BELARUSIAN STATE TECHNOLOGICAL UNIVERSITY

FACULTY OF PRINT TECHNOLOGY AND MEDIA COMMUNICATIONS

SCIENTIFIC AND EDUCATIONAL AREAS

DEPARTMENT OF PRINTING PRODUCTION

General information

The Department staff comprises 11 teachers

The teaching staff includes 1 Professor, Candidat of Sciences, 6
assistant-professors, Candidates of Sciences,
1 senior teacher, Candidat of Sciences,
2 senior teachers, 1 teacher

On department have training preparation 2 post-graduate students of the internal form of training, 2 undergraduate students of the internal form of training and 1 undergraduate student of the correspondence form of training

General information

The department defended 8 candidate dissertations, the themes of which are related to the problems of technology, management and economics of the publishing and printing complex of Belarus, seven of them were defended by the graduates of the department

Courses taught

- Polygraphy and desktop publishing systems
- Bases of polygraphic production
- Theory of color and color reproduction
- Technology of printing production
- Technology of processing of the graphic information
- Technology of formal processes
- Technology of printing processes
- Technology of pre-printing and printing processes
- Technology of post-printing processes
- Metrology, standardization and quality management of printing products
- Modeling of technological processes of polygraphic production

Courses taught

- Operative polygraphy
- Fundamentals of scientific research and innovation activities
- Basics of polygraphic production systems
- Methods of system analysis
- Marketing in publishing
- Protection of polygraphic products
- The theory of processes of reprotechnical registration
- Technology on the equipment of form processes in the production of packaging and tare
- Technology of printing and finishing processes in the production of packaging and tare
- Packaging technology
- Packing, bundling and pre-packing of food, medical and cosmetic drugs and products

Courses taught

- Engineering of technological processes of polygraphic production
- Packaging and bundling of industrial products
- Engineering of packing and pre-packing units of enterprises
- Engineering of production packaging and tare
- Engineering and design packaging and tare
- Theory of quality management systems for printing products (masters)
- Statistical modeling of technological processes of printing production (masters)
- Structural mechanics of polygraphic materials (masters)
- Simulation models of organization and management processes in the printing industry (masters)

Study programs

Speciality Technology of Printing Production
(Ist cycle — Baccalaureate)
Machines, aggregates and processes (polygraphy),
System analysis, management and information processing
(IInd cycle — magistracy)
Machines, aggregates and processes (polygraphy),
(postgraduate study)

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Research areas

1. Comprehensive research on mechanics and information management processes and information play in printing production systems.

2. Development and implementation of the operational method of the input control of the main printing materials.

3. Study on printed contact mechanics, ink transfer theory in printing process, the structural heterogeneity influence the physical and mechanical properties of the paper on its behavior in printing and other printing processes.

Research areas

4. Improvement of strategic management at the enterprises of publishing and printing complex based on an innovative model of development organizations

5. The development of programs of strategic development of printing companies on the basis of a complex logistic models.

6. Study of the efficiency of enterprises management structure in terms of organizational conflicts. Optimization of organizational planning in the printing industry.

7. Optimization of the production process of the existing enterprise, search for technical solutions to overcome technological problems and improve product quality.

Research products and technology № 1

Title	Synthesis of vector images based on the theory of symmetry
Description	Developed and software implemented a method for the synthesis of symmetric vector traceries based on the basic elements of simple shape. As a result of the given sequence of symmetric transformations of the base element, a new symmetrical object is formed. At each new stage of the transformation, the current symmetric object will be used as the new base element, resulting in a more complex tracery. Composite traceries are formed by combining multiple symmetrical objects

Research products and technology № 1

Advantages	On the basis of a simple graphical object it is possible to form a complex ornament in the form of a symmetric multi-level system
Application areas	For the artistic design of printed materials, as well as for its protection from falsification
Technology readiness level	The results are presented in scientific articles, acts of introduction (4 acts) and dissertation work
Cost effectiveness	Economic advantages are expressed in increasing productivity in the prepress stage

Research products and technology № 1

Intellectual property rights protection	A certificate of registration of the computer program # 832 from 01.12.2015
Cooperation proposals	The developed method can be used for the synthesis of vector traceries of various shapes and symmetries
Contacts	Sipaila S. U. Department of Printing Production. Minsk, Sverdlova str., 13a. Phone: +375 17 327 26 88, e-mail: sipailo@belstu.by

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Synthesis of vector images based on the theory of symmetry

Description of the symmetry of Belarusian ornaments as composite images

Examples of rosette ornaments

$$2 \cdot m = 2 \cdot m \cap 4 \cdot m$$

$$4 \cdot m = 4 \cdot m \cap 4 \cdot m \cap 4 \cdot m$$

Examples of border ornaments

$$(a):2 \cdot m = (a):\{2 \cdot m \cap 4 \cdot m\}$$

$$(a):2 \cdot m = [(a):\{2 \cdot m \cap 4 \cdot m\}] \cap [(a):2 \cdot m])$$

Examples of mesh ornaments

$$(a:a):4 \cdot m = [(a:a):4 \cdot m] \cap \cap[(a:a):4 \cdot m] \cap [(a:a):4 \cdot m]$$

$$(a:a):4 \cdot m = [(a:a):4 \cdot m] \cap \cap[(a:a):4 \cdot m] \cap [(a_d:a_d):4 \cdot m]$$

$$(a/a):2 \cdot m = (a/a):\{2 \cdot m \cap 4 \cdot m\}$$

$$(b:a):2 \cdot m = [(b:a):2 \cdot m] \cap \cap[(b:a):\{2 \cdot m \cap 4 \cdot m\}]$$
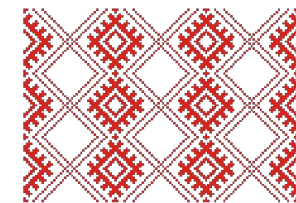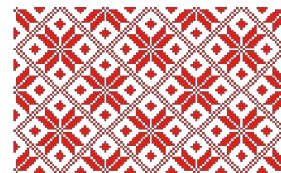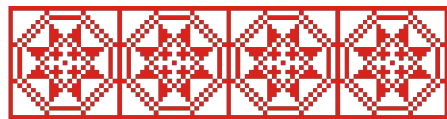
Synthesis of vector images based on the theory of symmetry

Examples of a formalized description of ornamental rosettes

$$M_{1,2}(17, 2, 3, 4) = [(a_{1,-1,17} \rightarrow a_{1,1,2}) \cup (a_{1,-1,16} \rightarrow a_{1,1,1})] \rightarrow a_{3,3,4} \rightarrow n_{4c}^{\cup}$$
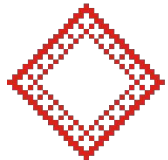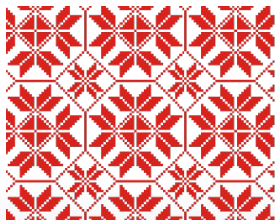
$$M_{2,4}(1, 2, 6, 1, 1) = [M_{1,2}(13, 1, 2, 6) \cup M_{1,4}(10, 10, 9) \overline{\cap} M_{1,4}(10, 10, 9] \cup$$
$$\cup M_{1,4}(16, 1, 1)$$
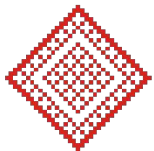
$$M_{3,5}(M_{2,4}, M_{1,2}) = M_{2,4}(1, 2, 7, 1, 1) \cup (M_{1,2}(9, 1, 2, 5))$$
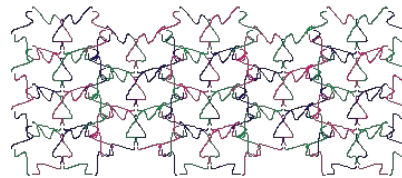
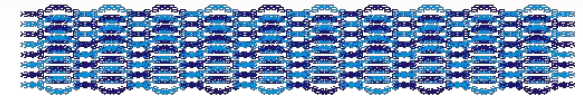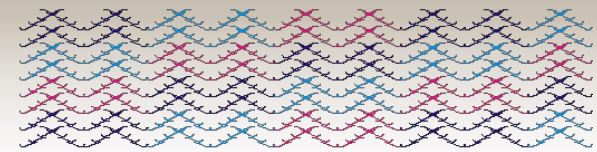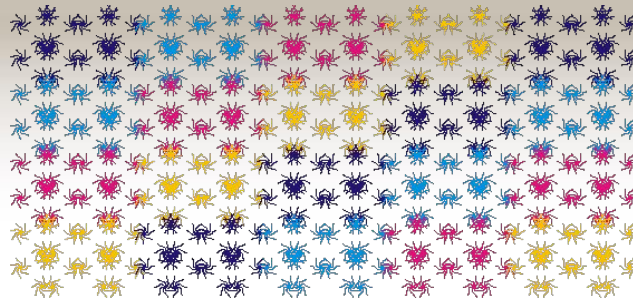**An example of a formalized description of mesh ornaments**

$$[M1 \rightarrow a_{42,0,3} \rightarrow a_{0,42,2}] \cup [(M2 \rightarrow a_{42,0,3} \rightarrow a_{0,42,2}) \rightarrow b_{21,21}]$$
$$i = R(M1) - 1 = 42$$

Automatic synthesis of vector symmetrical patterns

Research products and technology № 2

Title	The definition of optimum parameters of offset printing technological process in the basis of a method of the ink balance
Description	The integrated estimation of technological parameters for the offset printing process using the theoretical method of paint balance and the fractal model of paint transfer in offset allows to simulate the process of ink transfer, to give a preliminary analysis of the surfaces of the printed contact and to reduce the period of adjustment of the printing machine. This approach allows one to take into account the influence of the microstructure of the printing plates, the blanket and the surface to be printed on the amount of ink transferred

Research products and technology № 2

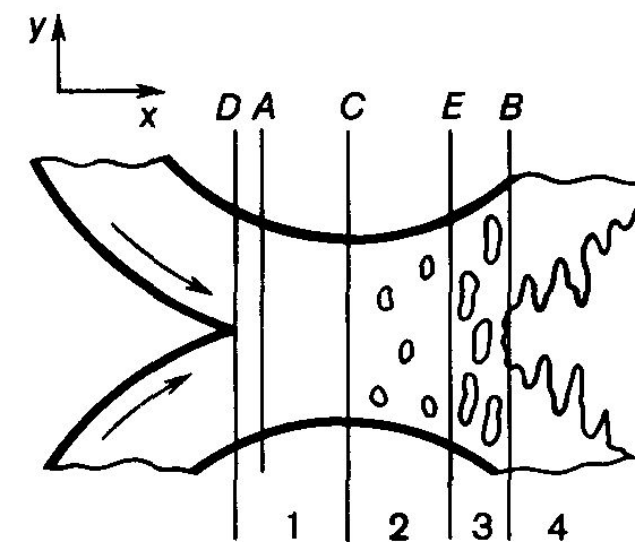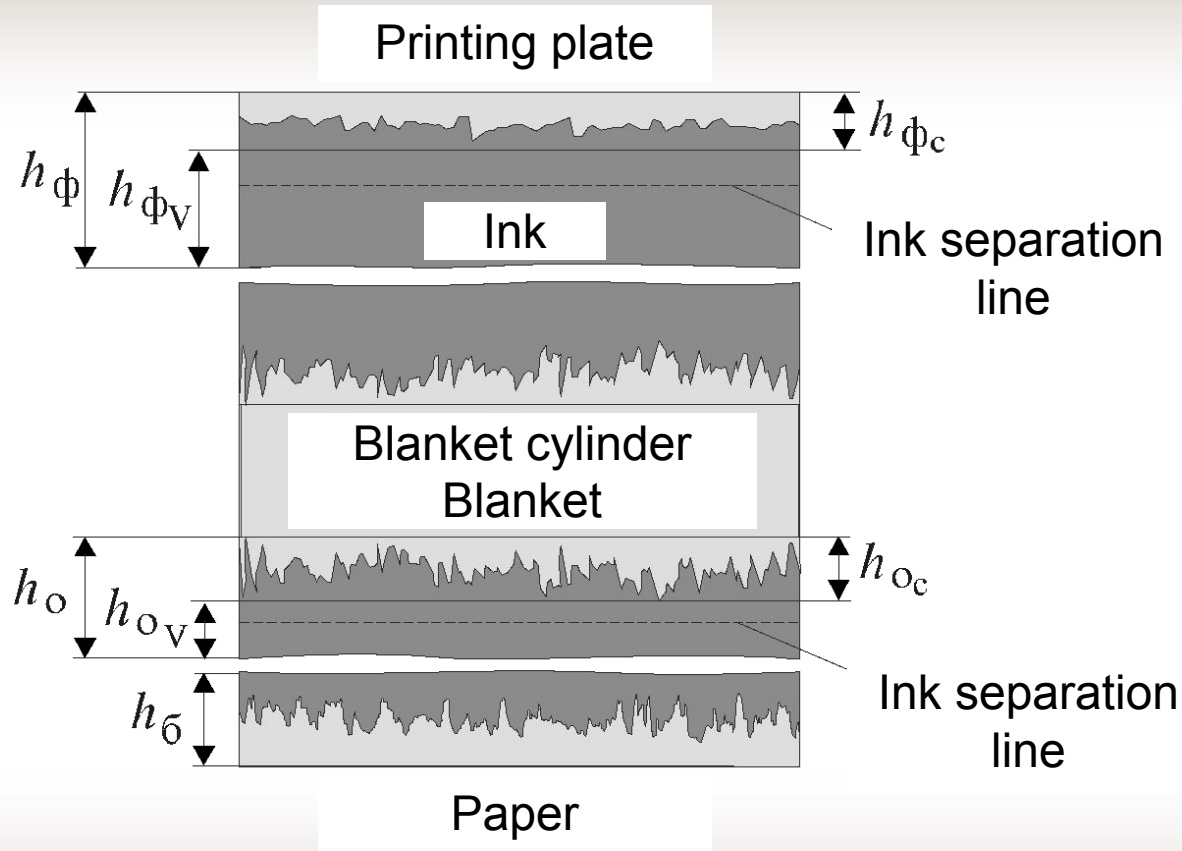|	
Advantages	**The proposed development allows improving the quality of printed materials, reducing labor input and material consumption of offset printing technology**
Application areas	**Improving the technology of printing processes, researching the interaction of paper, ink, blanket and printing plate in the printing process**
Technology readiness level	**The results are presented in 2 monographs, 10 articles, 3 patents of the Republic of Belarus, 1 thesis**
Cost effectiveness	**The paper consumption will decrease by 90.0% in the debugging operations, the paint consumption will decrease by 55.5%, the time expenditure will decrease by 42.6%**

Research products and technology № 2

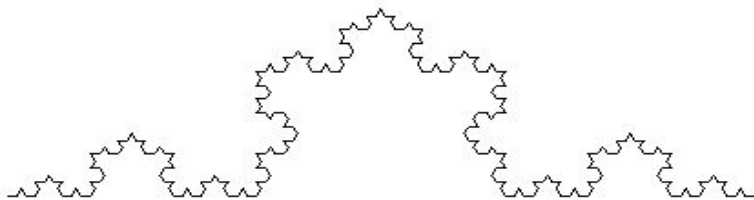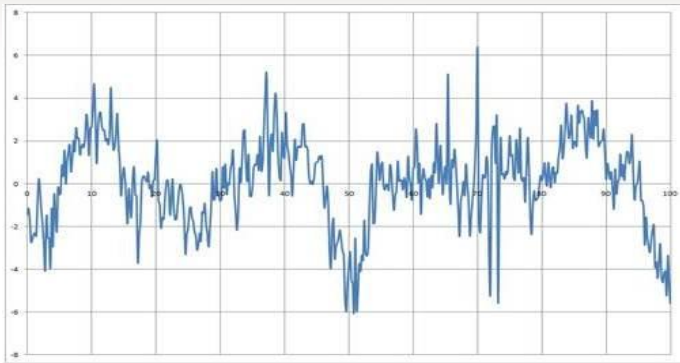| Cooperation proposals	The results of the research can be used to develop scientifically grounded solutions for improving the technology of printing processes, investigating the manifestations of fractal features of the interaction of paper, paint, blanket and printing form in the printing process
Contacts	Medyak Diana Department of Polygraphic Production. Minsk, Sverdlov Str. 13a Tel. +375 17 327 26 88 E-mail: medyak@belstu.by

Modeling of the paint transfer
In offset printing

Investigation of the printed contact mechanics

Printing plate

$h_{\phi c}$

Ink

Ink separation line

h_{ϕ} | $h_{\phi V}$

Blanket cylinder
Blanket

$h_{O c}$

h_{O} | $h_{O V}$

h_{δ}

Ink separation line

Paper

Research of polygraphic materials properties

The influence of structural heterogeneity of paper on its behavior in the printing process

Research products and technology № 3

Title	Information quality assessment of printed products.
Description	Information assessment of the quality of the reproduction of impressions in different ways printing. The evaluation is based on the information approach, which allows to analyze the completeness of the information transmission when the input parameters of the printing process that provides an opportunity to identify real possibilities when getting prints. This approach also allows to consider the influence of the microstructure of the printed surface on the magnitude of the information capacity of prints.

# Research products and technology № 3

Advantages	Allows to determine the limits of information capacity for specified printing process, and to determine the loss of information when reproducing prints of different printing methods.
Application areas	In assessing the quality of printed products, and also for protection of printed products against falsification.
Technology readiness level	The results are presented in 15 articles.

Research products and technology № 3

| Cooperation proposals	The developed approach can be used when studying the quality of printed products, as well as to protect the printed products from falsification while playing it unoriginal way.
Contacts	Gromyko Iryna Department of "Printing Production". Minsk, Sverdlov Str. 13a. Tel. +375 17 327 26 88, e-mail: gromyko@belstu.by

Quality assessment of printed products

Graded assessment of the quality of reproduction of fine originals
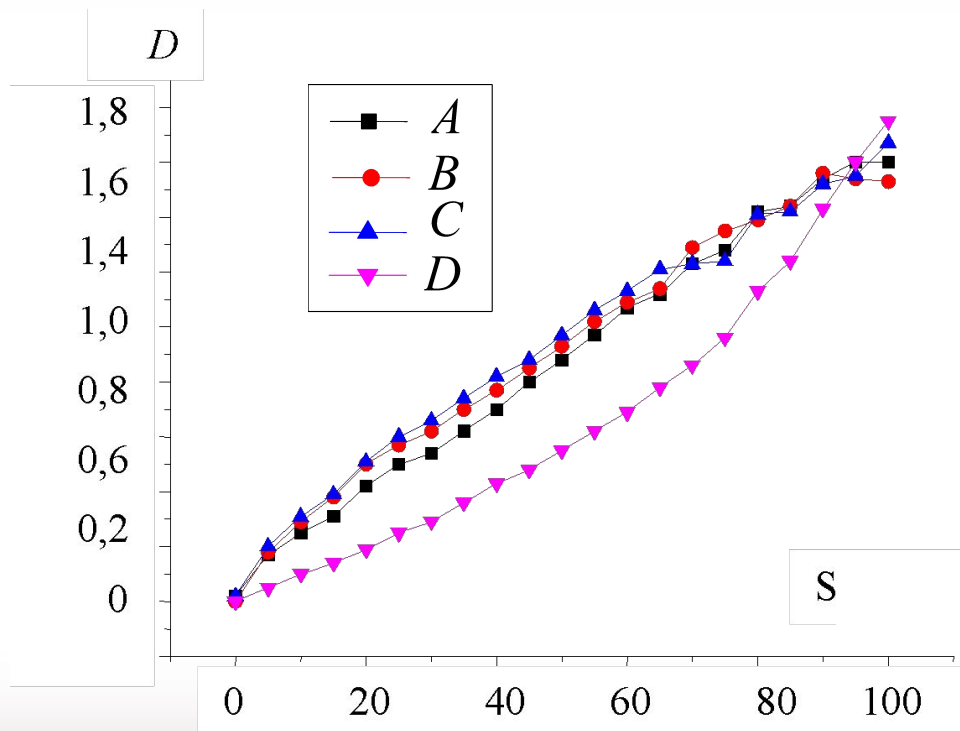
A — scan resolution 150 dpi;
B — scan resolution 300 dpi;
C — scan resolution 600 dpi;
D — digital original

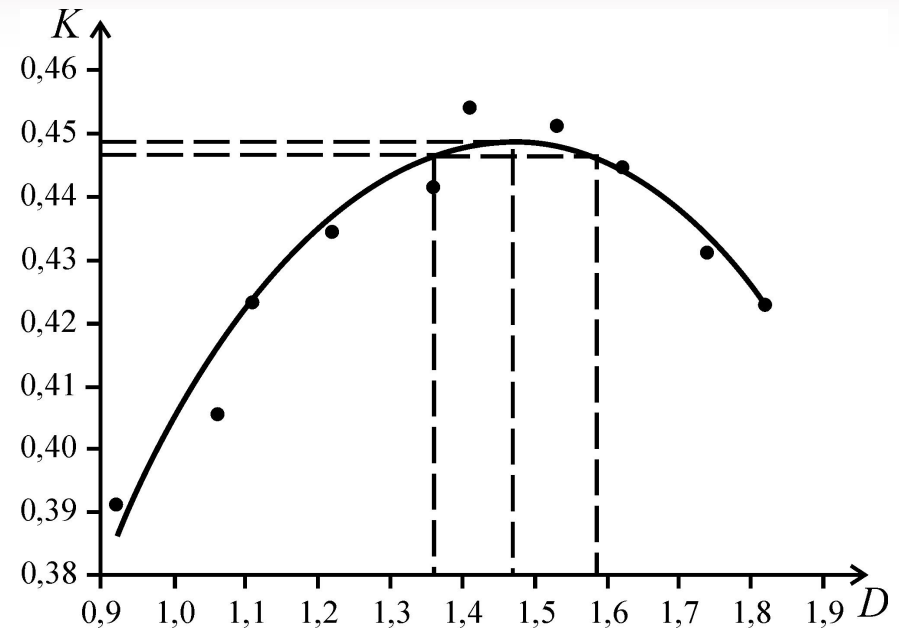# Quality assessment of printed products

The effect of anisotropy of the structure of the paper relative print contrast

The dependence of the relative print contrast the optical density
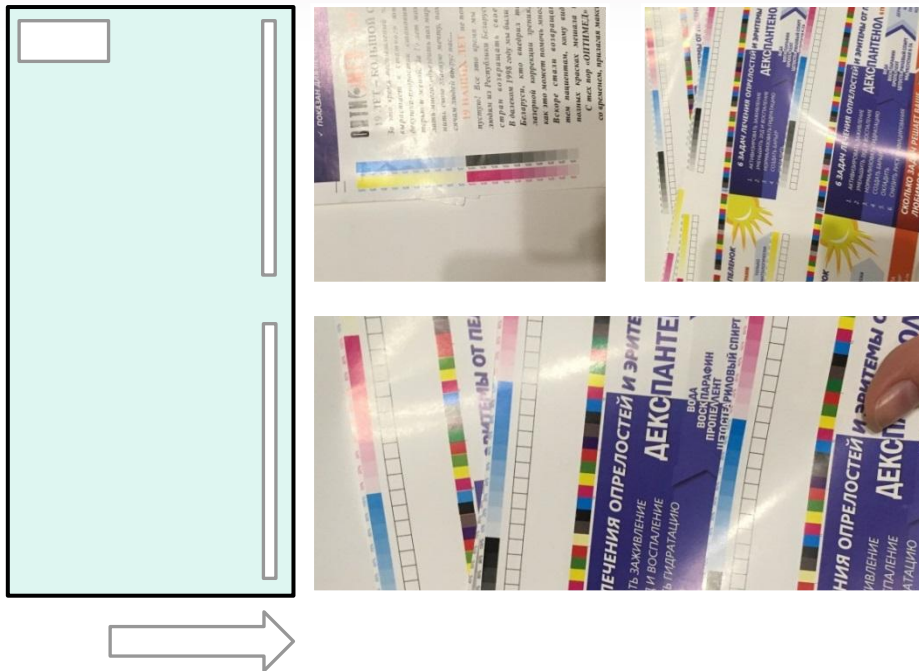
The indicators of the quality of the prints in different directions

Information quality assessment of printed products

Definition of losses of the information capacity of prints in the printing process of the circulation
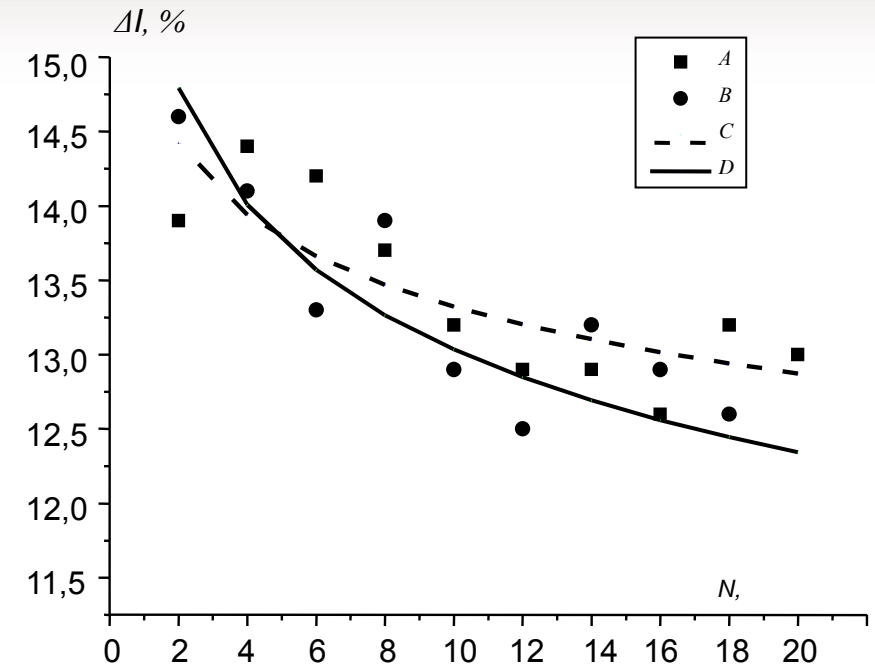
A — experimental data sheet print; B — experimental data for roll printing;
C — the approximating function for sheet printing;
D — the approximating function for roll printing

Research products and technology № 4

Title	Optimization of organizational planning in production
Description	The system of organizational management in publishing and printing complex of Belarus, the printing industry and at its enterprises is probed. Algorithms and a complex of programs for simulation modeling on a computer of different types of structures of control are developed. Influence of the main indices and a type of an organization structure on efficiency of functioning of management system in the printing industry is probed.

Research products and technology № 4

| Advantages	Development of a scientifically based approach to improving the organizational management of the Belarusian printing industry.
Application areas	The results of the research can be used to develop scientifically sound solutions in the field of restructuring and reorganizing schemes and apparatus for managing printing industry enterprises, improving planning and comprehensive assessment of the directions of the development of the printing industry.
Technology readiness level	The results are presented in a monograph, 10 scientific articles, 20 conference materials, dissertation

Research products and technology № 4

| Cooperation proposals	Development of proposals for improving organizational management schemes at enterprises aimed at increasing the effectiveness and efficiency of management, as well as the economic efficiency of their operation.
Contacts	Trusevich N.E. Department of "Printing Production". Minsk, Sverdlov Str. 13a. Tel. +375 17 327 26 88, e-mail: trusevich@belstu.by

Analysis of management structures

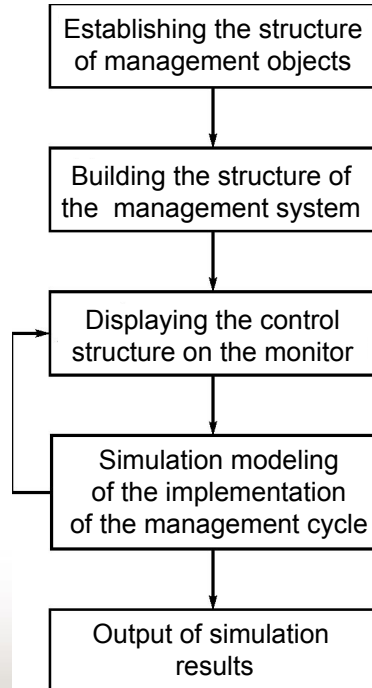## Phase diagram of the management cycle

X — cost , Y — effectiveness
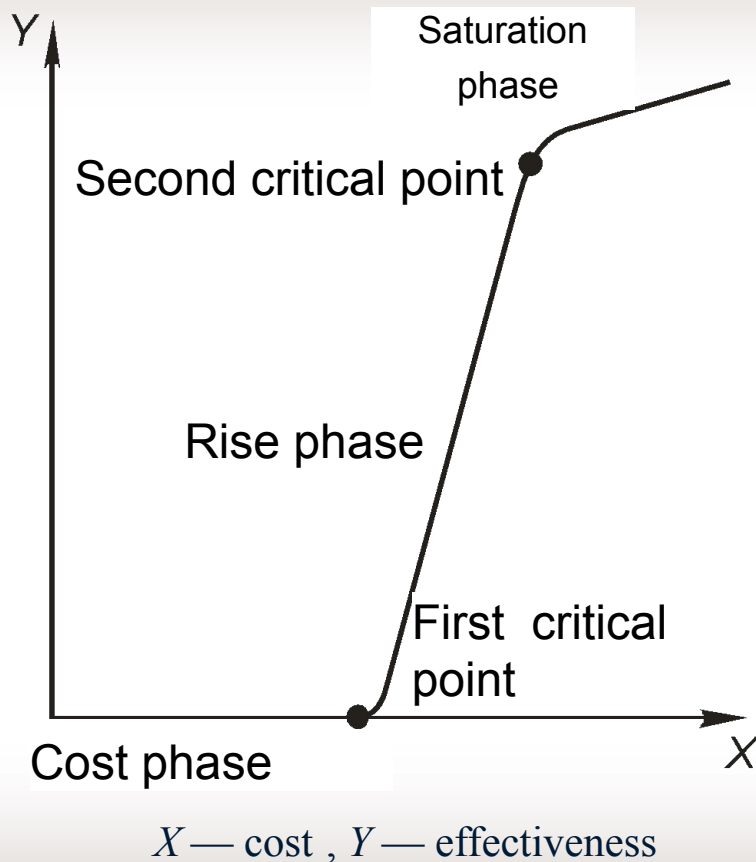
Phase diagram for a linear scheme
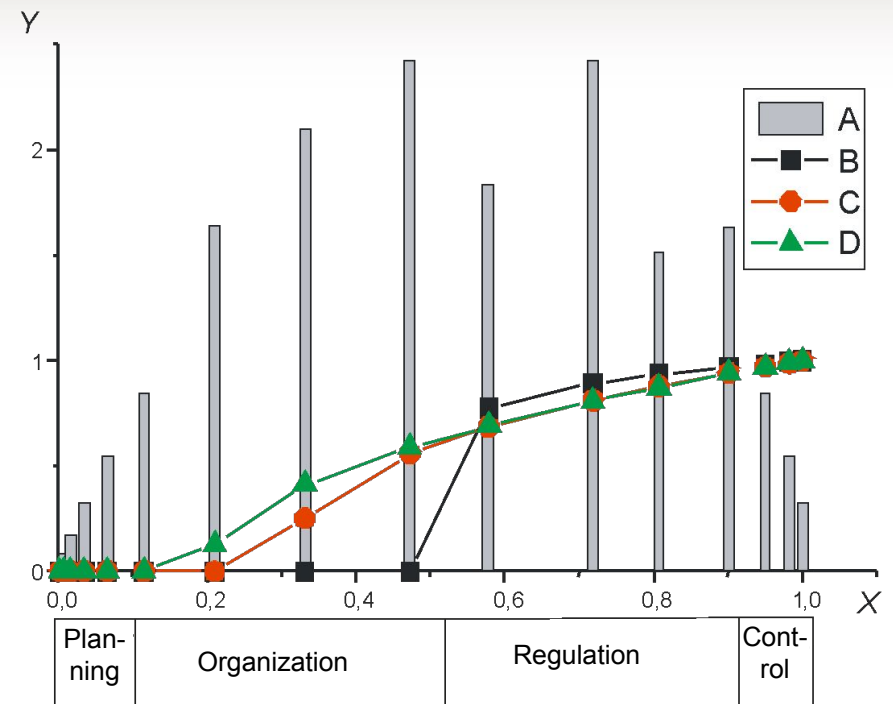
A — operations of the management cycle ;
B — diagram for problems with dimension d = 2;
C — d = 3; D — d = 4

Optimization of organizational planning in production

Schematic diagram of an algorithm of simulation modeling of systems of organizational control
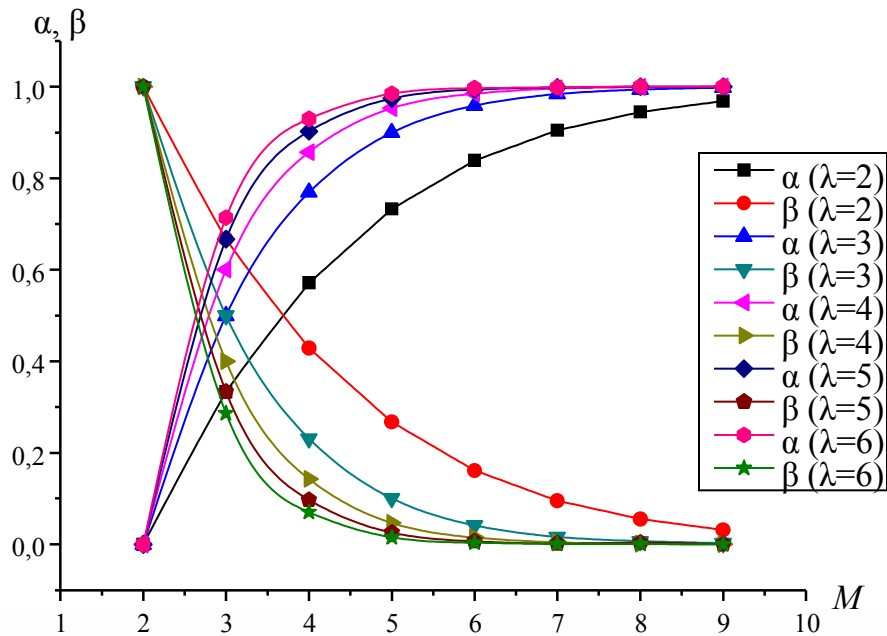
Scheme of a five-level linear structure under the norm of controllability $\lambda = 2$
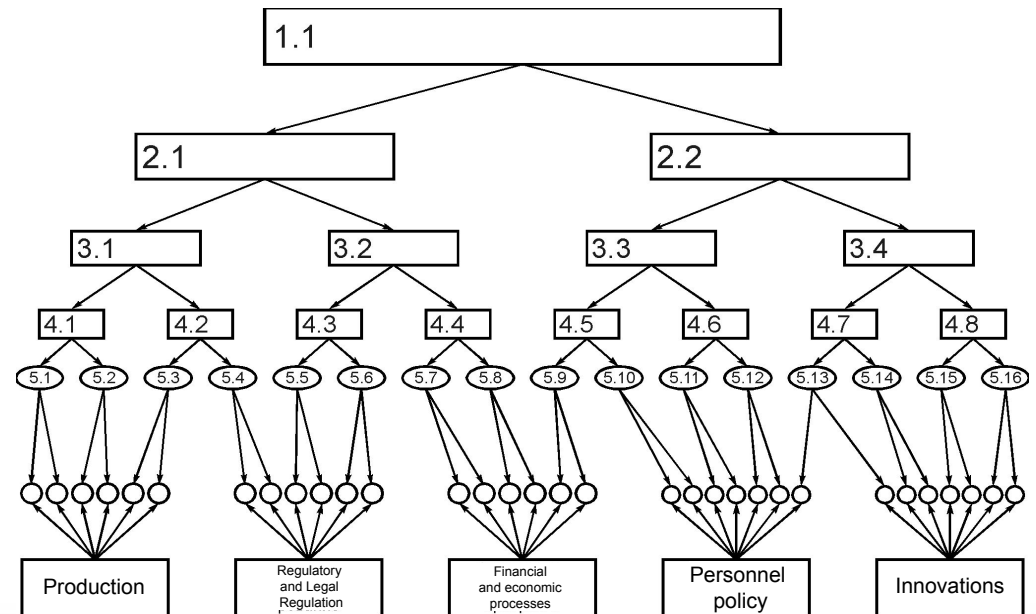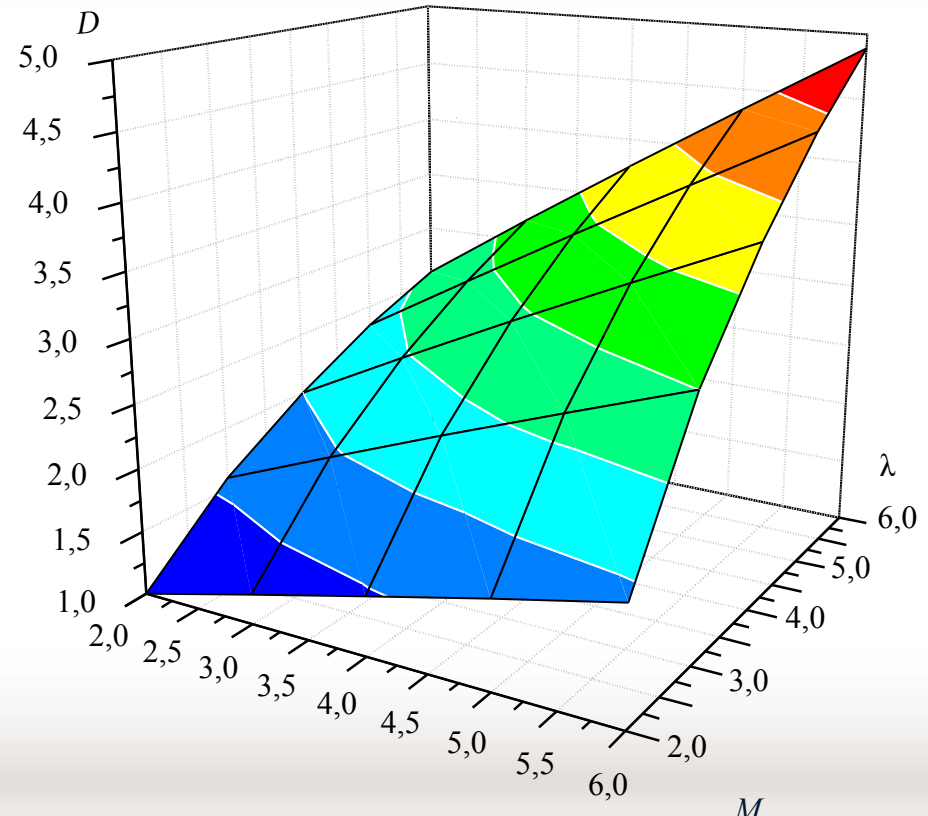
Assessment of level of systemacity of organization structures

Dependences of the conjugate coefficients (α and β)
(α and β) on the number of levels in the control system (M)

Dependence of the fractal dimension of linear organizational structures on the number of levels and the norm of controllability

Research products and technology № 5

| Title	Study of the efficiency of enterprises management structure in terms of organizational conflicts
Description	The methodology of simulation modeling of organizational conflicts is developed. A system of models for describing various types of positional conflicts is constructed. The estimation with the help of the constructed models of the influence of conflicts on the effectiveness of the management cycle in various organizational structures was performed. Methods of strategic planning have been developed taking into account the influence of positional conflicts. Formation of an active, purposeful communication of theory and practice of management.

Research products and technology № 5

Advantages	**The development of this approach will allow to create an active purposeful communication of the theory and practice of management.**
Application areas	**The development of this approach will make it possible to form an active, purposeful connection between management theory and practice.**
Technology readiness level	**The results are presented in 10 scientific articles, 2 conference materials**

Research products and technology № 5

| Cooperation proposals	Conduct a diagnosis of a particular type of conflict. Study of the psychological climate in the collectives and its influence on production. Development of practical recommendations for the prevention of organizational conflicts.
Contacts	Trusevich N. E. Department of "Printing Production". Minsk, Sverdlov Str. 13a. Tel. +375 17 327 26 88, e-mail: trusevich@belstu.by

Study of the effectiveness of the functioning of management structures

Types of interpersonal elationships

Dependence of a decrease in employee productivity on the level of cooperation in interpersonal relations
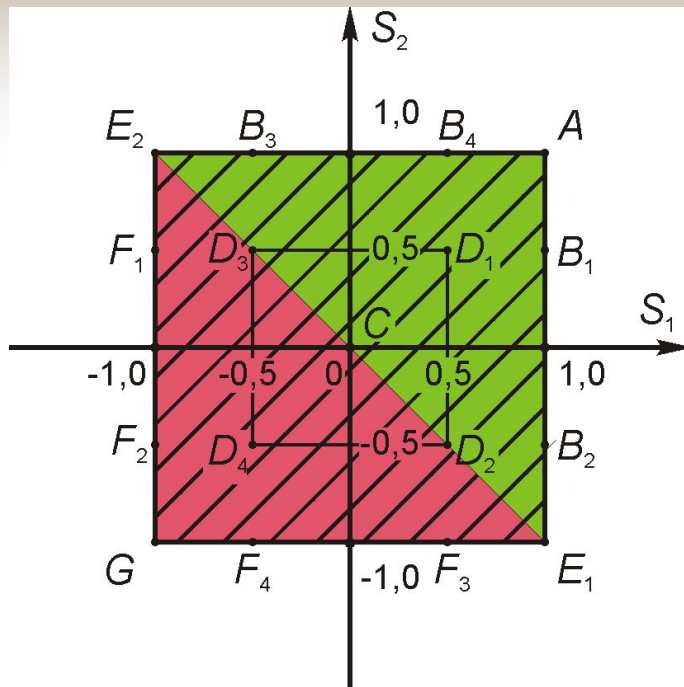
A — Mutually-positive; B_i — One-sidedly contradictory-positive; C — Indifferent; D_i — Mutually contradictory; E_j — One-sided positive-negative; F_i — One-sidedly contradictory-negative; G — Mutually-negative; $i = 1, \ldots, 4; j = 1, 2$


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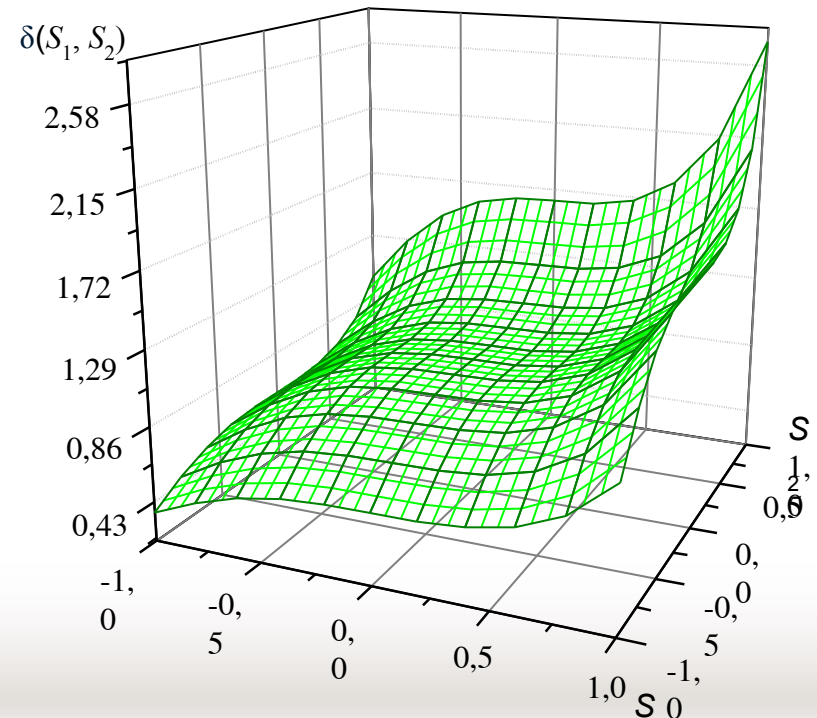
Contradictions and organizational conflicts in enterprises

Comparison of the share of contradictions and conflicts in their total sum
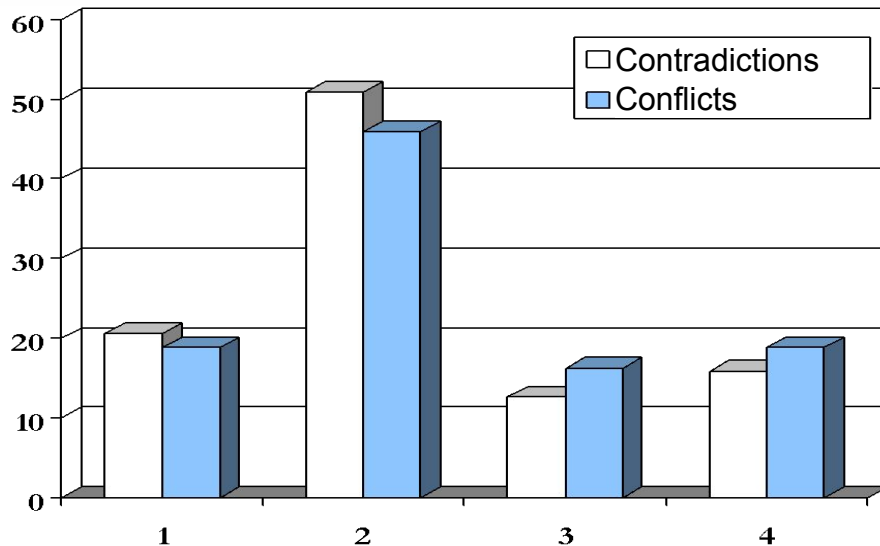
1 — intrapersonal contradictions / conflicts
2 — interpersonal contradictions / conflicts
3 — contradictions / conflicts personality - group
4 — intergroup contradictions / conflicts

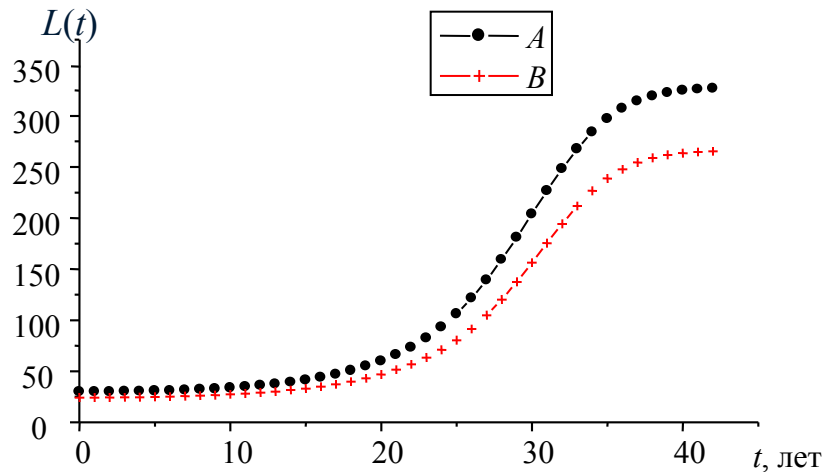## Comparison of the proportion of interpersonal contradictions and conflicts in their total amount
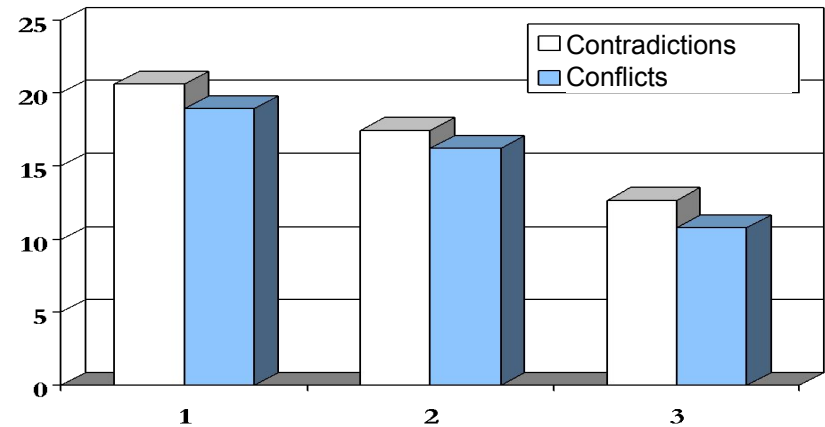
1 — one-level contradictions / conflicts
2 — contradictions / conflicts with the higher level
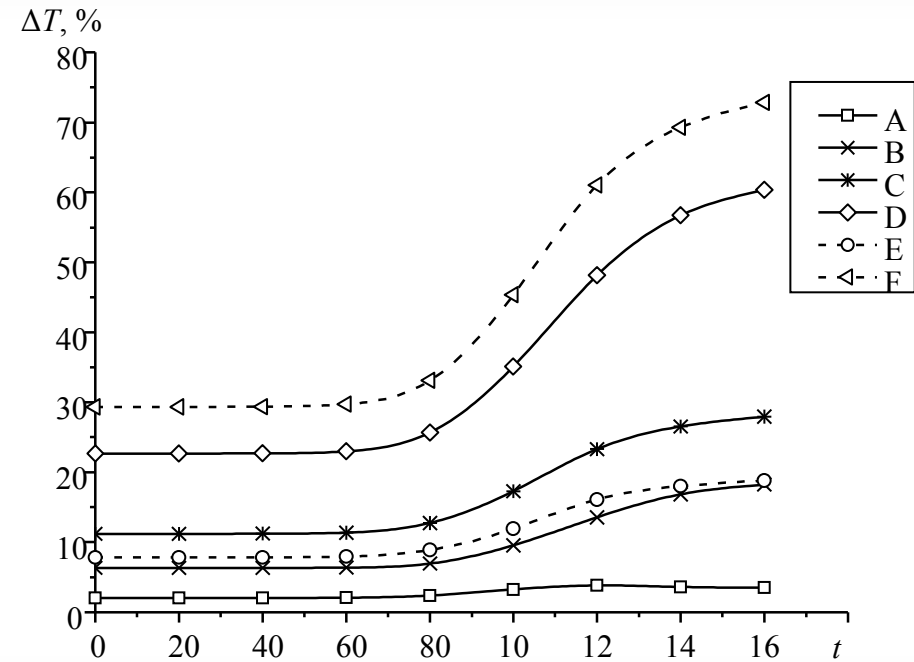3 — contradictions / conflicts with the lower level

Simulation modeling of organizational conflicts

Life cycle in case of development of career of employees

A — according to the optimal plan;
B — according to the slowed-down schedule

Change in the time of solving the managerial task when involving in interpersonal conflict

$A — m(5) = 5; B — m(5) = 4; C — m(5) = 3;$
$D — m(5) = 2; E — m(3) = 3; F — m(3) = 2$

DEPARTMENT OF PRINTING PRODUCTION

Cooperation proposals