Ljubica Velimirovic (Serbia) Marija Ciric Milan Zlatanovic	BENDINGS OF SPHERICAL CURVES
18:00 -18:15	Marija Obradovic (Serbia) Branko Malesevic Maja Petrovic	CONIC SECTIONS OF A TYPE OF EGG CURVE BASED CONOID
18:15-18:30	Aleksandar Cucakovic (Serbia) Magdalena Dimitrijevic	DEFINING THE PRINCIPAL AXES OF THE QUADRIC CONE – GENERAL CASE WITH ELLIPTIC BASE SECTION CURVE
18:30 -18:45	Carmen Marza (Romania) Georgiana Iacob	STUDY REGARDING THE GRAPHICAL AND ANALY-TICAL APPROACH OF THE TRANSITION PIECES BETWEEN PIPES WITH PERPENDICULAR AXES
18:45 -19:00	Solfins	SOLID WORKS presentation

Friday, 25.June 2010. Faculty of Mechanical Engineering, Belgrade – Room: 513		
Time	Presenter	Paper Title
Chair	Prof. Aleksandar Cucakovic, PhD	Scientific Program – Theoretical Geometry
9:00 -9:15	Ljubica Velimirovic (Serbia) Milica Cvetkovic Marija Ciric, Nikola Velimirovic	GAUDI SURFACES
9:15 -9:30	Ljubica Velimirovic (Serbia) Marija Ciric	VISUALISATION OF THE WILLMORE ENERGY OF THE SURFACES
9:30 -9:45	Laslo Voros (Hungary)	PLANAR TESSELLATIONS BASED ON SHADOWS OF MORE-DIMENSIONAL CUBES
9:45 -10:00	Gordana Djukanovic (Serbia) Vjaceslava Matic	GRAPHIC TRANSFORMATION OF HYPERBOLIC PENCILS OF CIRCLES INTO PENCILS OF CONICS AND THESE INTO PENCILS OF CURVES OF THE 3rd OR 4th ORDER
10:00-10:15	Sonja Krasic (Serbia) Vladan Nikolic	MAPPING OF A SPHERE INTO ROTATIONAL HYPERBOLOID WITH THE AID OF THE ABSOLUTE CONIC IN GENERAL COLLINEAR SPACES
10:15 -10:30	Sonja Krasic (Serbia) Biserka Markovic	MAPPING OF A SPHERE INTO ROTATIONAL PARABOLOID WITH THE AID OF THE ABSOLUTE CONIC IN GENERAL COLLINEAR SPACES
10:30-11:00	Coffe/ Tea bbreak	

Friday, 25.June 2010. Faculty of Mechanical Engineering, Belgrade – Room: 513		
Time	Presenter	Paper Title
Chair	Doc. Sonja Krasic, PhD	Scientific Program – Geometry in Engineering
11:00 -11:15	Magdalena Orban (Romania) Sanda Bodea	PARTICULARITIES OF CURVATURE DETERMINATION OF SOME CURVES WITH APPLICATIONS IN MACHINE BUILDING
11:15 -11:30	Viktor Milejkovskyi (Ukraine)	GEOMETRICAL MODELING OF THE JET BOUNDARY LAYER
11:30 -11:45	Aca Randjelovic (Serbia) Olgica Lazarevic	DESCRIPTIVE GEOMETRY AND THE RULES OF INFANTRY WEAPONS SHOOTING
11:45-12:00	Olgica Lazarevic (Serbia) Vojislav Batinic Nenad Radisavljevic	THE APPLICATION OF DESCRIPTIVE GEOMETRY IN THE SERBIAN ARMY ENGINEERING BRANCH
12:00-12:15	Tugomir Kokelj (Serbia) Olgica Lazarevic	APPLICATION OF DESCRIPTIVE GEOMETRY IN THE PROCESS OF DETERMINING TOPOGRAPHIC ELEMENTS FOR INDIRECT ARTILLERY FIRE
12:15-12:30	Lozica Ivanovic (Serbia) Danica Josifovic, Andreja Ilic	DESIGN OF THE GEARING SPECIAL FORMS
12:30 -14:00	Lunch break	
Chair	Prof. Ljubica Velimirovic PhD	Scientific Program – Geometry in Engineering
14:00 - 14:15	Miodrag Nestorovic (Serbia) Aleksandar Cucakovic Biljana Jovic	GEOMETRIC ANALYSIS VARIANT OF FREE-FORM
14:15 - 14:30	Milena Stavric (Austria) Albert Wiltsche Christian Freißling	GEOMETRIC AND AESTETIC DISCRETISATION OF FREE FORM SURFACES
14:30 - 14:45	Slobodan Misic (Serbia) Marija Obradovic	FORMING THE CUPOLA WITH CONCAVE POLYHEDRAL SURFACES BY CORRUGATING A FOURFOLD STRIP OF EQUILATERAL TRIANGLES
14:45 - 15:00	Branislav Popkonstantinovic Dragan Petrovic (Serbia) Zorana Jeli	KINEMATICAL PRINCIPLES AND SOLID MODELING OF THE GRAVITY DRIVEN TRAIN REMONTOIRE MECHANISM
15:00 - 15:30	Branislav Popkonstantinovic Zorana Jeli (Serbia) Dragan Petrovic	PRACTICAL SOLUTIONS FOR THE TEMPERATURE COMPENSATION OF THE LONG PERIOD COMPOUND PENDULUM
15:30 - 16:00	Vladimir Calic (Serbia) Pranislav Popkonstantinovic Zorana Jeli	GEOMETRY OF TRANSITIONAL DEVELOPMENT SURFACES

Friday, 25.June 2010. Faculty of Mechanical Engineering, Belgrade – Room: 513		
Time	Presenter	Paper Title
16:00 -16:30	Coffee/ Tea break	
Chair	Doc. Milena Stavric, PhD	Scientific Program – History of Geometric Disciplines
16:30 -16:45	Nenad Pavlovic (Serbia) Milos Milosevic Andrija Milojevic	COMPUTER AIDED GRAPHICAL ANALYSIS AND SYNTHESIS OF MECHANISMS
16:45 -17:00	Maja Petrovic (Serbia) Marija Obradovic	FORMING A REGULAR PENTAGON, DECAGON AND PENTAGRAM USING ORIGAMI TECHNIQUES
17:00 -17:15	Craciun Florina (Romania) Dragan Florin, Dragan Dellia	THE PLACE OF GEOMETRY IN TRANSILVANIAN SCHOOLS AT THE BEGINNING OF XX CENTURY
17:45 – 18:00	Natacha Kirilova Danailova (Bulgaria)	PROF. NIKOLA UZUNOV – THE FOUNDER OF DEPARTMENT “DESCRIPTIVE GEOMETRY”
17:30 -18:00	Lazar Dvnikovic	PLENAR LECTURE – RELATIVISTIC GEOMETRY
18:00 -18:30	AutoDESK	ArchiCAD presentation
20:00	Dinner Party	

Friday, 25.June 2010. Faculty of Architecture, Belgrade - Room 202		
Time	Presenter	Paper Title
Chair	Doc. Marija Obradovic PhD	Scientific Program – Geometry in Arts
9:00 -9:15	Slavik Jablan (Serbia) Radovic Ljiljana	PERCEPTION OF SPACE IN PAINTING
9:15 -9:30	Radovic Ljiljana (Serbia) Slavik Jablan	GEOMETRIZATION IN ABSTRACT ART
9:30 -9:45	Ivana Marcikic (Serbia)	PERSPECTIVE IN PAINTING
9:45 -10:00	Marijana Kalabic (Serbia)	PYRAMID MIRROR ANAMORPHOSIS AND SPACE
10:00-10:15	Petar Blagojevic (Serbia) Filip Popovic Tatjana Tripkovic	THE POTENTIAL OF GEOMETRICAL AND ARTISTIC CHARACTERISTICS OF THE HYPERBOLIC PARABOLOID IN APPLIED ARTS
10:15 -10:30	Srdjan Okanovic (Serbia) Uros Tatic	THE STREET LIGHT DESIGN
10:30-11:00	Coffee /Tea Break	

Friday, 25.June 2010. Faculty of Architecture, Belgrade - Room 202		
Time	Presenter	Paper Title
Chair	Doc. Radovic Ljiljana, PhD	Scientific Program – Geometry In Architecture And Design
11:00 -11:15	Nenad Jovanovic (Serbia) Sonja Krasic	HORIZONTAL PERSPECTIVE INSPIRED BY THE 3D STREET ART
11:15 -11:30	Vladan Nikolic (Serbia)	ARCHITECTURE FREE FROM SUPPORT, FLOATING ILLUSIONS OF ARCHITECTURAL STRUCTURES
11:30 – 11:45	Ksenija Hiel (Serbia) Radovan Stulic Tatjana Kocetov Misulic	WOODEN CURVED FORMS IN ARCHITECTURE
11:45-12:00	Ljiljana Vukajlov (Serbia)	GEOMETRY OF URBAN AND RURAL BLOCK BASES IN THE TOWNS OF VOJVODINA AND SURROUNDING REGIONS
12:00-12:15	Ksenia Hiel (Serbia) Derek Fraser (UK) Luka Bajic, Radmila Lazovic	THE ROLE OF GEOMETRICAL FORMS IN NOVI SAD PARK DESIGNS
12:15-12:30	Milena Krkjjes (Serbia) Vladimir Kubet Olga Caric	PUBLIC PERCEPTION DEPENDING ON MORPHOLOGY OF CORNER BUILDINGS
12:50-14:00	Lunch break	

Saturday, 26.June 2010. Faculty of Mechanical Engineering, Belgrade , Room: 513		
Time	Presenter	Paper Title
Chair	Prof. Ljiljana Petrusovski PhD	Scientific Program – Theoretical Geometry
9:00 -9:15	Maja Petrovic (Serbia) Marija Obradovic	CONSTRUCTING THE EGG CURVES USING THE GOLDEN RATIO OF PENTAGON
9:15 -9:30	Maja Petrovic (Serbia) Marija Obradovic	THE COMPLEMENT OF HUGELSHAFFER'S CONSTRUCTION OF THE EGG CURVE
9:30 -9:45	Risto Tasevski (Macedonia)	PROJECTION OD 4D SURFACES COMPOSED OF THREE VARIABLES
9:45 -10:00	Delia Dragan (Romania) Raluca Neirsany Claudia Alb, Florin Dragan	STUDY OF SURFACES GENERATED BY ANTISYMMETRIC PARABOLA BRANCHES
10:00-10:15	Jelisava Kalezic (Montenegro) Marija Jevric	FRACTALS IN URBAN PLANNING
10:15 -10:30	Marija Jevric (Montenegro) Zvonko Tomanovic	AN APPLICATION OF STEREOGRAPHIC PROJECTIONS TO ROCK WEDGE STABILITY
10:30-11:00	Coffe/ Tea break	

Saturday, 26.June 2010. Faculty of Mechanical Engineering, Belgrade , Room: 513		
Time	Presenter	Paper Title
Chair	Doc. Mirjana Devetakovic – Radojevic PhD	Scientific Program – Computer Graphics
11:00 -11:15	Branko Malesevic, (Serbia) Ivana Jovovic Milan Campara	GROBNER BASIS IN JAVA WITH APPLICATION IN COMPUTER GRAPHICS
11:15 -11:30	Ratko Obradovic(Serbia) Branislav Popkonstantinovic Predrag Sidjanin Milos Vujanovic Zoran Milojevic	COMPUTER GRAPHIC AND COMPUTER ANIMATION STUDIES AT SERBIAN FACULTIES
11:30 -11:45	Sima Pastor (Serbia) Ratko Obradovic Milivoj Kojic	COMBINATION OF PERPENDICULAR OSCILLATIONS AND ANALYSIS OF HARMONIOPGRAPH'S CURVES USING MATH AND CAD TOOLS
11:45-12:00	Milan Mitic (Serbia) Biljana Jovic Aleksandar Cucakovic	TREE PLANT MODELING USING GRAPHIC PACKAGE ARCHICAD
12:00-12:15	Bojan Vujcic (Serbia) Vladimir Susic Marija Obradovic	DEVELOPMENT OF DIGITAL MODEL OF TERRAIN (DMT) USING AUTOCAD AND SURFING SOFTWARE PACKAGES

Saturday, 26.June 2010. Faculty of Mechanical Engineering, Belgrade, Room: 513		
Time	Presenter	Paper Title
12:15-12:30	Maja Petrovic (Serbia) Marija Obradovic	SOLVING THE SITUATION OF AIRPORT BLED BY DIGITAL TERRAIN MODELING USING THE SOFTWARE PACKAGE RHINOCEROS
12:30 - 14:00	Lunch break	
Chair	Prof. Ratko Obradovic, PhD	Scientific program - Graphics Education
14:00 - 14:15	Carmen Marza (Romania) Georgiana Iacob	REPRESENTATION METHODS FROM THE CURRICULAR AREA OF DESCRIPTIVE GEOMETRY PUT IN AGREEMENT WITH THE LAW FOR QUALITY ASSURANCE IN HIGHER EDUCATION
14:15 - 14:30	Delia Dragan (Romania) Florin Dragan, Raluca Nerisany	GENDER BASED SPACE PERCEPTION RELATIOSHIP
14:30 - 14:45	Gordana Djukanovic (Serbia) Milena Stavric (Austria)	VISUALISATION AND ANIMATION OF GEOMETRIC TOPICS
14:45 - 15:00	Dorin Barbinta (Romania) Radu Dardai, Raluca Nerisanu	DEVELOPING SPACE PERPCEPTION BY MEANS OF 3D REPRESENTATIONS
15:00 - 15:30	Katarina Jevtic – Novakovic Miloje Simanic (Serbia)	THE TRADITIONAL AND CONTEMPORARY IN THE STUDENT’S MIRROR
15:30 - 16:00	Dejana Neducin (Serbia) Vesna Stojakovic, Radovan Stulic	TOWARDS A NEW APPROACH IN TEACHING DESCRIPTIVE GEOMETRY
16:00 - 16:30	Coffee / Tea break	

Saturday, 26.June 2010. Faculty of Mechanical Engineering, Belgrade, Room: 513		
Time	Presenter	Paper Title
Chair	Prof. Radovan Stulic, PhD	Scientific program - Graphics Education
16:30 -16:45	Milan Sijakov (Serbia) Radovan Stulic	GEOMETRY OF FREE-FORM IN ARCHITECTURAL CURRICULUM
16:45 -17:00	Branislav Popkonstantinovic Zorana Jeli, (Serbia) Miodrag Stoimenov Bozidar Stamenkovic	A NEW APPROACH TO MAINTENANCE OF PRACTICAL COURSE "ENGINEERING GRAPHICS" IN FACULTY OF MECHANICAL ENGINEERING, UNIVERSITY IN BELGRADE
17:00 -17:15	Marija Obradovic (Serbia) Magdalena Dimitrijevic Slobodan Mistic	SEMINARY PAPER AS AN ADDITIONAL TASK IN TEACHING DESCRIPTIVE GEOMETRY
17:15-17:30	Bozidar Stamenkovic (Serbia) Goran Srdanovic	METHODS OF WORK AND PROBLEMS ARISING IN WORK WITH PUPILS IN SECONDARY MACHINE SCHOOLS DURING STUDYING THE SUBJECT "COMPUTER GRAPHICS" AND "MODELING MACHINE ELEMENTS AND CONSTRUCTIONS"
17:30 -17:45	Aleksandar Cucakovic Biljana Jovic (Serbia)	OPTIONAL COURSE ENGINEERING GRAPHICS ON DEPARTMENT FOR LANDSCAPING ARCHITECTURE AT THE FACULTY OF FORESTRY, UNIVERSITY OF BELGRADE
17:45 -18:00	Yana Kancheva (Bulgaria)	CONCERNING APPLICATION OF VARIOUS LINE TYPES ON CONSTRUCTION DRAWINGS
18:00 -18:30	Hellmuth Stachel	CLOSING SPEECH

Sunday, 27.June 2010. Faculty of Mechanical Engineering, Belgrade		
Time	Event	Location
	Excursion	AVALA MOUNTAIN NEAR BELGRADE
10:00-10:15	Gathering at the front gate of Faculty of Mechanical Engineering, Belgrade	
17:00	Return	

LOCAL ORGANIZERS WELCOME ADDRESS

Dear colleagues, professors and coworkers,
Dear Participants,
Dear Friends,

A cordial and warm welcome to you all at the 2nd International Conference for Geometry and Engineering Graphics "moNGeometrija2010" in Belgrade! We are glad that you have joined the conference and that you are willing to contribute the further development of Geometry and Graphics. We, the members of the Conference Committees, will do our best for your hospitality and to make you feel at home here in Serbia, among new and old participants and colleges, among new and old friends.

We are gathered here at the Faculty of Mechanical Engineering to talk, discuss and exchange experiences about various topics in Geometry and Graphics, problems of education reform and further improvement of education, as well as about numerous subjects and themes of science and art branches related to, and connected with Geometry, Graphics and Visual communications. Actually, we are here to celebrate Geometry as the most universal language not just of science, art, engineering and mankind, but also of human Soul and Nature Itself.

I would like to wish you now plenty of interesting, stimulating and fruitful discussions with your colleagues, great success in your work and I hope that you will have the opportunity to do some sightseeing in our beautiful city of Belgrade.

Ph. D. Branislav Popkonstantinovic
President of Serbian Society for
Geometry and Graphics

Faculty of Mechanical Engineering
University of Belgrade

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DEVELOPING SPACE PERCEPTION BY MEANS OF 3D REPRESENTATIONS

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Abstract

In the context of accelerated development of information technology, the use of the computer in education becomes a necessity. If traditional teaching methods have been verified by practice in time, modern methods make this verification with the help of the technical progress in the field of computers.

This paper aims at presenting the intersection of two bodies and its solution by the traditional method and with the help of the modern computer. It is considered that the parallel manner of presentation of the two methods leads to a faster and easier understanding of the problem.

Key words: intersection, prism, common solid, progress, engineering.

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THE POTENTIAL OF GEOMETRICAL AND ARTISTIC CHARACTERISTICS OF THE HYPERBOLIC PARABOLOID IN APPLIED ARTS

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Résumé

The aim of this paper is to research the hyperbolic paraboloid through applied geometry. There are three approaches to the theme of the hyperbolic paraboloid which have potentials in fine and applied arts as well as design:

-The developing of the net of hyperbolic paraboloid, using cone segments. The aim is to show the efficiency of the developed net approximation method.

-The pictorial projection on the net of the hyperbolic paraboloid.

-Researching the rotation of the hyperbolic paraboloid, expecting a number of interesting forms.

Key words: hyperbolic paraboloid, rotation, projection, geometric transformation

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GEOMETRY OF TRANSITIONAL DEVELOPMENT SURFACES

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Resume

The technique has often the problem of transition from one shape and the size of the cross section of water to another. The continuity of the transition changes to pieces easily accomplished when He made this casting. However, at low pressure lines (ventilation, pneumatic transport) that allow thin-wall lines, transitional pieces are made of thin sheet metal or welding summer. Technology and need continuous change of the cross section requires that surfaces transitional pieces to be developing that could make the cutting and bending sheets without their creasing or stretching.

We will consider cases of transition from polygon to polygon and polygons on a flat curve. Tool use SolidWorks 3D software that has the ability to work with planes and cubes. The basic concept of work based on the application of geometry in the industry making parts from sheet metal deformation, cutting and welding.

Key words: surface, plane, polygon, sheet metal

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THE PLACE OF GEOMETRY IN TRANSILVANIAN SCHOOLS AT THE BEGINNING OF XX CENTURY

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Resume

The study is "a look" over almost two hundred years of education in Romanian schools, insisting on geometry. The reason of choosing this subject is the less information we have found about geometry (separated from the mathematical study) as one of the discipline considered important in education. In hard conditions, geometry, like other disciplines continued for centuries to have an important role in education. The two influences upon educational system, (German and Austrian, on one hand, and French on the other hand) have been dissolution into one Romanian educational system. Representatives of Romanian science and culture of the XIX and XX century succeeded in difficult conditions to diminish the educational postponement comparative with the developed European nations.

Key words: geometry, technical drawing, Transylvania, education

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DEFINING THE PRINCIPAL AXES OF THE QUADRIC CONE - GENERAL CASE WITH ELLIPTIC BASE SECTION CURVE

Aleksandar Čučaković¹
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RESUME

This paper presents an constructive procedure of determining three mutually orthogonal principal axes (three planes of symmetry) of the quadric cone, the general case with elliptical base section curve. The constructive procedure is based on establishing correlative correspondance between the base curve plane (points and lines) and bundle of lines and planes at the vertex of the cone. At the base curve plane, two pairs of collocal, corelatively associated planes are set. After overlapping two of them, the other two collocal planes become collinear. Three double points in two generally collinear planes are intersection points between three principal axes and base plain of the cone.

Key words: The general case of cone; the main axes of cone; corellative transformation; polarity; auto polar tetrahedron

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**OPTIONAL COURSE ENGINEERING GRAPHICS ON
DEPARTMENT FOR LANDSCAPING ARCHITECTURE AT THE
FACULTY OF FORESTRY, UNIVERSITY OF BELGRADE**

**Aleksandar Čučaković , PhD¹
Biljana Jović , MSc²**

This paper is dedicated to our dear colleague Jelena Maksić, PhD professor who establish subject Engineering graphics at the Faculty Forestry, University of Belgrade.

Resume

The paper gives a brief overview of the course content, aim and outcomes of the optional course Engineering graphics, in the school 2009/10.year, the Department of Landscape Architecture at the Faculty of Forestry in Belgrade. A good example of what should be done on the other technical faculties, how to preserve the basic course Descriptive geometry and how to establishment new optional courses as well as how to position course on the corresponding higher year of study. In addition this paper points out the importance of preserving the existence of basic course Descriptive Geometry at all technical faculties, with the possibility for curriculum supplement the theoretical foundations of computer graphics.

Key words: Descriptive geometry, Computer graphics, Engineering graphics, Optional courses

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FUNDAMENTAL MATRIX IN EPIPOLAR GEOMETRY

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Abstract

The information and communications in our society are performed by computer and visual technics, in which the images representation is of great importance. That's the reason for the increasing interest to the multiple view geometry during the last years. It analyzes the relations between the object views by changing of the camera's position. The epipolar geometry covers the projective geometry properties between two perspective views. An arbitrary projective space coordinate system is considered. A correlation is established between the points in the first image plane and a pencil of lines in the second image plane. The algebraic representation of the epipolar geometry is the fundamental matrix F . Some representations of the matrix F are derived: 1. F as a function of the two projective matrixes 2. F as a function of the homography between the two pencils of epipolar lines.

Key words: epipolar geometry, epipoles, homography, projection matrix, fundamental matrix

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GRAPHIC TRANSFORMATION OF HYPERBOLIC PENCILS OF CIRCLES INTO PENCILS OF CONICS AND THESE INTO PENCILS OF CURVES OF THE 3rd OR 4th ORDER

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Summary

This research deals with transformation of hyperbolic pencils of circles and their specific features into pencils of curves of the 3rd and 4th order and their specific features and vice versa. The basic transformation will be inversion, which will be interpreted in two ways: as quadratic transformation in classical projective geometry and as pure symmetry in relativistic geometry, with constant parallels between two geometric systems and possibilities of their explication and generalization.

In this paper, hyperbolic pencils of circles map into pencils of conics by homology, which then map into pencils of conics. Finally pencils of conics map into pencils of curves of the 4th or 3rd order (this mapping entails mapping of singular conics which are broken into corresponding pairs of straight lines).

Key words: Pencils of circles, pencils of conics, pencils of curves of the 3rd or 4th order, homology, inversion.

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VISUALISATION AND ANIMATION OF GEOMETRIC TOPICS

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Resume

This paper presents the process of teaching in which Euklid DynaGeo, Cabri3d, Great Stella, Sketch Up and AutoCAD software packages have been implemented. A great number of examples and models have made it much easier for the students to understand spatial relations because the use of these software packages improves the coordination between the two brain hemispheres, which is essential for understanding spatial relations and for creative expression of future engineers.

The significance of this paper lies in the presentation of experience gained by implementing various software packages and spatial models which have enhanced the quality of education.

Key words: Applied Engineering Graphics, 3d modelling, software packages for drawing and modeling

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GENDER BASED IQ AND SPACE PERCEPTION RELATIONSHIP

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Abstract

This paper analyses the results of tests administered to first year students of the Faculty of Civil Engineering of Cluj-Napoca. In the first test, the objective consisted in determining the intelligence coefficient of the students, while in the second test, we assessed the spatial perception level reached by undergraduates, after learning the descriptive geometry and technical drawing modules. Finally, data were interpreted considering the subjects gender, correlations were made and conclusions were drawn.

Key words: IQ, MCT (Mental Cutting Test), spatial perception, students' gender

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STUDY OF SURFACES GENERATED BY ANTISYMMETRIC PARABOLA BRANCHES

Delia Drăgan¹
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Abstract

The paper aims at studying some translation surfaces with plane director generated by antisymmetric parabola branches with parameters. The control of parabolic points from the surface situated on a given curve permits the determination of the introduced parameters.

Key words: translation surfaces, parabolic points, directrix plane, free form.

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INTERNAL DYNAMICS OF SCULPTURE

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Resume

The work devoted to the formalization of sculpture dynamics and its role in forming space surroundings. In the computer model the position of axes of shoulders, pelvis, knees and feet are given by designer taking in a count recommendation proposed by authors based on parameters of internal sculpture dynamics.

Key words: Sculpture dynamics, Computer model, Process of teaching

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THE REFLECTED ENERGY MAP

Dvoretzky Alexander¹
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Resume

The work devoted to the determination of the flux distribution on any section of the reflected ray congruence. Three dimensional model as the surface of flux distribution for quantitative estimation of flux distribution on the receiver is obtained. The calculations are based on the energy map obtained with mathematical and computer simulation.

Key words: Surface of Flux Distribution, Energy Map, Orthogonal Net, Congruence.

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THE ROLE OF GEOMETRICAL FORMS IN NOVI SAD PARK DESIGNS

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Résumé

Simple and complex geometrical forms have been used by landscape designers throughout history in planning the layout of open green spaces. When designing parks, designers use two dimensions (2D), three-dimensions (3D), but also the fourth dimension (4D) - time. In this paper, geometrical forms in Novi Sad parks are analysed. The goal is to explore how much simple or complex geometrical forms were used conceptually in the design of open spaces. The park design concepts are analysed using the techniques established by Lynch. These results will be evaluated against 'plans' as a way to organise the layout of functions and forms on 2D drawings, the use of 'sections' and 'axonomic projections' as a way to organise the 3D forms. In addition, the fourth dimension of time is often presented by a series of 3D drawings, to present different stages of the natural growth of plants, topiary, shadows etc.

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WOODEN CURVED FORMS IN ARCHITECTURE

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Résumé

The good knowledge of geometric structures of various spatial forms is fundamental in every design, particularly in architecture. Concerning the wood, this question becomes even more sophisticated, since the optimal design of a building and/or its component parts has to be based on a proper combination of used materials, structural forms/systems and the desired spatial configuration.

In the paper we present and analyze some examples of a successful usage of wood as a dominantly applied material in architectural design with curved geometric forms.

Key words: Geometric structure, Curved forms, Wooden elements, Architectural design.

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DESIGN OF THE GEARING SPECIAL FORMS

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Abstract

In this paper is analyzed the special forms of gearing generated by the different combination of the rolling and base circles of the kinematic pair in contact. Characteristic form of the gear tooth based profiles is trochoid. The advance of these profiles in relation to the standard involute profile is the convex-concave contact of the meshing profiles. To the aim of obtaining better characteristics of the special gearing is done the equidistant modification of the based profiles. It is also defined the geometrical constrains to the equidistant modification. Based on obtained analyzing are generated different gear pairs and given their application by some mechanical construction: rotary piston motors (Wankel engine), gerotor pumps and transmission of power (cyclo reductor), and these profiles can be used also for the other special applications.

Key words: special form of gearing, trochoid, equidistant modification, gerotor pump, cyclo-reductor

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PERCEPTION OF SPACE IN PAINTING

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Abstract

During the history, perception of space in painting is changed from one- and two-dimensional geometric patterns, that dominate in Paleolithic and Neolithic art, through "hierarchical perspective" and orthogonal axonometry used in Egyptian painting, Byzantine counter-perspective, Renaissance linear perspective, cubistic polycentrism, perceptive perspective, to the non-orientable space of abstract painting. Trying to explain 3D-vision as the reconstruction of 3D-image from its 2D-projection, that is in general not unique, we will consider different extreme forms of perspective (e.g., anamorphoses), or the formation of ambiguous reconstructions of 2D-projections resulting in visual illusions and impossible figures.

Key words: perception, space, perspective, visual illusions, impossible figures

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**A NEW APPROACH TO MAINTENANCE OF PRACTICAL
COURSE "ENGINEERS GRAPHICS IN FACULTY OF
MECHANICAL ENGINEERING, UNIVERSITY IN BELGRADE**

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Resume

During the many years of practical work with students on the subject "Engineering Graphics" according to the Bologna Declaration of Mechanical Engineering in Belgrade, there was a big change of principles and methods of working with students. During the transition to the maintenance system of teaching students according to Bologna Declaration of Mechanical Engineering in Belgrade began to practical part of the course "Engineering Graphics" work exclusively on computers. The method proved to be very practical, efficient and high quality, but the setting itself the task had to suffer major changes.

In this paper it is discussed how there was a change settings task to students in relation to previous experience, all will be explained through examples of successful task solved by student of the first year of studies. Great emphasis and presentation will rely only on the change of the practical exercise of the course "Engineering Graphics".

Key words: education, development tasks

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FRACTALS IN URBAN SPACE

Jelisava Kalezić 1
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Resume

The paper discusses the application of fractal geometry in urban as well as other investigations of physical structures of cities, human settlements and the town at all. The famous theorist Konstantinos Apostolos Doxiadis has studied the causes and consequences of the process of growth and development of cities. He defined the particular scientific discipline that deals with ekistics - complex study of cities. At the same time, urban structures have a geometry that contains whole complexity of the city and its uniqueness expressed in the form of geometric patterns in which the city originated, and which is being developed.

Key words: fractal, fractal geometry, the urban area, urban structure, physical structure.

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STEREOGRAPHIC PROJECTIONS IN ROCK WEDGE STABILITY ANALYSIS

Marija Jevrić ¹
Zvonko Tomanović ²

Resume

Many engineering geological data about a rock structure are registered during tunnel excavations in a hard rock, discontinuities data firstly. A slope failure and wedge stability are in relation to these data. This papers are related to application of geometrical principles to joint plane defining, as so as an application of stereographic projections to presenting of these planes. Short review of graphical presentation of discontinuity planes by the use of stereographic projection technique is given here.

Key words: planes of discontinuities, stereographic projection, wedge stability, cartographic stereonet

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HORIZONTAL PERSPECTIVE INSPIRED BY THE 3D STREET ART

Nenad Jovanović¹
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Abstract

Horizontal perspective is essentially the same as the frontal perspective, but has certain specifics. For this perspective the perspective plane is horizontal, so it most of the chosen so that it coincides with the horizontal coordinate plane xy 3D street art represents drawing on a horizontal plane, which, viewed from one point (view point) appear to have third dimension (height). This way of drawing is known as the perspective of one view point. Construction of horizontal perspective can be carried out in three ways: it can be computer generated (analytic perspective), visual (painting perspective) and construction via the penetration of rays (geometrical perspective), in the paper, geometrical way of horizontal perspective construction is presented in detail on several examples of architectonic structures.

Key words: horizontal perspective, street 3D art

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CONCERNING APPLICATION OF VARIOUS LINE TYPES ON CONSTRUCTION DRAWINGS

Yana Kancheva¹

Abstract

Drawings are a basic part of engineering projects. Organization and order of the elements used when creating a drawing are regulated by ISO standards which concern to both hand-made and computer-made (using a CAD program) drawings.

A review of several standards concerning line types used on construction drawings is made and examples from engineering practice are included. By examining the standard line types and line widths as well as defining a few terms, the author gives some recommendations about a practical usage of the line as a significant representational element.

Key words: line type, line width, drawings, construction drawing, ISO standards.

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APPLICATION OF DESCRIPTIVE GEOMETRY IN THE PROCESS OF DETERMINING TOPOGRAPHIC ELEMENTS FOR INDIRECT ARTILLERY FIRE

Tugomir Kokelj¹
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Summary

This paper presents a segment of the practical application of Descriptive Geometry in the process of determining the topographic elements for indirect artillery shooting. By applying it, the problem of visualizing determining topographic elements in Cartesian coordinate system (model 3D) by using an adequate mathematical model, has been resolved.

Key words: Descriptive geometry, mathematical model, topographic elements, indirect artillery shooting

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MAPPING OF A SPHERE INTO ROTATIONAL PARABOLOID WITH THE AID OF THE ABSOLUTE CONIC IN GENERAL COLLINEAR SPACES

Sonja Krasić¹
Biserka Marković²

Abstract

In collinear projective spaces are associated all the projective creations, including quadrics (II degree surfaces). In the general collinear spaces, set with five pairs of unequivocally associated points, it is necessary first to constructively determine the characteristic parameters, such as: vanishing planes, axes and centers of spaces. Mapping of quadrics from one space into another has been constructively processed by the common elements of the absolute conic and the infinitely distant conic of the quadric in the first space through their associated pair of conics in finiteness.

In order to map the sphere in the first space into the rotational paraboloid in the second space, it is necessary to select the sphere in a way that its center is situated on the axis of this space and that it intersects the vanishing plane in the first space along the degenerated imaginary conic, which decomposes to two imaginary straight lines, whose intersection point coincides with center of the absolute conic figure.

Key words: quadrics, common elements of the absolute conic and infinitely distant conics of the quadric, sphere, rotational paraboloid.

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MAPPING OF A SPHERE INTO A ROTATIONAL HYPERBOLOID OF TWO SHEETS WITH THE AID ABSOLUTE CONIC IN GENERAL COLLINEAR SPACES

Sonja Krasić ¹
Vladan Nikolić ²

ABSTRACT

General collinear, projective spaces are set with five pairs of unequivocally associated points. Mapping of the quadric (II degree surface) from one space into another is constructively realized via common elements of the absolute conic and infinitely distant conic of the quadric, via the common elements of their associated pair of conics in the finiteness. It is necessary to constructively determine first the characteristic parameters of collinear spaces, such as vanishing planes, axes and centers of spaces, and then the figures (projections) of the absolute conics in both spaces. In order to map the sphere in the first space, map into the rotation hyperboloid of two sheets in the other space, it is necessary to choose the sphere so that its center lies on the axis of this space, and that it intersects the vanishing plane in the first space along the real circumference, which is concentric with the figure of the absolute conic.

Key words: quadrics, common elements of the absolute conic and infinitely distant conic of the quadric, sphere, rotating hyperboloid of two sheets.

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Sonja Krasić¹
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Key words: quadrics, common elements of the absolute conic and infinitely distant conic of the quadric, sphere, rotating hyperboloid of two sheets.

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PUBLIC SQUARES PERCEPTION DEPENDING ON MORPHOLOGY OF CORNER BUILDINGS

**Milena Krklješ¹
Vladimir Kubet²
Olga Carić³**

Resume

Squares present hot spots of public happenings in the open. Depending on buildings' use, activities are located within their boundaries, intended for different age, social and economic groups of users. True quality of squares is highly dependent on their use, as well as their social and ambient characteristics. Perception depends on size of their open space and frames by which they are defined. Being that corner buildings are the ones most emphasized, they are capable of possessing a sturdy influence on a square's perception. In this paper, squares of Novi Sad have been analyzed and a correlation between morphology of corner buildings and the way in which squares are being perceived has been drawn. Geometry of squares as well as of their surrounding structures' blueprints, especially those of corner buildings, represents one of the essential elements for creation of memories.

Key words: squares, corner buildings, perception, geometry, public spaces

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THE APPLICATION OF DESCRIPTIVE GEOMETRY IN THE SERBIAN ARMY ENGINEERING BRANCH

Olgica Lazarević¹
Vojislav Batinić²
Nenad Radisavljević³

Summary

Planning methods are also applied for successful completion of the tasks which are within military jurisdiction. Military roads construction together with constructing bridges and overcoming water obstacles are of special importance for engineering. This piece of work describes the use of oblique projection in determining the line of road, embankments and cuttings. It also describes ways of making access roads, embankments and ascending-descending ramps by using "quick-tracing" methods before constructing a bridge in case of a quick river crossing by the unit.

Key words: cutting, embankment, road, support pillar, ramp

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GROEBNER BASES IN JAVA WITH APPLICATIONS IN COMPUTER GRAPHICS

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Ivana Jovović²,
Milan Čampara³

Abstract

In this paper we present a Java implementation of the algorithm that computes Buchberger's and reduced Groebner's basis step by step. The Java application enables graphical representation of the intersection of two surfaces in 3-dimensional space and determines conditions of existence and planarity of the intersection.

Key words: Groebner basis, intersection of surfaces, Java application

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PERSPECTIVE IN PAINTING

Ivana Marcikić¹

Résumé

For a full examination and understanding of perspective by scientific, constructive method of space representation, it is necessary to apply also the solutions conceived and developed during the creative activity of visual artists - the so called, painterly perspective.

When they discovered the classical perspective, the Renaissance painters were fascinated by the method, but still they changed it in those segments where it drastically deviated from natural seeing. By painterly means - colour, light and shadow - they realized their own variations of the generally accepted constructive procedure.

The mirror image and shadow represent a doubled perspective picture. The mirror adds to the space in the painting the space behind the observer or the space that is screened off, while the shadow, both in natural and artificial light sources, represents a new perspective image from that source as a new centre of projection.

Key words: pictorial perspective, constructive perspective, space in painting, visual effect.

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PYRAMID MIRROR ANAMORPHOSIS AND SPACE

Marijana Kalabić¹

Résumé

The aim of this paper is to present a continuation of the mirror and the 3D object anamorphosis research and to show the differences between the cone mirror and the pyramid mirror anamorphosis.

The emphasis is on the pyramid anamorphosis. The analysis is supported by drawings and the experiment.

Key words: anamorphosis, 3D model, pyramid mirror, geometry, mirror reflection.

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**REPRESENTATION METHODS FROM THE CURRICULAR AREA OF
DESCRIPTIVE GEOMETRY, PUT IN AGREEMENT WITH THE LAW
FOR QUALITY ASSURANCE IN HIGHER EDUCATION**

**Carmen Mârza¹
Georgiana Iacob²**

Abstract

As a result of the Romanian higher education agreement to the Bologna Process, it becomes absolutely necessary, to revise the syllabi to the majority of the subject matters, so that to exist a harmonization to the European level. The graphical engineering matters are in a continuous mobility, because of the direct relationship with the computer aided drafting software.

In this paper, one presents the main representation systems studied in the Romanian Technical Universities. For a suggestive analysis, one selects an accessible assembly, which is represented in the following projection systems: the orthogonal projection on two/three planes of projection (Monge representation), the projection with elevations, the axonometric representation and the perspective. An objective analysis of their advantages or disadvantages is then made.

Key words: higher education, quality low, graphical subjects, Monge representation, axonometric representation.

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**STUDY REGARDING THE GRAPHICAL AND ANALITICAL
APPROACH OF THE TRANSITION PIECES BETWEEN PIPES WITH
PERPENDICULAR AXES**

**Carmen Mârza¹
Georgiana Iacob²**

Abstract

The special dynamics which characterize the installations field requires a continuous study of the plant components, among the tubing has an essential role.

In this paper we propose to give two connecting solutions between pipes with perpendicular axes: first, the connection case through the cone frustums and second, the connection using the transition pieces composed by triangles and cylindrical nappes. From hydraulic point of view, is recommended the last solution. One makes the study both - graphical and analytical. The practice shows that the graphical approach is not so exactly as the analytical, but if the Descriptive Geometry Theory is known, the solutions obtained in this way, are more fast, accessible and exactly enough.

Key words: intersection of curve surfaces, sphere as auxiliary surface, cone frustum, transition piece.

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GEOMETRICAL MODELLING OF THE JET BOUNDARY LAYER

Viktor Milejkovskyi¹

Résumé

The energy-saving in ventilating systems is related to use of effective schemes of an air supply. Currents of various shapes and types are thus used. The basic problem of design of new methods of an air supply is a complexity of mathematical modelling of currents which leads to need for expensive experiments with a great time usage that joins in the cost price of ventilating systems.

The approach to mathematical modelling of the jet boundary layer of currents on the basis of the geometrical analysis of their large-scale structure is offered. The offered hypotheses are confirmed by checking on known currents.

The offered way of mathematical modelling gives the possibility to develop effectively new and to improve known methods of an air supply.

Key words: geometrical analysis, mathematical model, current, puff, energy-saving.

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FORMING THE CUPOLAE WITH CONCAVE POLYHEDRAL SURFACES BY CORRUGATING A FOURFOLD STRIP OF EQUILATERAL TRIANGLES

Slobodan Mišić¹
Marija Obradović²

RESUME

The cupolae with concave polyhedral surfaces consist of: two regular polygons, n -gone and $2n$ -gone in parallel planes, interconnected by an envelope constituted of series of equilateral triangles. The paper describes cupolae which originate by corrugating of a fourfold strip of equilateral triangles, forming thereby the envelope of a cupola. In this manner, a non-convex polyhedron is emerged. Such a method of corrugating the envelope, allows the solutions for generating cupolae with base polygon which number of sides exceeds $n=10$, which was the maximal number of sides for cupole with the envelope consisted of twofold strip of equilateral triangles. By analyzing the elements of these polyhedra and by help of their paper models, we find geometric constructions and projection procedures by which it is possible to graphically display the cupolae.

Key words: cupola, concave polyhedral surface, envelope, model

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TREE PLANTS MODELING USING GRAPHIC PACKAGE ARCHICAD

Milan Mitić¹
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Aleksandar Čučaković³

Résumé

Experts with different educational profile use vegetation modeling: landscape architects, architects, planners, engineers, graphic designers, illustrators and others. Development of computer technology emerged a large number of graphics packages that deal with modeling of vegetation, each of them in a special way of dealing with this subject matter, and some of them are specialized to perform only certain operations.

Below is processed tree plant modeling using ArchiCAD graphics package, with critical emphasis on the advantages and disadvantages of this software. Through examples, it is shown how to use this graphical package, with certain commands which affect the modeling of tree plants change in detail, showing foliage, the scale and diameter of foliage, the height and thickness of the trunk, density and color of leaves, etc

Key words : modeling, vegetation, tree, software, ArchiCAD

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TOWARDS A NEW APPROACH IN TEACHING DESCRIPTIVE GEOMETRY

Dejana Nedučin¹
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Résumé

In reference to the implementation of Bologna process and contemporary tendencies in both education and professional domain, a constant adjustment of the structure, content and methodology of every academic course is inevitable. Developing skills, knowledge and expertise that may later be practically applied, as well as achieving more efficient learning, present the key issues when conducting its reform. The paper discusses the results of implementing a new approach in teaching the course of Descriptive Geometry on the study programs of Architecture and Urban Planning, and Civil Engineering on the Faculty of Technical Sciences, University of Novi Sad, that is compliant with transformed curriculum of each study program and its specific educational objectives and outcomes. It presents an overview of changes in course's structure and content and a comparative analysis of students' success rate prior and after the reform.

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GEOMETRIC ANALYSIS VARIANT OF FREE-FORM DOME

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Resume

In this paper we analyzed geometry on concrete example one of many proposal for roof structure of the National Museum in Belgrade. Classification of curvature surface and geometric modes of surface generation is presented. For constructional purposes one of the most convenient methods of geometrically specifying surfaces is to consider them as paths or traces of straight lines and curves. Generated surface structure is carried out by forming sinusoidal structural roof forms trough which the atrium illuminates.

Different variants of free form domes are considered. Investigating possible solutions of domes free form shapes we used a grid of squares, triangles, hexagons, etc. According to a structural form of the dome, several options for cover of the structure are presented.

Key words: Space structures, 3D mesh, Free form

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ARCHITECTURE FREE FROM SUPPORT ARCHITECTONIC STRUCTURES ILLUSION OF FLOATING

Vladan Nikolić ¹
Olivera Nikolić ²

Abstract

The paper presents an assumption that throughout the entire period of human civilization development, there was a continuity of an idea of "floating" architectonic structures. This continuity was demonstrated by historical examples. The paper also considers the causes of such formal approach, from the utilitarian ones to the conceptual and aesthetic.

Through an analysis of the continuity of idea and the formal manifestation of the mentioned structures, one discovers the ways of creation of this effect and the resulting classification of the ways.

Contemporary examples have been presented as well as the visions of future and architecture free of supports, architecture with very pronounced futuristic, but not utopistic characteristics.

Key words: architecture free from support, floating illusion

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THE TRADITIONAL AND THE CONTEMPORARY IN THE STUDENT'S MIRROR

Katarina Jevtić-Novaković¹
Miloje Simanić²

Resume

The traditional means of communication in industrial civilisation is technical drawing, which is founded on the principles of descriptive geometry. With the end of the industrial era and the arrival of information technology, a new framework of production arises which changes the craft of drawing. The knowledge and ability to use these technologies involve a new educational context, expanded by the techniques of computer graphics.

College of Civil Engineering and Geodesy in Belgrade runs three courses for engineers: civil engineering, geodetics and architecture and each has its own, specific program of descriptive geometry. In the past couple of years, lectures in this subject have been made accessible on the internet in the form of animated CAD drawings. During the term, students' work is continuously monitored; and additional course work, which requires 3D modelling, has been introduced to supplement the more traditional tests. As the teaching method incorporates self-assessment, by inviting the critical opinions of students on any innovations in teaching, as well as on difficulties encountered, the integral part of this paper, then, is a questionnaire in which students have expressed their views and suggestions. This paper aims, among other things, to offer a starting point for a discussion about the quality of the teaching process.

Key words: descriptive geometry, animation, critical opinion, student

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SEMINARY PAPER AS AN ADDITIONAL TASK IN TEACHING DESCRIPTIVE GEOMETRY

Marija Obradović¹
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RESUME

As a result of introducing Bologna process in education, classes of Descriptive geometry were reduced. In order to acquire such a complex matter as Descriptive geometry, it was necessary to provide an additional task as homework. After three years of experience in practicing classic additional supplementary problems, we made an attempt to innovate homework, following an idea to achieve creativity in appliance of Descriptive geometry knowledge in engineering practice. During the training classes, we recognized the students' problem of connecting abstract apprehensions and principles of Descriptive geometry with basic problems and tasks of engineering practice. Form of seminary paper was chosen as an appropriate one for handling the themes and method units of Descriptive geometry program. Each student, in a group of 30 students, had its own theme to elaborate in text interpretation and drawings, also recognizing (photos ...images) and presenting examples in real life (buildings or other examples in art, design or industry).

Key words: Descriptive Geometry, seminary paper, graphical appendix.

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CONIC SECTIONS OF A TYPE OF EGG CURVE BASED CONOID

Marija Obradović¹
Branko Malešević²
Maja Petrović³

RESUME

A cubic egg curve obtained by Hügelschäffer's construction, can be spatially interpreted as a plane section of a type of a conoid set through a specially chosen 4-th order intersecting curve of two quadrics: right cylinder and cone. That implies that the apex of a cone must lay on the axis of a cylinder in order to obtain one sheet surface. This type of conoid will be of 4-th order, and will exclude plane sections by conics. We consider a special case of forming an akin conoid that would include also conic sections. If the apex of the cone is set off the cylinder axis, there would appear a double conoid, as a surface set through the intersection curve of the quadrics. Its plane section will be a double egg curve obtained by generalized Hügelschäffer's construction. In case that cylinder and cone would intersect by a degenerated 4-th degree space curve on two conics (circle and ellipse), there would emerge double egg curve, as a plane section of the double conoid. The curve degenerates onto ellipse and a quartic curve - Granville's egg. We also gave a mathematical condition of degeneration of the base double egg curve.

Key words: conoid, Hügelschäffer's construction, ellipse, egg curve.

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COMPUTER GRAPHICS AND COMPUTER ANIMATION STUDIES AT SERBIAN FACULTIES

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Zoran Milojević⁵

Résumé

Computer graphics studies are founded before almost fifty years at USA and Western - European Universities. The number of Competent Person in this area is rising every year because of high number of diverse using and jobs.

We are interested to make analysis what happens at Serbian Universities with this kind of Studies? Do they exist here, or do we have to organize them.

If we wish to do this, first we should prepare proposal for this Studies,so we need to prepare Subjects and contents.

Key words: Computer Graphics, Computer Animation, Curriculum Reform

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THE STREET LIGHT DESIGN

Srdjan Okanović¹
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Resume

This paper explains and exposes one possible design solution and the installation for the street light. Design is simple and functional, based on optical laws of specular and diffuse reflection. The installation, as well as the maintaining procedure is practical and inexpensive. Complete solution is suitable and aesthetically acceptable for various types of urban environments. 3D modeling, rendering, visual effects, animations and optical simulation are accomplished and obtained by the using of Autodesk Maya and Dassault Systèmes Solid Works software application.

Key words: aesthetics, design, Maya, reflection, street light;

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PARTICULARITIES OF CURVATURE DETERMINATION OF SOME CURVES WITH APPLICATIONS IN MACHINE BUILDING

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Abstract

Determination of curvature of plane and spatial curves in the view of establishing the possibilities of their generation by the active parts of machine tools, of these parts or of the corresponding software of CAM/CNC systems design is of a great importance. In this paper there are analysed the modalities of graphic determination, using specific methods of descriptive geometry, of curvature of plane or spatial trajectories traced by the points of cinematic components, with applications to cycloid curves generated in the gear functioning.

Key words: plane curves, spatial curves, curvature

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COMBINATION OF PERPENDICULAR OSCILLATIONS AND ANALYSIS OF HARMONOGRAPH'S CURVES USING MATH AND CAD TOOLS

Sima Pastor¹
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Résumé

Motions with relatively simple or very complex trajectories can be obtained by combining perpendicular oscillations. These trajectories are known as Lissajous curves. This article gives a short historical review on Lissajous curves. Analytical solution of perpendicular oscillations in complex plane is presented.

A dynamical analysis of perpendicular oscillator with a number of parameters was made using CAD software ProEngineer and modeling a simple harmonograph. An analytical preparation had been carried out using Mathcad software in order to obtain the parameters of characteristic curves. The results of a number of analysis are presented. A method of unambiguous naming of the curves is developed in the article. At the end, an impact of some parameters of the oscillating system on the shape of Lissajous curves is explained.

Key words: Combination of perpendicular oscillations, Lissajous curves, ProE Mechanism, Dynamical analysis, Mathcad, Harmonograph

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COMPUTER-AIDED GRAPHICAL ANALYSIS AND SYNTHESIS OF MECHANISMS

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' *Résumé* '

There are numerous methods for analysis and synthesis of mechanisms based on geometrical constructions. Disadvantages of graphical methods related to drawing accuracy, repeatability and getting solution in only one position of a mechanism can be overcome using the interactive geometry software Cinderella. It uses a computational model of the geometry implemented in a dynamic geometry environment. By means of dynamic drawings it currently adapts the graphical design for subsequent positions of a mechanism. In the course of the Theory of Machines and Mechanisms at the Faculty of Mechanical Engineering in Niš the benefits of this software have been proved for education purposes on examples of many applied mechanisms and machines.

Key words: mechanisms, analysis, synthesis, graphical methods, educational software

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THE COMPLEMENT OF THE HUGELSCHAFFER'S CONSTRUCTION OF THE EGG CURVE

Maja Petrović¹
Marija Obradović²

RESUME

Hügelschäffer's construction, based on the distortion of the ellipse construction, provides an egg-shaped curve. This curve is a mixed cubic curve, the cubic hyperbolic parabola of type A. Curve is a three-branched and except the oval arising from mentioned construction, it contains two more branches which converge towards two asymptotes: one linear and one parabolic asymptote. Since the Hügelschäffer's construction does not give a solution for this part of the curve, we discussed the possibility of amendments to this construction, so that the entire course of the curve could be graphically processed. We came to a solution using Cartesian hyperbole complementary to the circles from Hügelschäffer's construction.

Key words: Hügelschäffer's construction, egg curve, asymptote, circle, hyperbola

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CONSTRUCTING THE EGG CURVES USING THE GOLDEN RATIO OF PENTAGON

Maja Petrović¹
Marija Obradović²

RESUME

In the paper it is considered a construction of an egg curve obtained by continual joining of the circular arcs with three different centers. These three centers form sharp or flat triangles of the pentagon (sharp and flat triangles are the basic building shapes of Penrose tiling). They have many relationships with both the Fibonacci numbers and Phi. In such an egg curve, it is possible to inscribe two juxtaposed pentagons. We give also another construction which employs several, even infinite number of the pentagons. Those pentagons are forming a sequence related to Fibonacci sequence. The construction using the flat triangles will provide a curve which ratio between length of the perimeter and the sum of the length of its minor and major axes will give the coefficient Φ .

Key words: pentagon, egg curve, golden ratio, circular arc

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FORMING A REGULAR PENTAGON, DECAGON AND PENTAGRAM USING ORIGAMI TECHNIQUE

Maja Petrović¹
Marija Obradović²

RESUME

Forming of a regular pentagon, decagon and pentagram using origami technique is based on constructing the angle of approximately 36° by dint of A4 paper of format. The implemented method is "fold and cut". We endeavored to obtain the polygons with the most accurate sides, i.e. with the minimal aberration of the interior angle. It is also considered an ideal paper format, which would provide the most accurate result, with negligible error. As the most suitable, we accepted an argentic rectangle.

Key words: pentagon, decagon, pentagram, origami, argentic rectangle

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SOLVING THE SITUATION OF AIRPORT BLEED BY DIGITAL TERRAIN MODELING USING THE SOFTWARE PACKAGE RINOCEROS

**Maja Petrović¹
Marija Obradović²**

RESUME

In the paper, we conducted an examination of topographical conditions of the airport Bled location, using the digital terrain modeling. A detailed analysis of the ambience around the airport is done in relation to natural and artificial obstacles (already built facilities). The ambience is defined by the imaginary surfaces (the taxiways, takeoff surface, the access surface, the internal horizontal surface, conical surface and transitional surface of the takeoff-landing track) through which can not or should not penetrate obstacles.

Using the software package Rhinoceros, we modeled out the terrain at the foot of the mountain massif of the Savinjske Alps and the imaginary surfaces of the airport object, whereat possible obstacles were found. This method of 3D modeling gives a better visualization (display conditions on the ground) than previously applied methods of horizontal projection (2D) and methods of cross and transverse profiles.

Key words: airport, terrain, imaginary surface, starting-touch down path

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PRACTICAL SOLUTIONS FOR THE TEMPERATURE COMPENSATION OF THE LONG PERIOD COMPOUND PENDULUM

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Resume

This paper considers the influence of the pendulum temperature dilatation to the clock rate error and explains the basic principles by which this noxious effect can be minimized. Fast and efficient, pen - on - paper calculations, as well as the practical constructive solutions are given by which the technically acceptable thermal compensation of the long period compound pendulum can be obtained.

Key words: clock, compensation, dilatation, pendulum, temperature

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KINEMATICAL PRINCIPLES AND SOLID MODELING OF THE GRAVITY DRIVEN TRAIN REMONTOIRE MECHANISM

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Resume

The stochastic variation of the escapement impulses coupled with the pendulum circular error directly generate the clock rate error which must be diminished as much as possible for the sake of clock accuracy. This paper explains one among several possible solutions for the problem of the escapement impulses erratic behavior. The solution is achieved by the synthesis of one special type of constant force device called remontoire. Particularly, the basic kinematical principles and practical design of a gravity driven train remontoire mechanism are analyzed and explained.

Key words: clock, escapement, mechanism, pendulum, remontoire

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GEOMETRIZATION IN ABSTRACT ART

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Abstract

Basic geometric figures (triangle, square, circle...) are used from the beginning of art as geometric-visual archetypes. Examples of more sophisticated geometrical constructions (axonometry, linear perspective or multicentric vision) can be found in Egyptian, Renaissance, or Cubist painting. Clear and open space of abstract art offered the possibility for representation of geometrical ideas and concepts, not directly connected to the geometry of real world and its 2D-representation. After analyzing works of different abstract artists, the main representatives of XX century abstract art (P. Mondrian, K. Malevich, J. Albers, F. Stella,...), and Op-art (B. Riley, P. Sedgley, J.R. Soto...), we will analyze works of V. Vasarely, representing a kind of mathematical and combinatorial modular game.

Key words: visual archetypes, abstract art, Op art, modular game

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DESCRIPTIVE GEOMETRY AND THE RULES OF INFANTRY WEAPONS SHOOTING

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Resume

The content of this work describes the application of planning method with problem solving tasks during direct infantry weapon fire shooting. By applying the coordinate system and grid, it is possible to determine the medium shot, to calculate the probability of obtaining a distance within certain limits as well as the probability of hitting the target in direct shooting.

Key words: coordinate system, coordinate network, medium shot, the probability of hitting the target point, direct shooting

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GEOMETRY AND VISUALISATIONS OF FREE-FORMS IN ARCHITECTURAL CURRICULUM

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Résumé

Geometry and visualisation of free-forms is an academic course with the aim of restoration, enhancement and application of knowledge and skills acquired in courses Descriptive Geometry and Perspectives during the first and second year of study. Free-forms allow students to study different techniques for modelling and visualisation. They are also suitable for parameterisation and demonstration of parametric design capabilities. Furthermore model optimisation, patterns and seamless textures are analysed and few basic techniques are shown. In general, the course refreshes mental skills, regarding geometry and space, developed in earlier years of architectural study. It also enhances the knowledge of CAD software, necessary in today's architectural practice.

Key words: Geometry, Visualisation, Modelling, Parameters, Optimisation

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**METHODS OF WORK AND PROBLEMS ARISING IN WORK
WITH PUPILS IN SECOUNDARY MACHINE SCHOOLS DURING
STUDING THE SUBJECT "COMPUTER GRAPHICS" AND
"MODELING MACHINE ELEMENTS AND CONSTRUCTION"**

**Božidar Stamenković¹
Goran Srdanović²**

Resume

With the advent of personal computers, through their intense technological development and mass application in all fields, it became clear that the work of mechanical engineers and technicians must be done in modern way. This inevitably led to certain occupations, such as conventional mechanical technicians have replaced the other, which would be based on modern technology and of course the use of computers. Thus, the resulting machine technician and computer engineering (machine) control computer technician. Of course, new jobs are produced and new items for the construction, such as "Computer Graphics" and "modeling of machine elements and structures. In this paper we will explain the way we make studies in our school.

Key words: teaching pupils, modeling

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GEOMETRIC AND AESTHETIC DISCRETIZATION OF FREE FORM SURFACES

Milena Stavić¹
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Resume

The development of digital technologies in the last twenty years has led to an unprecedented formal freedom in design and in the representation in virtual space. Combining non-standard geometry with CAD tools enables a new way of expression and realization of architectural ideas and conceptions. The transformation of a virtual double-curved surface into a buildable physical structure and object is always accompanied by huge costs and big problems like geometric and statical ones.

This paper shows geometric methods how to control the construction of curved surfaces out of planar building elements. The approach is based on the discretization of the surfaces by plane elements derived from tangent planes. In order to satisfy also aesthetical requirements we engage plane geometrical patterns and ornaments and transfer them into spatial shape.

Key words: Free-form surfaces, discretization, patterns, symmetry groups

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PROJECTIONS OF 4D SURFACES COMPOSED OF THREE VARIABLES

Risto Tashevski ¹

Résumé

The paper is a continuation of previous research on 4D surfaces defined by two variables. In this paper, a geometric, a mathematical and computer algorithm of projections of 4D surfaces defining with functions with three variables are presented. Presentation of 4D surfaces are reduced of presentation of 4D points in 4D geometric space, points are transformed in 3D and 2D space and are previewed on the display. Determined points are connected in mesh of horizontal and vertical isolines. 4D surfaces are analyzed and confirmed analogy between 3D surfaces and 4D surfaces. Graphical presentations of the projections of 4D surfaces composed of three variables are more complex than the projections of the 4D surfaces composed of two variables.

Key words: 4D geometry, 4D space, 4D surfaces

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VISUALIZATION OF THE WILLMORE ENERGY OF THE SURFACES

Ljubica Velimirović ¹
Marija Ćirić ²

Abstract

Willmore energy, as a quantitative measure of how much a given surface deviates from a round sphere, is discussed. As the function of the surface point coordinates, Willmore energy of some special surfaces is visualized comparable with the mean and the Gaussian curvature of these surfaces. Also, the surfaces are colored in the function of mean, Gaussian curvature and Willmore energy. In this way, the change of these magnitudes along the surface is graphically presented.

Keywords: Willmore energy, visualization, Mathematica.

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BENDINGS OF SPHERICAL CURVES

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Abstract

Infinitesimal bendings of the spherical curves are considered and described. Some spherical curves are graphically presented (loxodrome, spherical nephroid, spherical cardioid, spherical spiral, Viviani's curve, etc) using program packet Mathematica, as well as their infinitesimal bendings. One's proved that it doesn't exist an infinitesimal bending of any spherical curve which belongs to the given sphere.

Keywords: infinitesimal bending, spherical curve, loxodrome, nephroid, cardioid, spiral, Viviani's curve, Mathematica.

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GAUDI SURFACES

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Abstract

Geometric characteristics of the special kind of ruled surfaces, Gaudi surfaces, are considered. Rigidity of the Gaudi surfaces is considered using tensor calculus approach. Visualization is given using Mathematica. Application at civil engineering and architecture is considered.

Keywords: Gaudi surfaces, construction, visualization.

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PLANAR TESSELLATIONS BASED ON SHADOWS OF MORE-DIMENSIONAL CUBES

László Vörös ¹

'Résumé'

We can have several procedures to construct 3-dimensional models of the more-dimensional cubes and 2-dimensional shadows of these, even on the classical field of Platonic and Archimedean solids. The lecture emphasizes the possibilities to construct two-dimensional tessellations based on tiling-sets gained from parallel projected shadows of zonotope models of more-dimensional cubes and of lower-dimensional elements of these. The base patterns of periodical tessellations can be built in similar shape with other tiling-elements and / or the shadows of different elements can be replaced with ones of lower-dimensional elements and all of these with shadows of the faces. This way, we can restructure the already gained tessellations. The repeated, rotated, in different arrays arranged plane-tiling group(s) call(s) forth new, some-times stereoscopic tiling. The grown density of the elements can give texture to the mosaic in addition to the geometric structure, raising new emotions.

Key words: constructive geometry, hypercube, tessellation, art and design

Remark: The creation of the constructions and figures was aided by the AutoCAD program and Autolisp routines developed by the author.

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DEVELOPEMENT OF DIGITAL MODEL OF TERRAIN (DMT) USING AUTOCAD AND SURFING SOFTWARE PACKAGES

Bojan Vujičić ¹
Vladimir Šušić ²
Marija Obradović ³

RESUME

This paper considers a problem of developing a digital model of topographic surface (terrain) which, as an empirical surface, requires a specific approach in 3D modeling. The solution is found by using two software packages: AutoCAD, used in classes of Computational Geometry, and Surfing, used as an educational tool in several subjects at the department of Survey, on the Faculty of Civil Engineering in Belgrade. We compared these two techniques of DTM development, in order to determine the advantages and deficiencies of both. Through creating different digital models and comparing the obtained results, our goal was to contribute upgrading the techniques of processing topographic surfaces, as an important segment of planning that connects Computational Geometry and Surveying.

Key words: digital model of terrain, AutoCAD, Surfing.

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GEOMETRY OF URBAN AND RURAL BLOCK BASES IN THE TOWNS OF VOJVODINA AND SURROUNDING REGIONS

Ljiljana Vukajlov PhD ¹

Resume

One of the most significant characteristics of every urban and rural block is its morphology. It implies block shapes in the foundations and in the volume. Therefore, shape, size, and proportional relations between width, length and height in a block are the most important factors of the morphology. Blocks are first noticed and recognized by their morphological properties, and then, on that basis, they acquire a special importance in the recollections of both their inhabitants and visitors.

This paper deals with shapes of block bases on the examples of central blocks in the towns of Vojvodina and its surrounding regions. In total, 16 central blocks have been analysed, 8 from the towns of Vojvodina and 8 from the towns in regions surrounding Vojvodina. Comparative analysis of the research results has presented the conclusion that the most common are rectangular block shapes. This property of block bases has been a result of several centuries' long experience in spatial organization of urban and rural blocks.

Key words:

Urban morphology, block shape

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ANALYSIS AND GENERATION OF COMPLEX SPHERICAL NETWORKS BASED ON OCTAHEDRAL AND ICOSAHEDRAL SYMMETRY GROUPS

George Zloković ¹

Résumé

Spherical networks for dome structures may be effectively generated by utilizing the octahedral and icosahedral symmetry groups, where maximum utilization of complex symmetry properties of these groups provides decomposition of the space of the network into ten G-invariant subspaces, with many advantages in regard to the conventional utilization of symmetry. Spherical networks based on these groups are formulated in their respective G-vector spaces using classes of conjugate elements (symmetry operations), character table of the group, idempotents of the centre of group algebra, class sums of group elements and dimensions of symmetry adapted subspaces of the space of the network. These spherical networks are generated by applying symmetry operations of the respective group on the elementary part of the network, with clear insight into their symmetry properties and easy navigation on the network by means of nodes with designated nodal types.

Keywords: group theory, symmetry groups, G-vector space, G-invariant subspace, spherical network

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