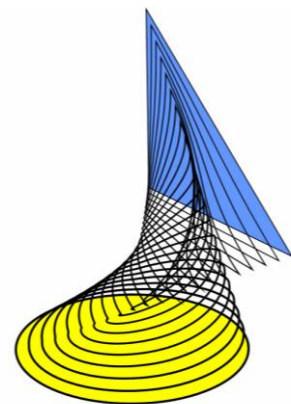
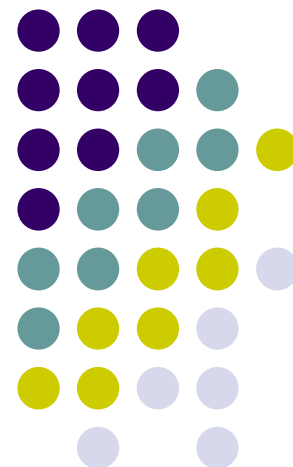


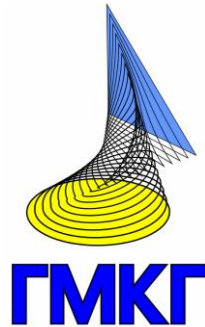
**National Technical University
“Kharkiv Polytechnic Institute”
Department of Geometrical
Modeling and Computer Graphics**



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About department

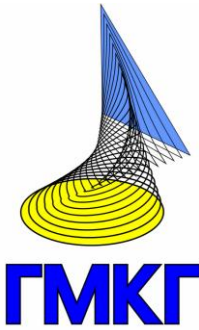


The Department of Geometrical Modeling and Computer Graphics trains students of “Information Technology in Design” specialty.

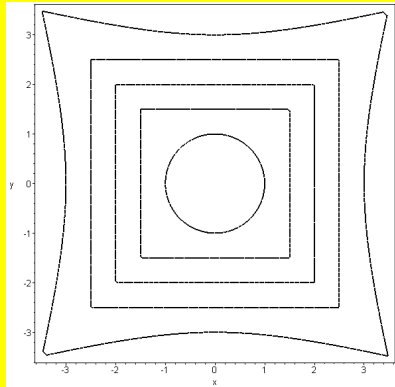
Our main disciplines are:

- ☐ Analytical geometry and computer graphics algorithms;
- ☐ Basics of computer graphics and design;
- ☐ CAD systems;
- ☐ Mobile development (programming of Android and Windows Phone devices);
- ☐ 3d modeling with Autodesk 3ds Max;
- ☐ Special effects of computer animation with Autodesk Maya;
- ☐ WEB-design and technologies;
- ☐ Data base systems;
- ☐ Artificial intelligence systems and methods;
- ☐ Character recognition and computer vision;
- ☐ Geometrical modeling of objects, phenomena and processes.

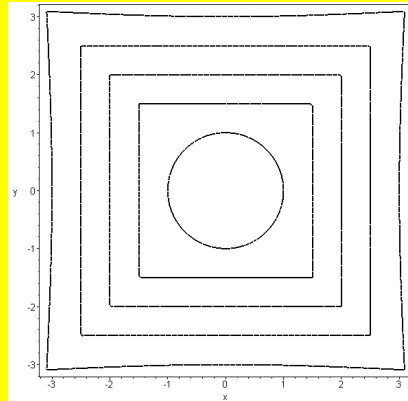
The wildfire contour prediction with Rvachev function method (interpolation and extrapolation)



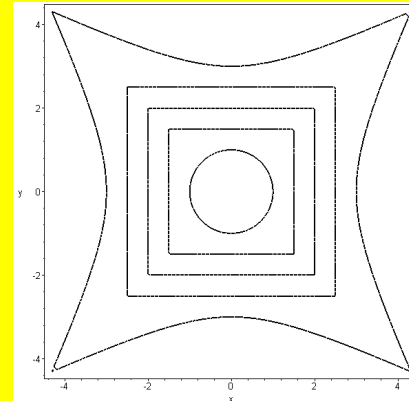
EXAMPLES OF EXTRAPOLATION ARE FOR INITIAL CONTOURS "CIRCLE AND THREE SQUARES"



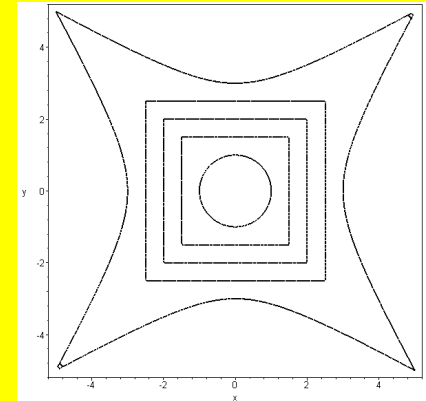
a



b

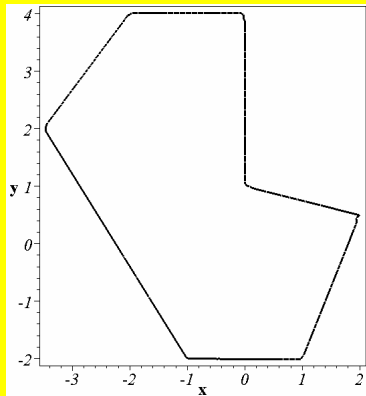
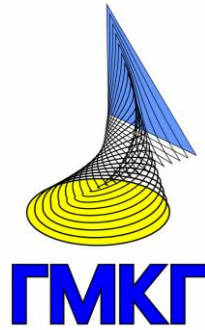


c

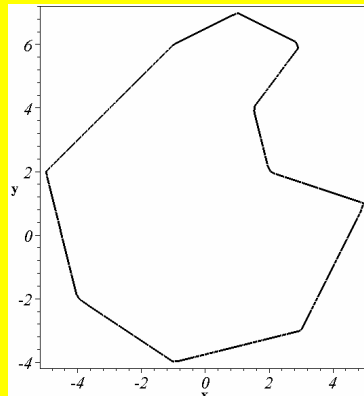


d

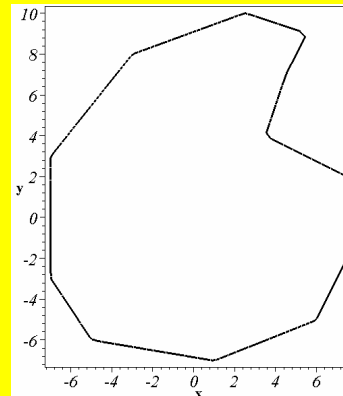
The wildfire contour prediction with R-function method (interpolation and extrapolation)



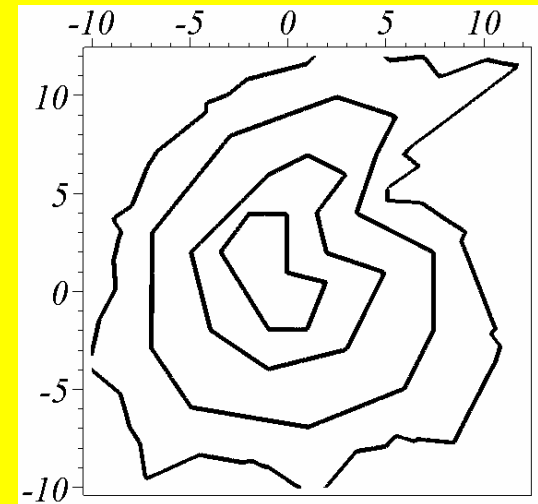
1st initial contour



2nd initial contour

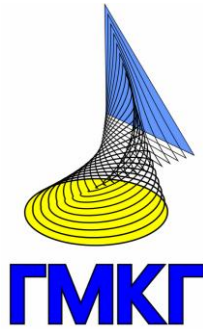


3rd initial contour

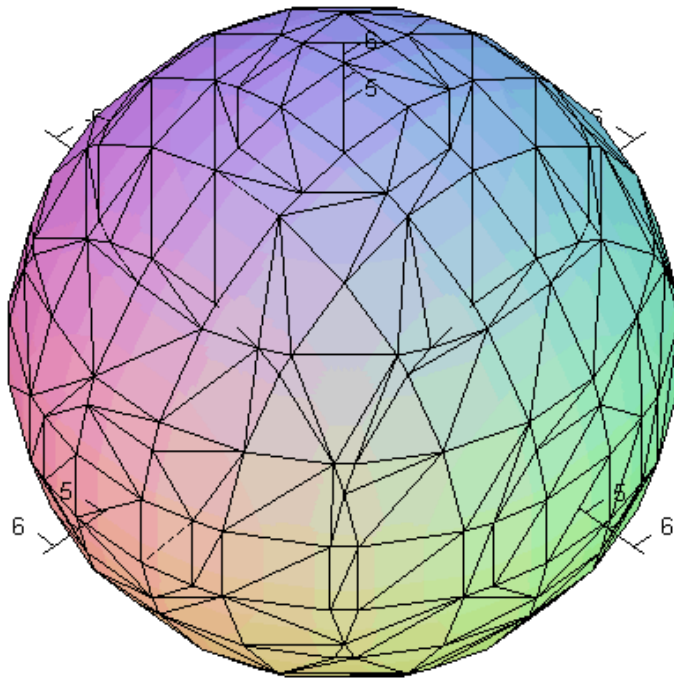


Result of image extrapolation
(external contour)

Modeling of complex 3d objects with R-function method



$$f_1 = x^2 + y^2 + z^2 - 5^2$$



$$f_2 = 4 - |x|$$

$$f_3 = 4 - |y|$$

$$f_4 = f_2 \wedge f_3$$

$$f_5 = -(z - 4)$$

$$f_6 = z + 4$$

$$f_7 = z$$

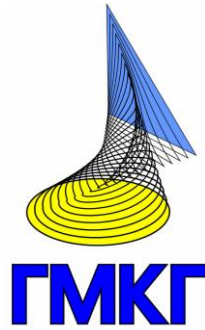
$$f_8 = f_4 \wedge f_7$$

$$f_9 = f_8 \wedge f_5$$

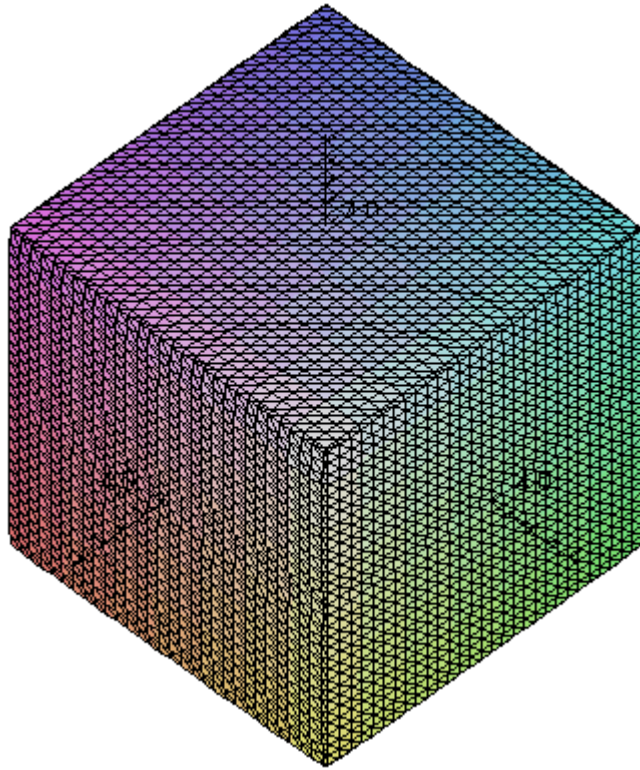
$$f_{10} = f_4 \wedge -f_7$$

$$f_{11} = f_{10} \wedge f_6$$

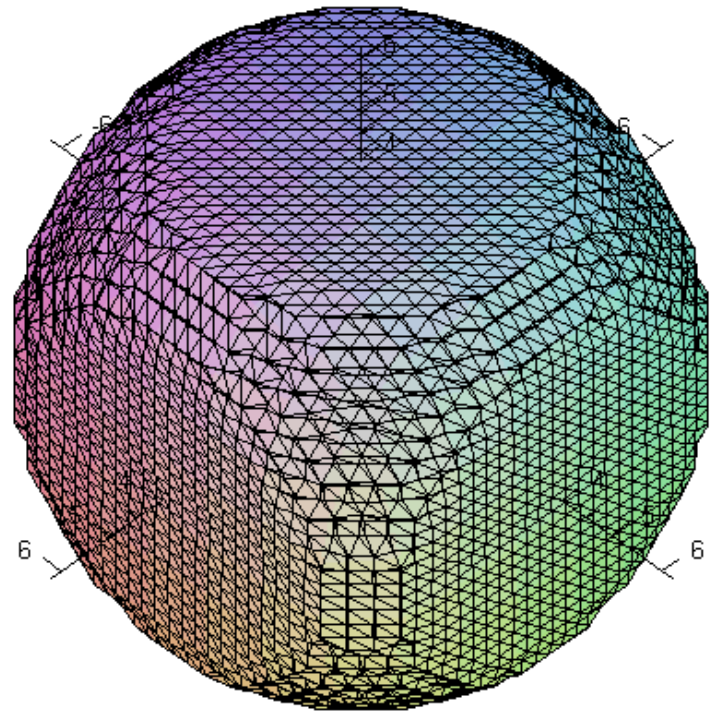
Modeling of complex 3d objects with Rvachev function method



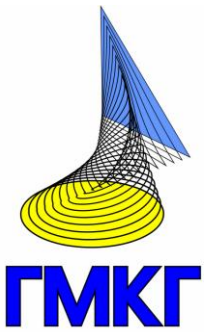
$$f_{12} = f_{11} \vee f_9$$



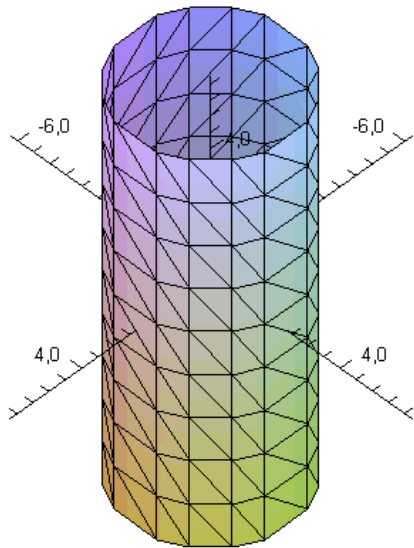
$$f_{13} = f_{12} \wedge -f_1$$



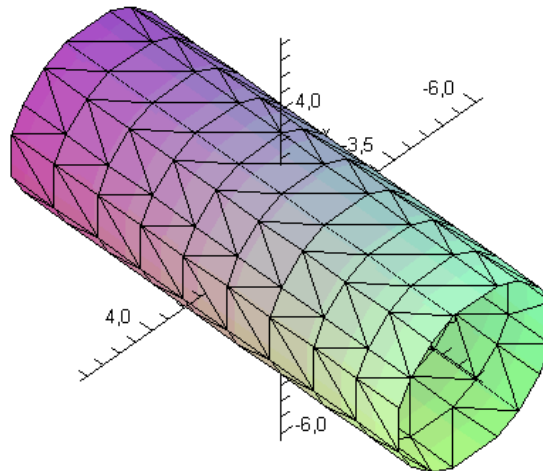
Modeling of complex 3d objects with R-function method



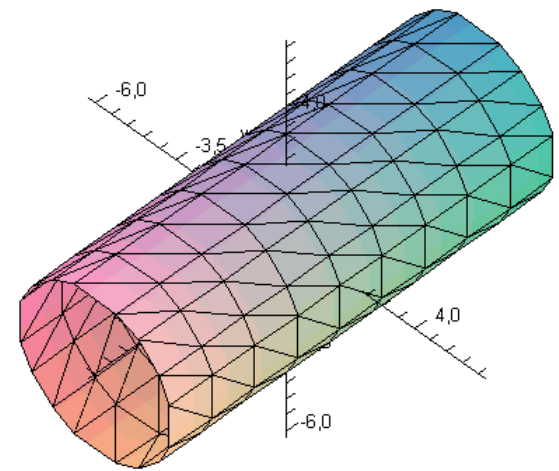
$$f_{14} = 1 - \frac{x^2}{2.5^2} - \frac{y^2}{2.5^2}$$



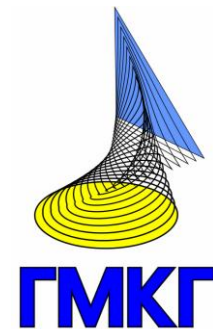
$$f_{15} = 1 - \frac{x^2}{2.5^2} - \frac{z^2}{2.5^2}$$



$$f_{16} = 1 - \frac{y^2}{2.5^2} - \frac{z^2}{2.5^2}$$

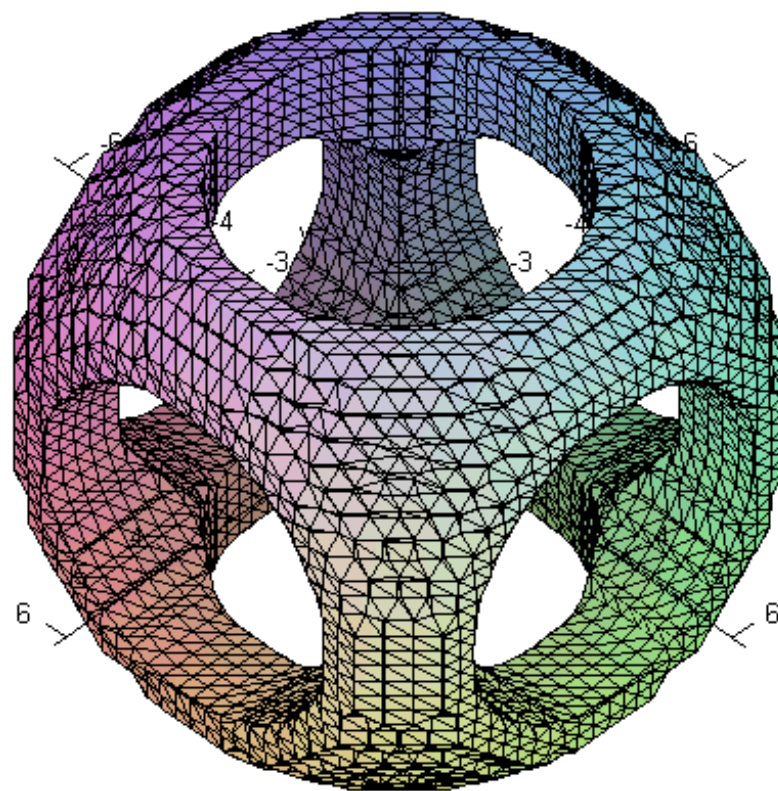
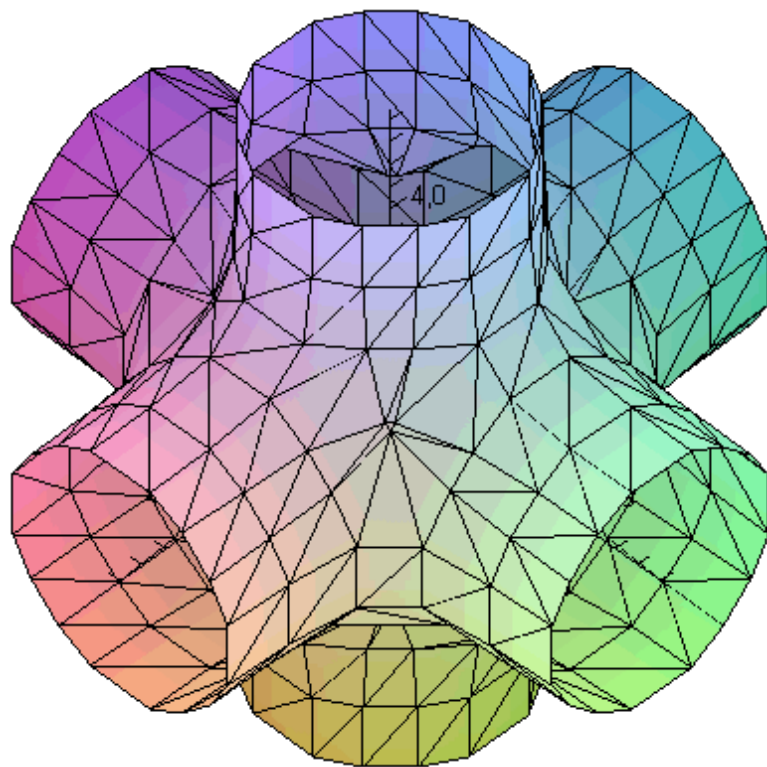


Modeling of complex 3d objects with R-function method



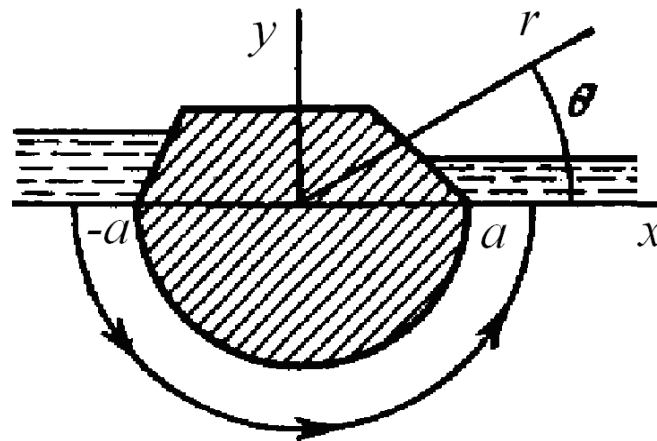
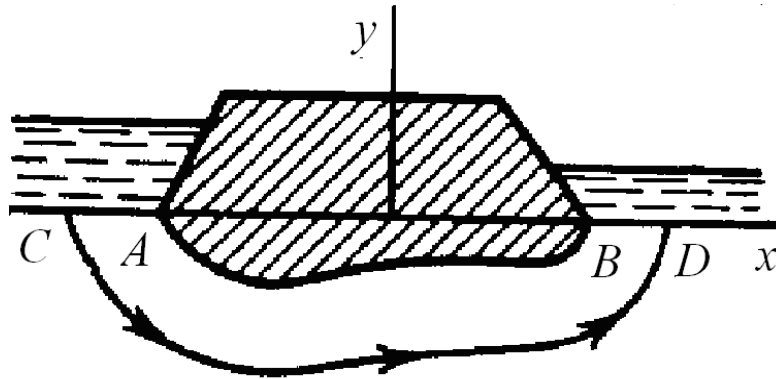
$$f_{17} = -((f_{14} \vee f_{15}) \vee f_{16})$$

$$f_{18} = f_{17} \wedge f_{13}$$

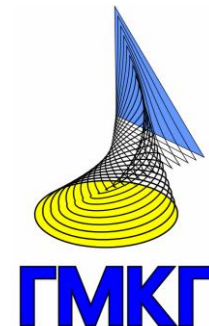


Generalized parallel sets of lines as characteristics of physical fields

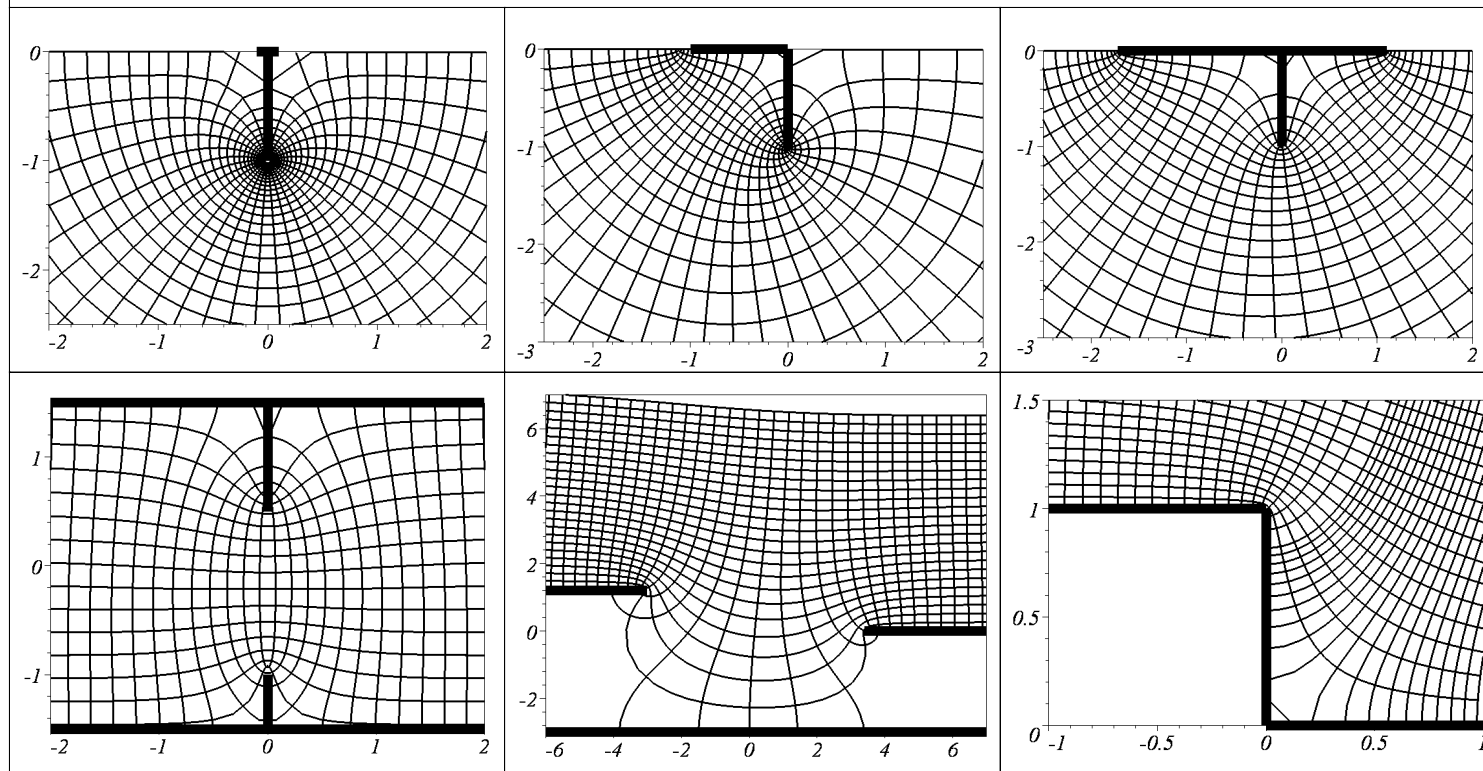
WATER FILTERING UNDER THE DAM



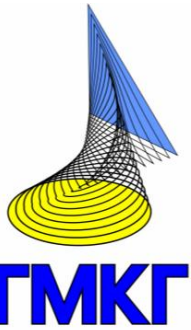
Generalized parallel sets of lines as characteristics of physical fields



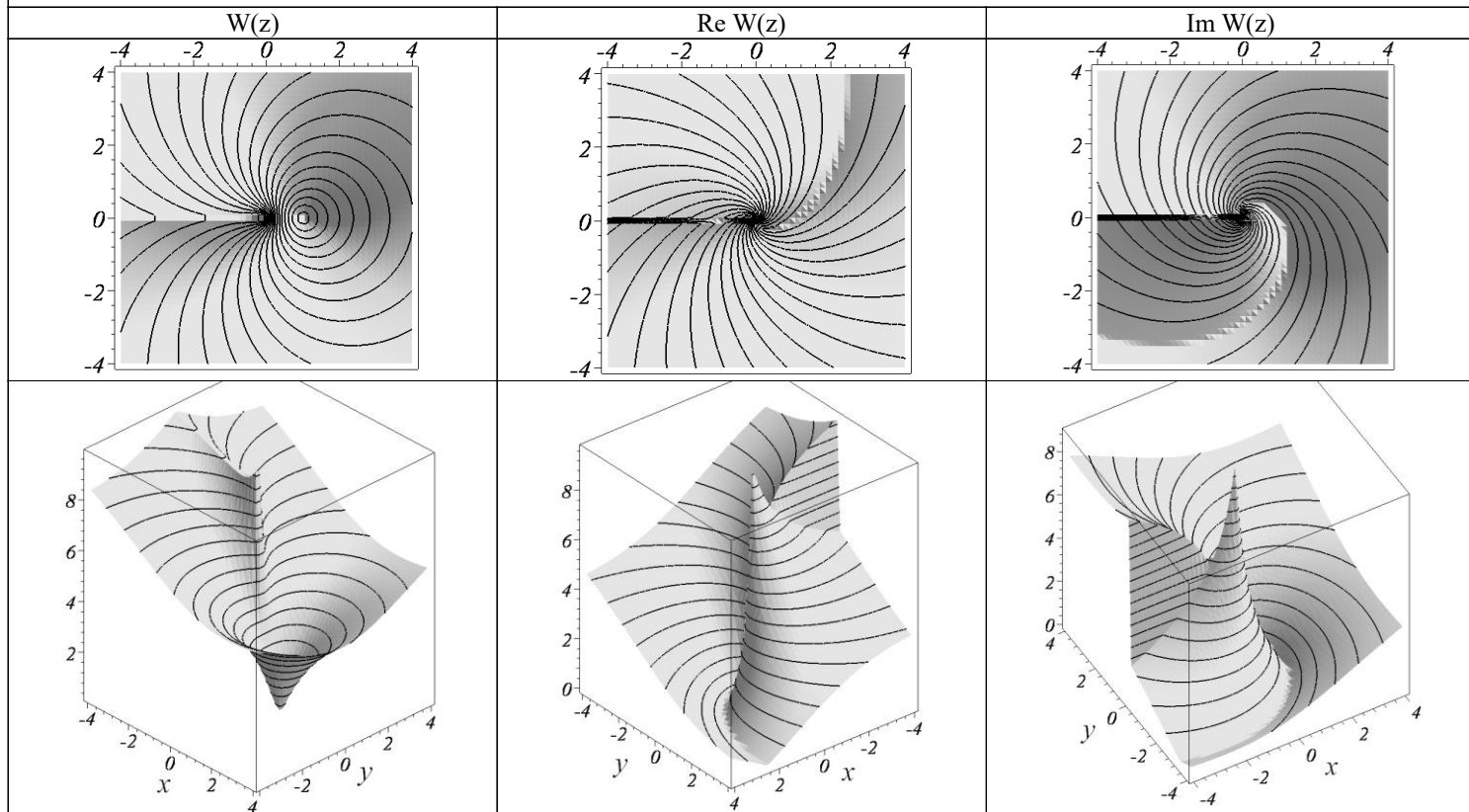
EXAMPLES OF FILTERING



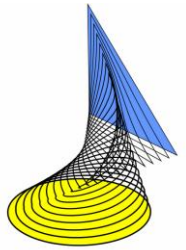
Generalized parallel sets of lines as characteristics of physical fields



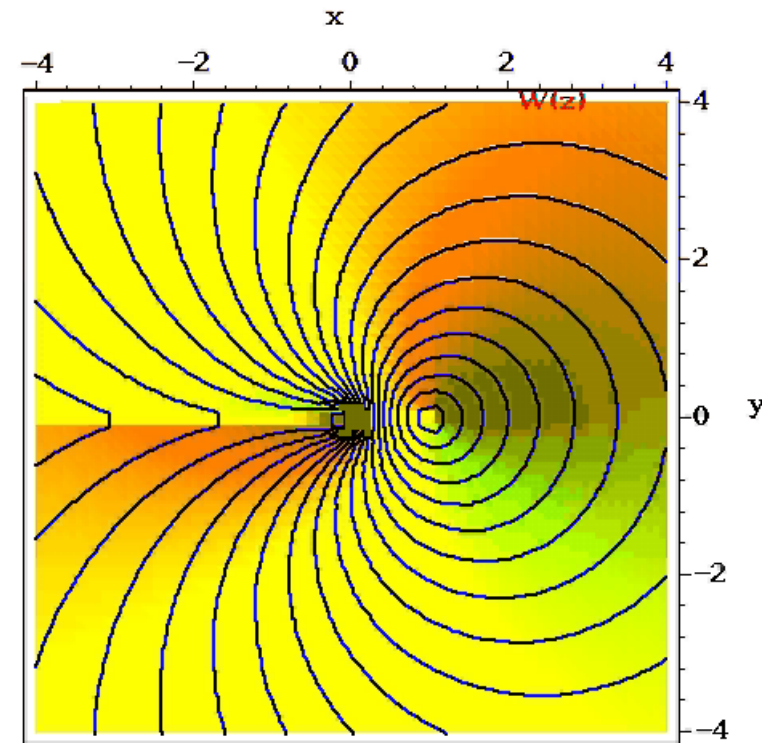
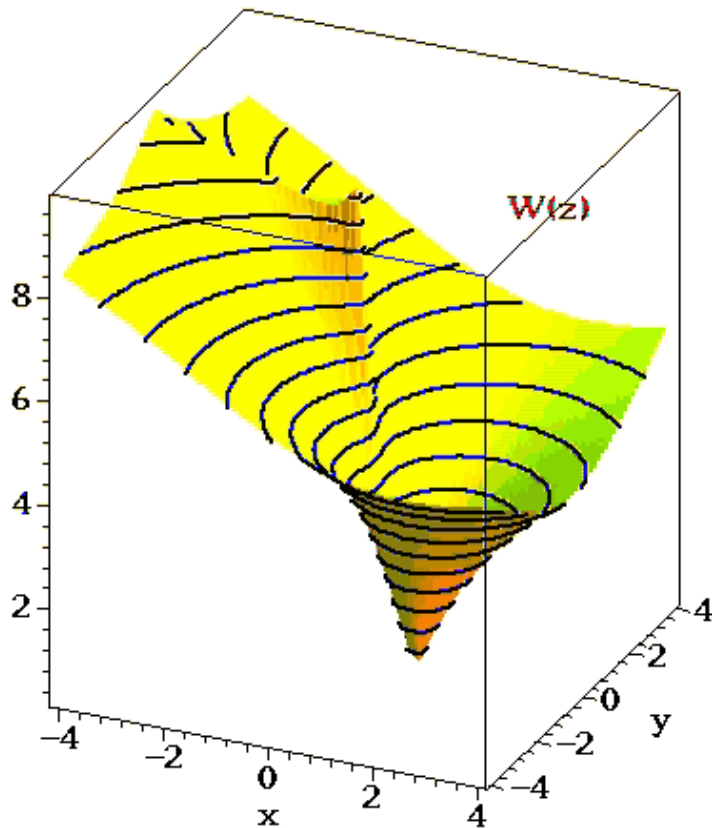
GEOMETRICAL INTERPRETATION OF VORTEX POTENTIAL



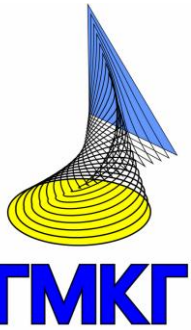
Generalized parallel sets of lines as characteristics of physical fields



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Heat conduction process modeling with form-factors of heat radiation

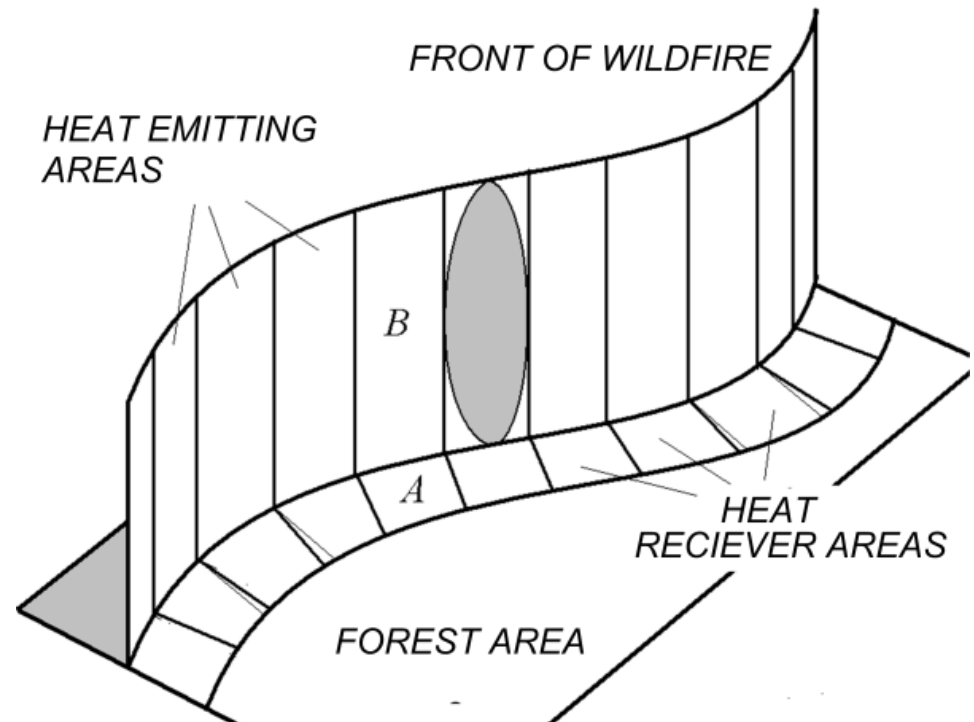


- Integral form factor of heat radiation

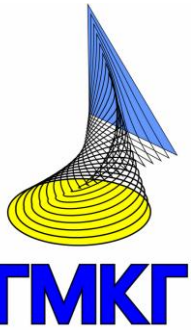
$$F_{A-B} = \frac{1}{A} \int_A \int_B \frac{\cos \alpha \cos \beta}{\pi r^2} dB dA$$

- Local form-factor from area dA of surface A to surface with definite size B

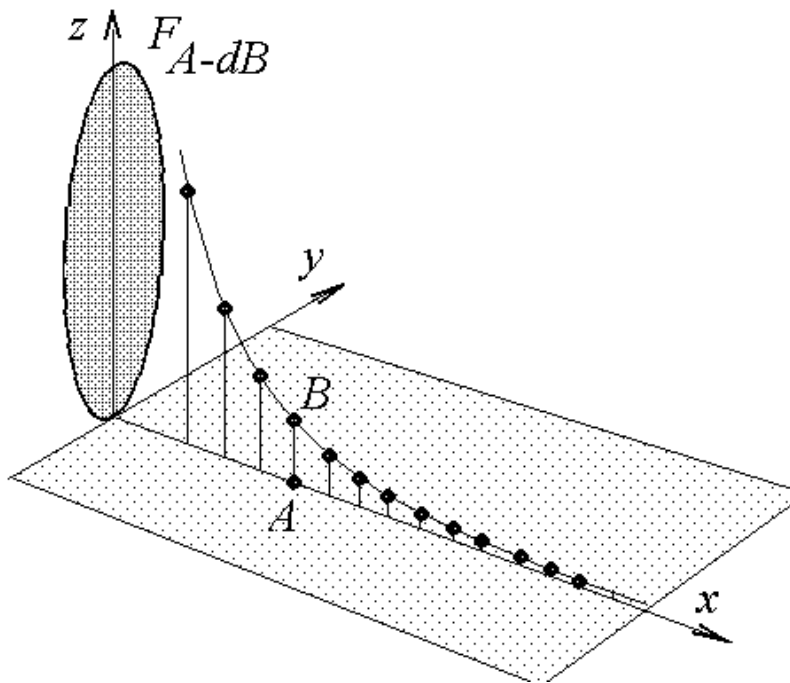
$$F_{dA-B} = \int_B \frac{\cos \alpha \cos \beta}{\pi r^2} dB$$



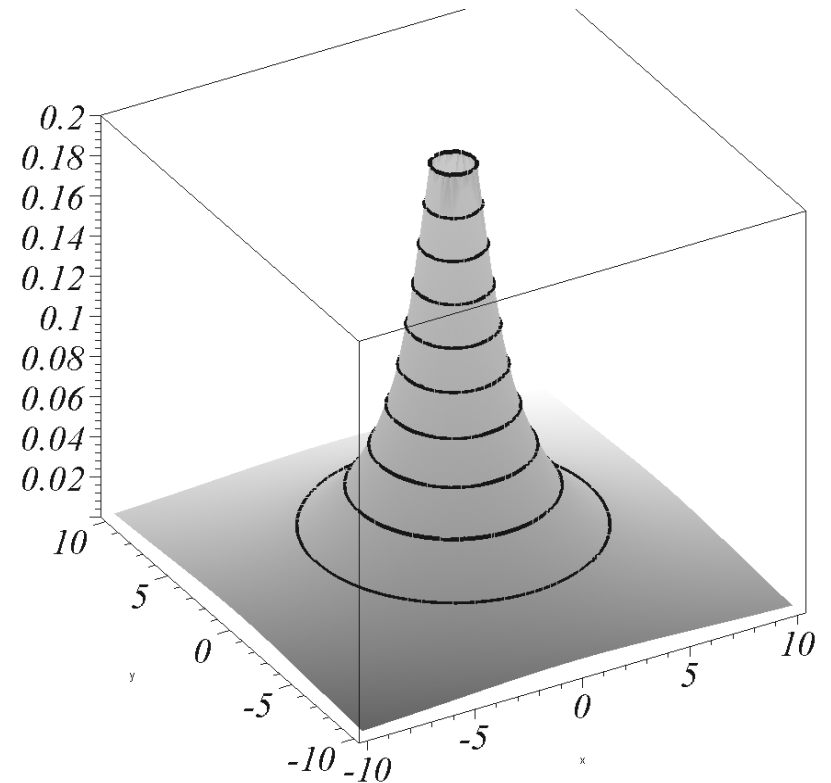
Heat conduction process modeling with form-factors of heat radiation



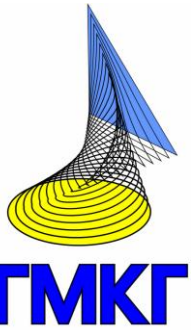
- Local form-factor distribution graph when the heat source is ellipse



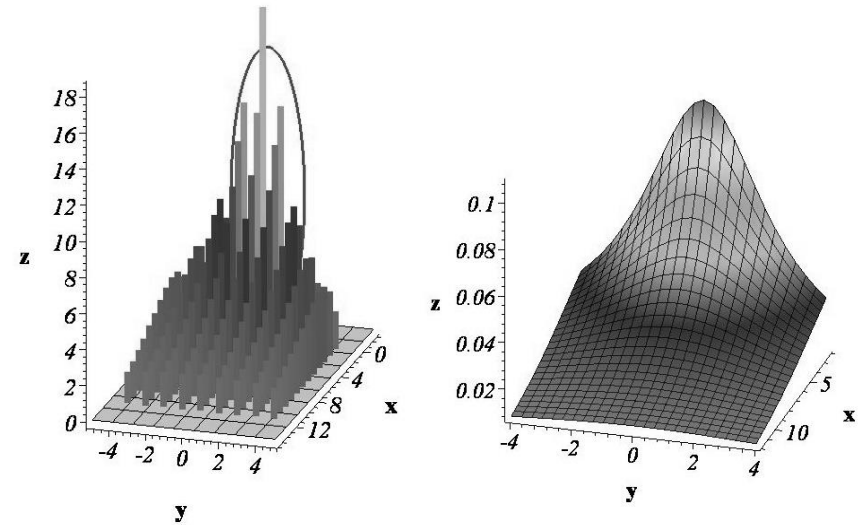
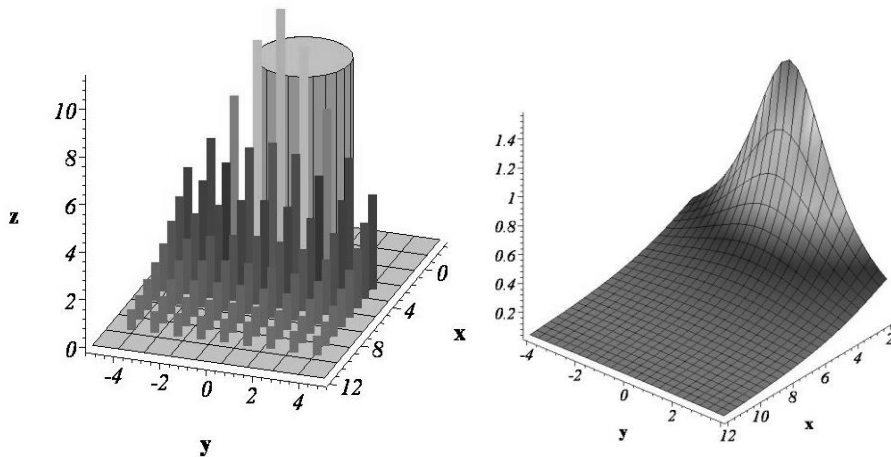
- When the heat source is surface of revolution



Heat conduction process modeling with form-factors of heat radiation

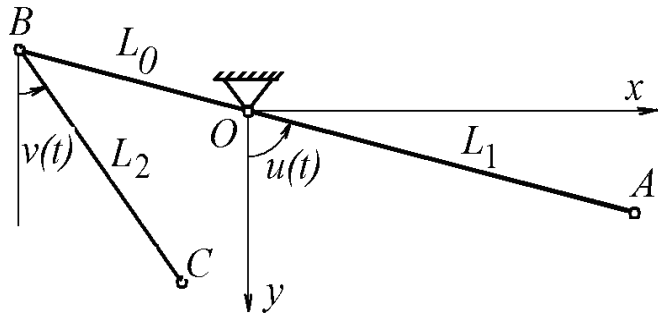


- Heat conduction from cylinder to plane
- Heat conduction from ellipse to plane

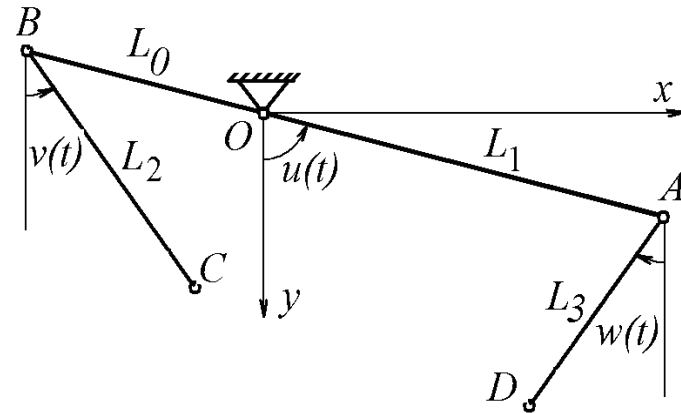


Geometrical modeling of dynamic systems

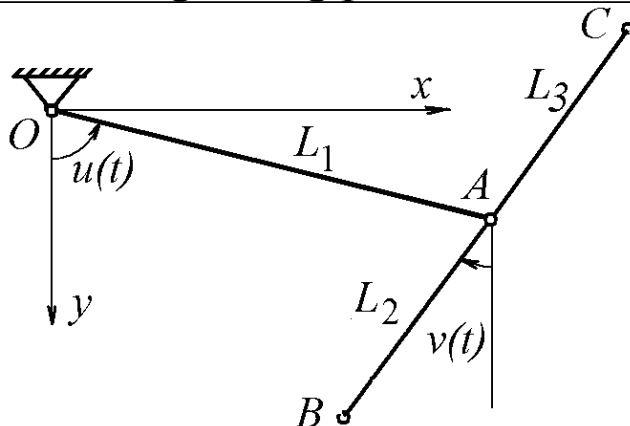
MULTILINK PENDULUM EXAMPLES



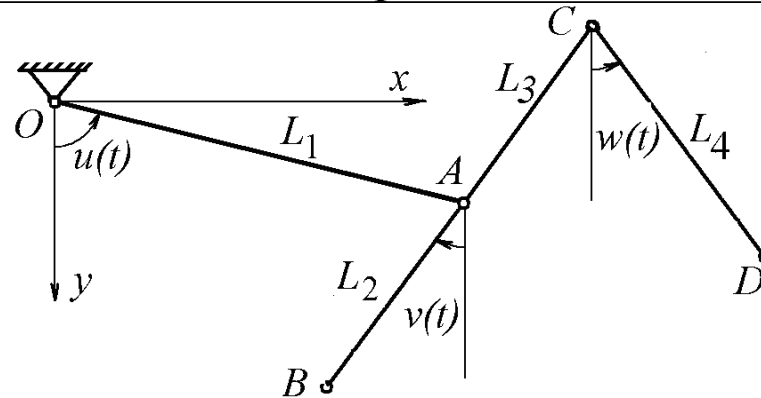
Magdeburg pendulum



Rocker pendulum

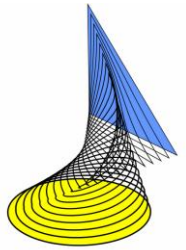


Tomson-Tet pendulum



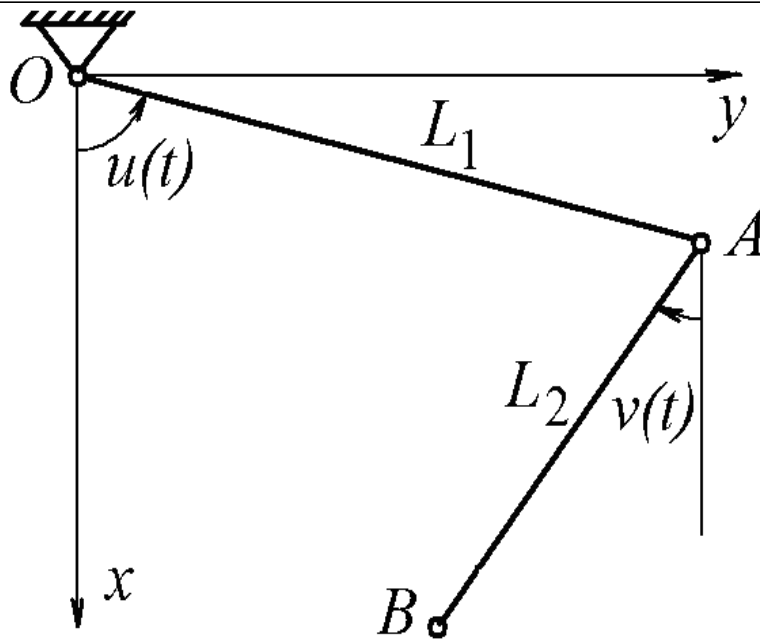
Combined pendulum

Geometrical modeling of dynamic systems



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DOUBLELINK PENDULUM VIBRATION

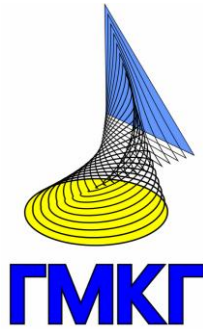


The pendulum dynamics can be defined from system of equations:

$$\frac{d}{dt} \left(\frac{\partial L}{\partial u'} \right) - \frac{\partial L}{\partial u} = 0 ;$$

$$\frac{d}{dt} \left(\frac{\partial L}{\partial v'} \right) - \frac{\partial L}{\partial v} = 0 .$$

Geometrical modeling of dynamic systems

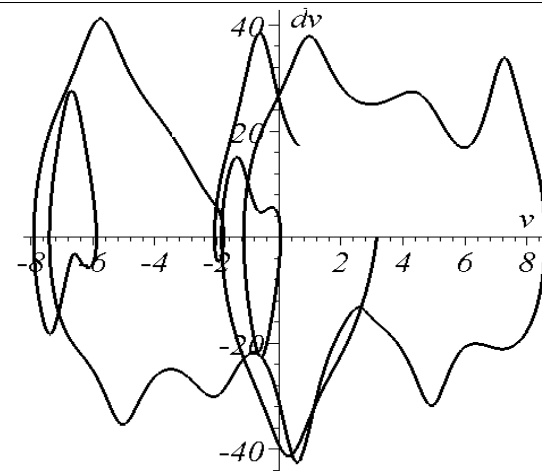
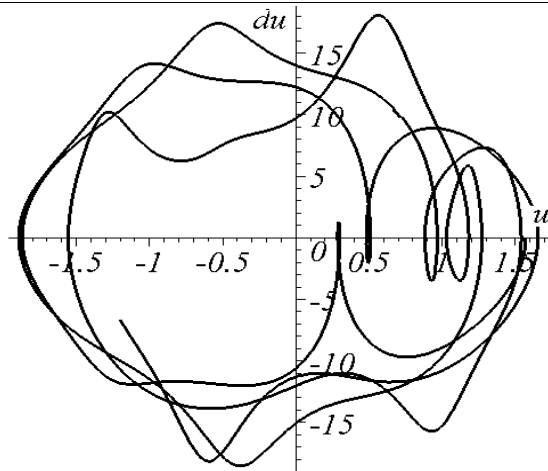
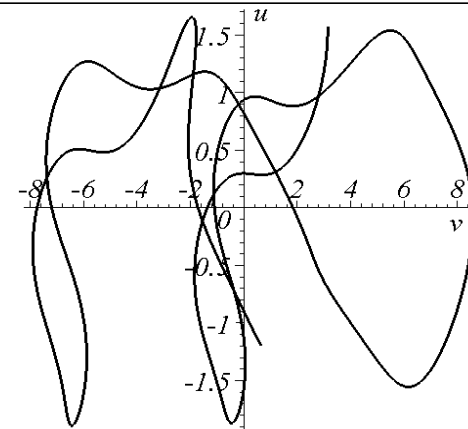


PHASE PORTRAITS OF PENDULUM

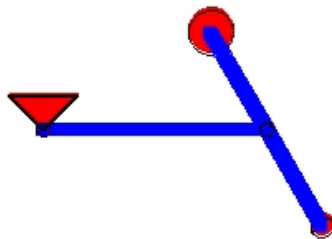
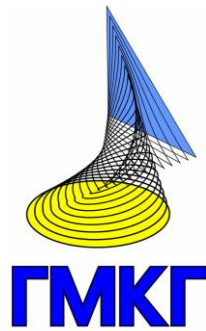
1. Angle $u(t)$ – angle $v(t)$ relation.

2. Relation $du(t)/dt$ – angle $u(t)$.

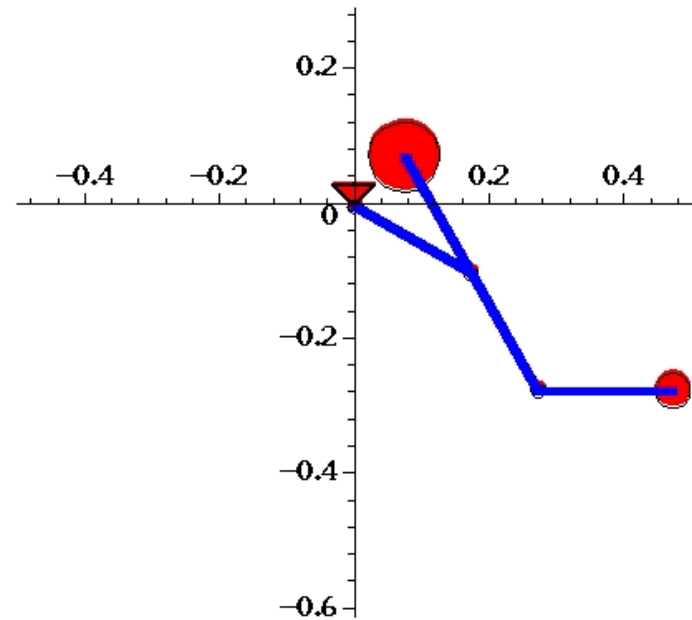
3. Relation $dv(t)/dt$ – angle $v(t)$.



Geometrical modeling of dynamic systems

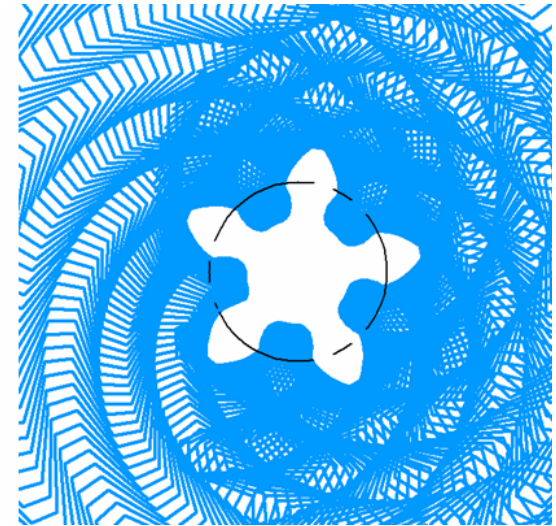
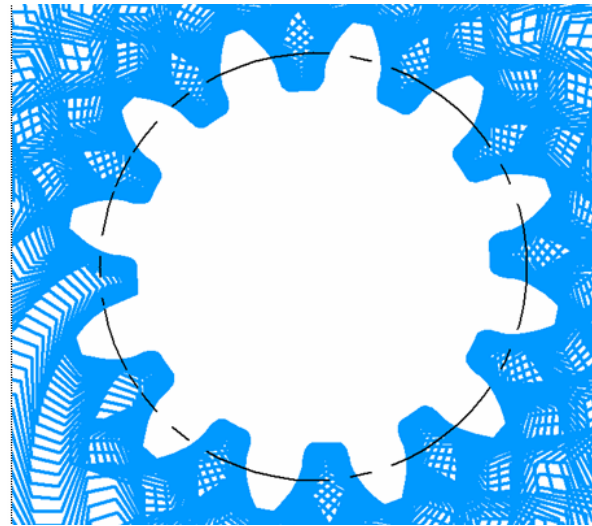
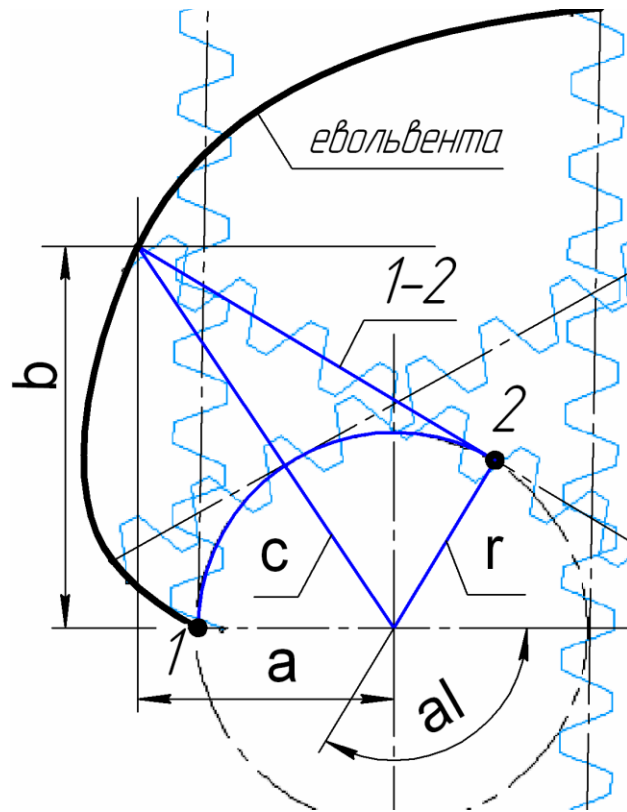
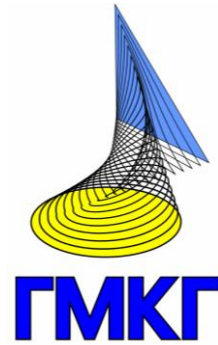


2_томсона_тета_нехаос.avi

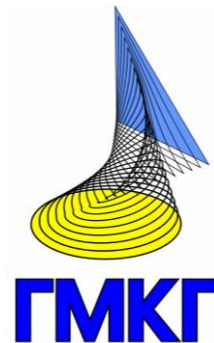


4_хаотич_комбинир.avi

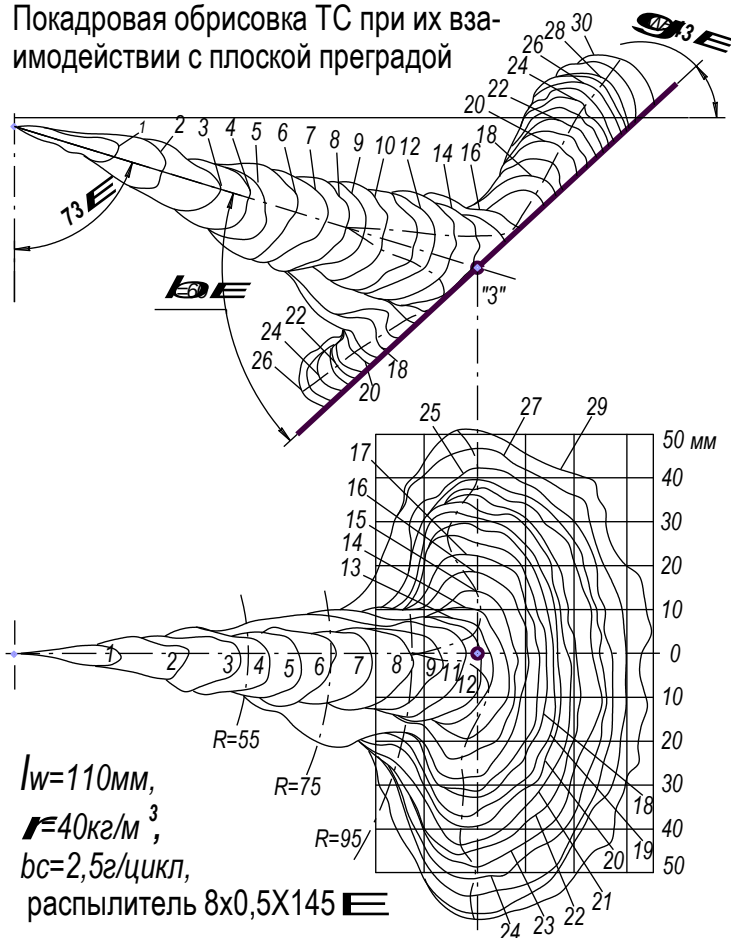
Animated modeling of gears



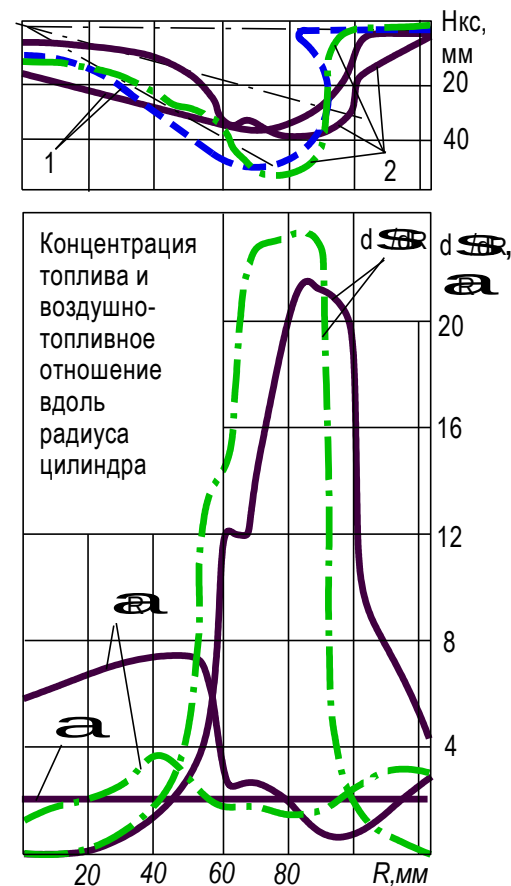
Geometrical modeling of internal combustion engines



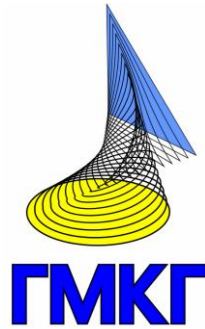
Покадровая обрисовка ТС при их взаимодействии с плоской преградой



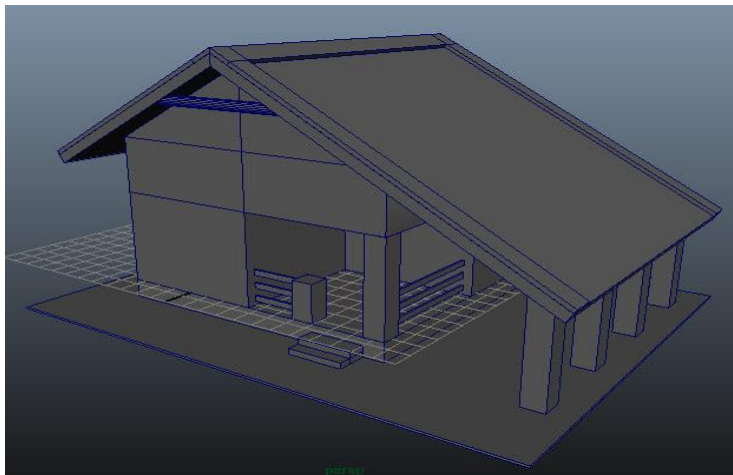
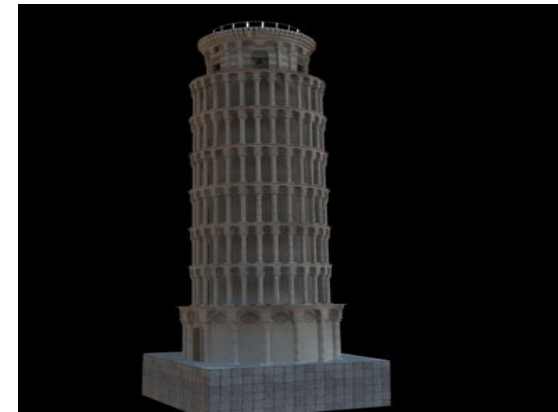
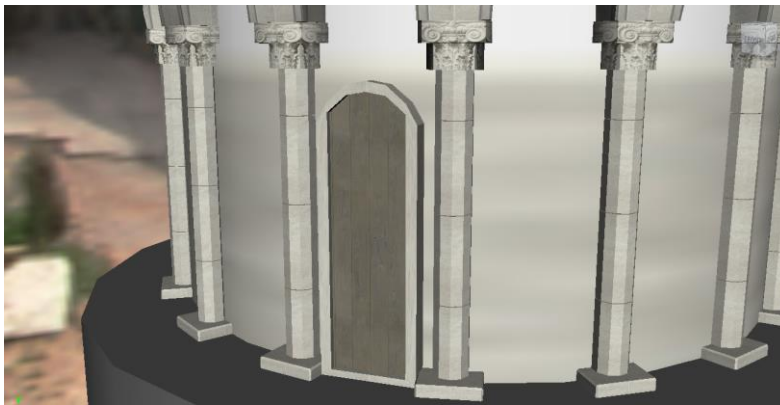
Факт.(1) и теоретический(2) профили КС



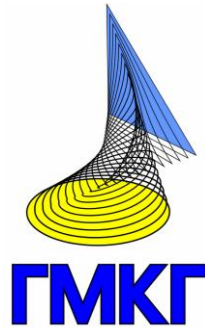
Computer graphics special effects modeling in Autodesk Maya



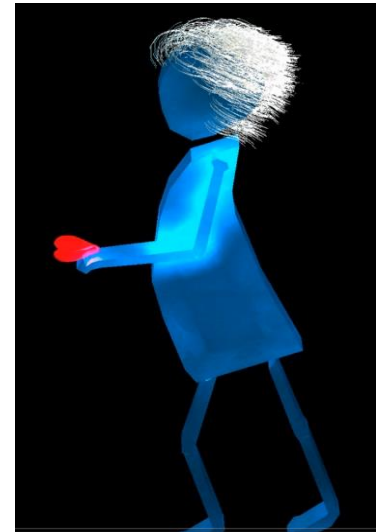
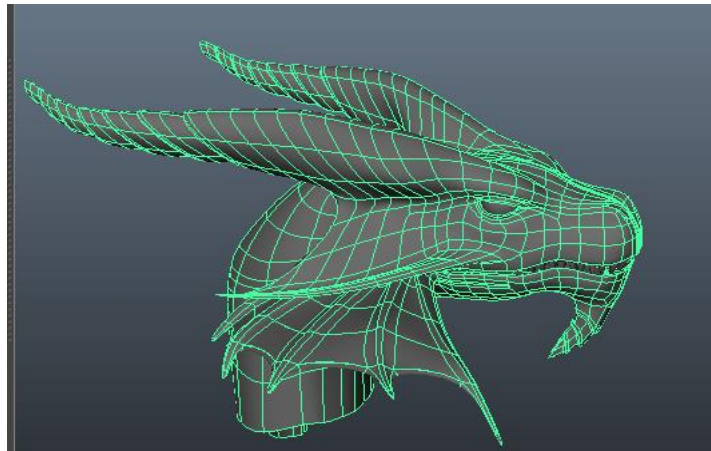
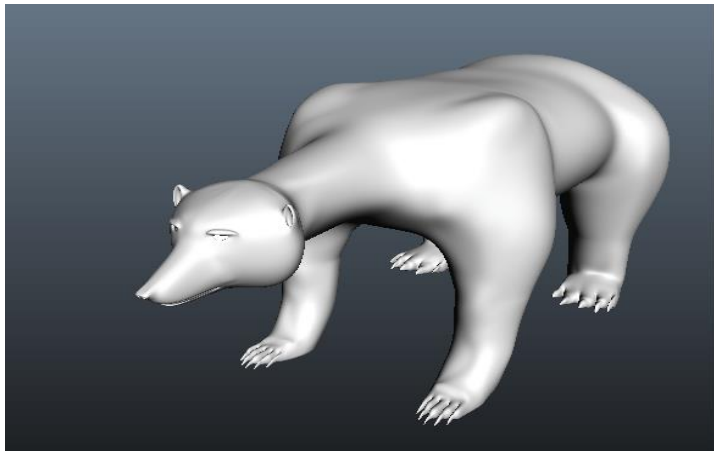
- Modeling of 3D objects and nature phenomena



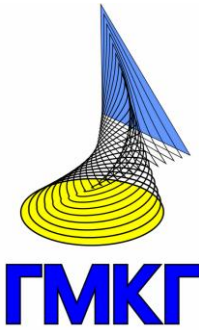
Computer graphics special effects modeling in Autodesk Maya



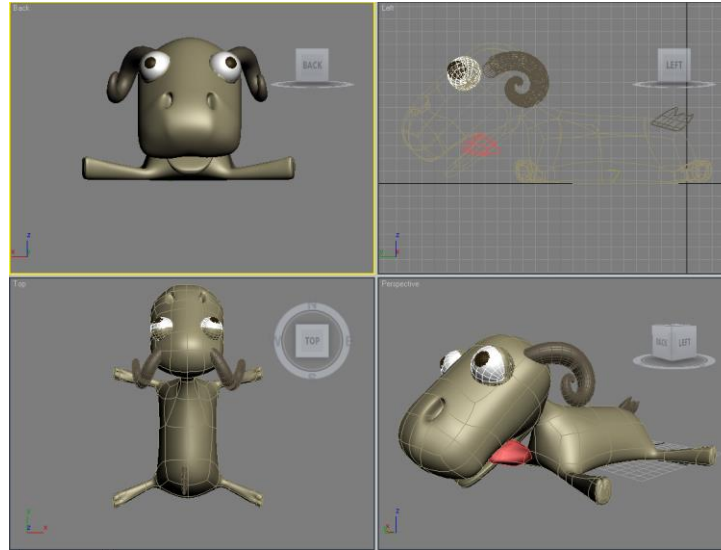
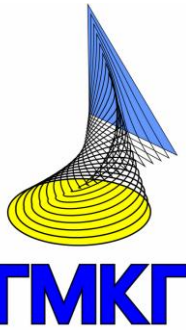
- Modeling and animation of characters for computer games



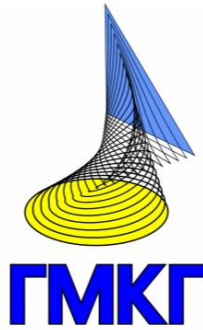
Modeling and animation of 3d objects with Autodesk 3ds Max



Modeling and animation of 3d objects with Autodesk 3ds Max



CONTACT INFORMATION



Address

NTU “KhPI”, 21, Kirpichev str., 61002, Kharkiv, Ukraine

Contacts

Department of Geometrical Modeling
and Computer Graphics

Tel. +38 057 707 65 75 Shoman Olga (head of department)
+38 057 707 64 31 (department GMCG)

Email: olgasho@ukr.net, kgmkg.ntu.khpi@gmail.com