

Mikhail Goubko

Doctor of Science in Mathematics and Physics

Contacts:

Department: Lab 57 (of Active Systems),
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Google Scholar profile: [click here](#)



Residence: Moscow, Russia

Vita: Click [here](#) to download my vita.

Personal information:

Born October 26 1977 in Chelyabinsk, USSR.

Married to Svetlana Puzyreva.

Children:

daughter Anastasia (born 2008).

daughter Tatiana (born 2014).

Education:

- Dr. Sci. (equivalent to Habilitation degree) in Mathematics and Physics from [Trapeznikov Institute of Control Sciences of RAS](#), 2014 (Systems Analysis, Control, and Communication). The thesis title: "Mathematical models and methods for hierarchical structure optimization in information systems" (see [the manuscript in Russian](#)).
- Cand. Sci. (equivalent to PhD) in Engineering from [Trapeznikov Institute of Control Sciences of RAS](#), 2003 (Control in Social and Economic Systems). The thesis title: "Coalition-proof mechanism design in organizations" (see [the book in Russian](#)).
- MS in Applied Mathematics and Physics from the [Moscow Institute of Physics and Technology](#) (Dept. of Radio-Engineering and Cybernetics), 2000. The thesis title: "Coalition-proof mechanisms of resource allocation in organizations".
- BS in Applied Mathematics and Physics from the [Moscow Institute of Physics and Technology](#) (Dept. of Radio-Engineering and Cybernetics), 1998. The thesis title: "Moral hazard for the "simple" agent".

Areas of interest:

Mathematical methods of complex systems' structure optimization and their application anywhere: from computer science and chemistry to management and logistics.

Popular digest of the research

Are there common laws in formation of an organic molecule, structuring an organization, or growing a decision tree? Mathematics gives the positive answer!

A system is a collection of elements connected with links, which form the *structure* of the system. Rational structures of natural systems are the result of survival, while the optimal structure of an artificial system must be planned at the design time. Systems science allows catching common properties of very diverse problems in the range from

communication network design to business processes enhancement, while combinatorial optimization provides the toolkit of universal solution methods. The clue is the property of *locality* often met in real life. If the degree of optimality of each element of a structure depends only on how the system is structured in the neighborhood of this element, then the structure can be considered as a chain of braced rings, and the optimal structure design reduces to sequential selection of optimal elements (“rings”) and their optimal connection (but do not forget to care for the desired size and the style of a “chain armor” being sewed!)

In the classic Huffman algorithm lying in the core of most archiving utilities an optimal coding tree is built in a bottom-up fashion by sequentially joining the roots of two branches of minimum “weight” under a single node. It can be surprising to get know that organic molecules with the lowest boiling temperature follow the similar formation rule. The same formula is used to calculate both the optimal user menu breadth (the number of options simultaneously available to a user on a screen of his or her iPhone for the most convenient navigation), and the optimal span of control (the number of immediate subordinates) in an efficient organization structure.

Many other general laws in complex structure design are revealed during the ongoing long-term fundamental research program. The developed algorithms, routines, and analytical techniques find their application in technology and management.

Full-time appointments:

2014-..., Trapeznikov Institute of Control Sciences of RAS, Lab 57, Leading researcher
2004-2014, Trapeznikov Institute of Control Sciences of RAS, Lab 57, Senior researcher

2000-2004, Trapeznikov Institute of Control Sciences of RAS, Lab 57, Researcher

Courses taught:

2000-2006 “Game theory” module in “Control in Organization” course for graduate students of the Moscow Institute of Physics and Technology (see the course book in Russian)

2003-2006 “Decision-making under fuzzy information” module in “Control in Organization” course for graduate students of the Moscow Institute of Physics and Technology (see the lectures notes in Russian)

2011 “Business Process Management Systems” module in “Operational management” course for graduate students of the Moscow University of Management

2013-... “Discrete Optimization Problems of Project Management” course for graduate students of the Moscow Institute of Physics and Technology

Editorial positions:

Large-Scale Systems Control (2008-2014 executive editor, 2015-... deputy editor-in-chief)

Automation and Remote Control (2015-...)

Zavodskaya Laboratoriya: diagnostika materialov, <http://zldm.ru>

Conferences organization:

XXVI EURO-INFORMS European Conference on Operational Research, Rome (2013), stream organizer

IV International Conference “Game Theory and Management”, St Petersburg (2010), section chair

International Conference “Large-Scale Systems Control”, Moscow (2009), program committee

III All-Russian Young Scientists Conference on Control Problems, Moscow (2008),

program committee

Innovations Management International Conference, Moscow (2006, 2010), program committee

International Conference "Theory of Active Systems", Moscow (2005, 2011, 2014), program committee

Scientific Conference of Moscow Institute of Physics and Technology, Moscow (2005, 2006), section chair

Plenary talks:

International Conference "Theory of Active Systems", Moscow (2011), Moscow, Russia, "Applications of the theory of hierarchy optimization" ([slides in Russian](#))

International Conference "Management in Large-Scale Systems" (MLSD'2013), Moscow, Russia, "Structure Design in Complex Systems: Optimization and Game theory" ([the abstract in Russian](#))

International Conference "Theory of Active Systems", Moscow, Russia (2014), "Optimizing structure of active systems"

XXXVII session of "Cybernetics of Power Systems" seminar, Novocheerkassk, Russia (2015), "Control problems in Power Grids"

Other activities:

Content manager of "The Theory of Control in Organizations" Internet site: <http://www.mtas.ru>

Manager of [TheMenuDesigner](#) project (the prototype of the automated tool for hierarchical menus design)

Research grants and awards:

2013-2015, Russian Foundation for Basic Research, the head, "Control Mechanisms for Network-shaped Systems"

2013-2015, Russian Foundation for Basic Research, the executor, "Models and Methods of Hierarchical Structure Optimization in Complex Systems"

2012, B.L.Ovsievich Memorial Prize, 3rd grade

2010-2012, Russian Foundation for Basic Research, the head, "Control Mechanisms for Network-shaped Organizations"

2010-2012, Russian Foundation for Basic Research, the executor, "Optimization Models of Multi-Level Organizations"

2007-2009, Russian Foundation for Basic Research, the executor, "Mathematical models and methods of optimal hierarchical structures search"

2006-2007 Academician Nikolai Fedorenko International Scientific Foundation of Economic Research, "Optimal organizational hierarchies"

Other skills:

Rich experience (since 1998) of Oracle business applications (OEBS, OFA, Hyperion, etc) implementation projects for Russian oil and gas industry (Consultant, Group Leader, Functional Architect, and Project Manager).

Hobby:

Alpine Skiing, winner of ICS RAS championship (2008, 2009, 2011).

Papers in peer-reviewed journals (as of Oct 2015):

In English:

[Minimizing Wiener Index for Vertex-Weighted Trees with Given Weight and Degree Sequences](#), MATCH Commun. Math. Comput. Chem., 2016, V. 75, No 1, P. 3-27.

(with O. Miloserdov) Simple Alcohols with the Lowest Normal Boiling Point Using Topological Indices, MATCH Commun. Math. Comput. Chem. 2016, V. 75, No 1 P. 29-56.

(with C. Magnant, P. Salehi Nowbandegani, I. Gutman) ABC Index of Trees with Fixed Number of Leaves, MATCH Commun. Math. Comput. Chem., V. 74, No 3. P. 697-701.

(with T. Reti) Note on Minimizing Degree-Based Topological Indices of Trees with Given Number of Pendent Vertices // MATCH Commun. Math. Comput. Chem. 2014. V. 72, No 3. pp. 633-639.

(with I. O. Volkova, E. A. Salnikova) Active consumer: Optimization problems of power consumption and self-generation // Automation and Remote Control, 2014, Volume 75, Issue 3. P. 551-562. (translation from Russian)

(with I. Gutman) Degree-based topological indices: Optimal trees with given number of pendants // Applied Mathematics and Computation. V. 240, 1 August 2014, P. 387–398.

Minimizing Degree-Based Topological Indices for Trees with Given Number of Pendent Vertices // MATCH Commun. Math. Comput. Chem. 2014. V. 71, No 1. P. 33-46.

(with A.I. Danilenko) Semantic-aware optimization of user interface menus // Automation and Remote Control, August 2013, Volume 74, Issue 8, pp 1399-1411 (translation from Russian).

(with V.N. Burkov, N.A. Korgin, and D.A. Novikov) Integrated Mechanisms of Organizational Behavior Control // Advances in Systems Science and Application. 2013. Vol. 13. № 2. P. 1 – 9.

(with V.N. Burkov, N.A. Korgin, and D.A. Novikov) Mechanisms of Organizational Behavior Control: A Survey // Advances in Systems Science and Application. 2013. Vol. 13. № 1. P. 1 – 13.

Optimal hierarchies of control for cost functions presentable as sum of homogenous functions / Automation and Remote Control. V. 71, No. 9, 2010. pp 1913-1926. (translation from Russian)

Algorithms to Construct Suboptimal Organization Hierarchies // Automation and Remote Control. V. 70, No 1, pp 147-162, 2009. (translation from Russian)

Mathematical Models of Formation of Rational Organizational Hierarchies // Automation and Remote Control. V. 69, No 9, pp 1552-1575, 2008. (translation from Russian)

The Search for Optimal Organizational Hierarchies with Homogeneous Manager Cost Functions // Automation and Remote Control. V. 69, No 1, pp 89-104, 2008. (translation from Russian)

Control of Organizational Systems with Network Interaction of Agents. II. Stimulation Problems // Automation and Remote Control. V. 65, No 9, pp 1470-1485, 2004. (translation from Russian)

Control of Organizational Systems with Network Interaction of Agents. I. A Review of Network Game Theory // Automation and Remote Control. V. 65, No 8, pp 1276-1291, 2004. (translation from Russian)

Structure of the Optimal Organization of a Continuum of Executives // Automation and Remote Control. V. 63, No 12, pp 1966-1979, 2002. (translation from Russian)

(with Karavaev A. P.) Coordination of Interests in the Matrix Control Structures // Automation and Remote Control. V. 62, No 10, pp 1658-1672, 2001. (translation from Russian)

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In Russian:

(с И.О. Волковой, Е.А. Сальниковой) Активный потребитель: задача оптимизации потребления электроэнергии и собственной генерации // Проблемы управления. 2013. №6. С. 53-61.

(совместно с А.И. Даниленко) Оптимизация пользовательских меню с учётом семантического качества // Проблемы управления. 2012. № 2. С. 53-63.

(совместно с В.Н. Бурковым, Н.А. Коргиным, Д.А. Новиковым) Теория управления организационными системами и другие науки об управлении организациями // Проблемы управления. 2012. № 4. С. 2-10.

(совместно с В.Н. Бондариком, С.И. Ивановой) Математическая модель оптимизации организационных структур стратегического развития // Экономика и менеджмент систем управления 3.1(5), 2012, С. 110-131.

(совместно с Н.В. Константиновой) Многоканальные организационные структуры и внедрение информационных систем управления // Системы управления и информационные технологии, №1(47), 2012. – С. 50-55.

(совместно с Н. А. Коргиным, Д. А.Новиковым) Управление организационными системами: современные научные направления. // Проблемы теории и практики управления. № 12. 2011. С. 62-71.

(совместно с Даниленко А.И.) Математическая модель оптимизации структуры иерархического меню. Проблемы управления. № 4, 2010. С. 49-58.

Оптимальные иерархии управления для функций затрат, представимых в виде суммы однородных функций // Проблемы управления, 2009. №3. С. 44-53.

Алгоритмы построения субоптимальных организационных иерархий / Автоматика и телемеханика. 2009. №1. С. 162-179.

Математические модели формирования рациональных организационных иерархий // Автоматика и телемеханика, №9, 2008. С. 114-139.

Поиск оптимальных организационных иерархий при однородных функциях затрат менеджеров // Автоматика и телемеханика, №1, 2008. С. 97-113.

(совместно с Баскаковым А.С., Семеновым П.И.) Модель выбора оптимальной древовидной иерархии // Системы управления и информационные технологии, №1.1(23), 2006. С. 20-22.

Управление организационными системами с сетевым взаимодействием агентов. Часть 2. Задачи стимулирования. // Автоматика и телемеханика. №9. 2004. С. 131-148.

Управление организационными системами с сетевым взаимодействием агентов. Часть 1. Обзор теории сетевых игр. // Автоматика и телемеханика. №8. 2004. С. 115-132.

Модель формирования бизнес-схем в транснациональных корпорациях // Системы управления и информационные технологии, 2003, 1-2(12), С. 44-48.

Структура оптимальной организации континуума исполнителей // Автоматика и телемеханика. 2002. № 12. С. 116 – 130.

(с Караваевым А.П.) Согласование интересов в матричных структурах управления // Автоматика и телемеханика. №10. 2001.

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Books and chapters (as of Oct 2015):

In English:

A co-author in "Burkov V., Goubko M., Korgin N., Novikov D. Introduction to Theory of Control in Organizations. - Boca Raton: CRC Press, 2015."

A co-author in "Burkov V., Goubko M., Kondrat'ev V., Korgin N., Novikov D. Mechanism Design and Management: Mathematical Methods for Smart Organizations (for managers, academics and students). - New York: Nova Publishers, 2013. (Print and e-book)" - the translation of "Бурков В.Н. и др. Механизмы управления. М.: Ленанд.2011."

In Russian:

Губко М.В. Модели и методы оптимизации иерархической структуры систем обработки информации. Дисс. на соискание степени д.ф.-м.н. - М: ИПУ РАН, 2014. - 370 с.

A chapter (together with Sergei Mishin) in "Бурков. В.Н., Коргин Н.А., Новиков Д.А. Введение в теорию управления организационными системами: Учебник / Под ред. Д.А. Новикова. - М.: Книжный дом "ЛИБРОКОМ", 2009."

Воронин А.А., Губко М.В., Мишин С.П., Новиков Д.А. Математические модели организаций: учебное пособие. -М.: ЛЕНАНД, 2008.

Математические модели оптимизации иерархических структур. - М.: ЛЕНАНД, 2006.

Управление организационными системами с коалиционным взаимодействием участников. М.: ИПУ РАН, 2003.

Губко М.В., Новиков Д.А. Теория игр в управлении организационными системами. М.: Синтег, 2002.

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Selected proceedings and abstracts (as of Oct 2015):

In English:

(with A. Varnavsky) What Do Users Really Like in Menus: Building Menu Optimization Criterion, CHI 2015 Workshop on Principles, Techniques and Perspectives on Optimization and HCI

Hierarchy optimization: theory and applications / Extended Abstracts of International Workshop "Networking games and management" (NGM-2012, Petrozavodsk). Petrozavodsk: KarRC, 2012. С. 20-22.

Model of supply network formation management / Collected abstracts of papers presented on the Sixth International Conference Game theory and Management. SPb.: Graduate School of Management SPbU. 2012. P. 91-92.

Heuristic algorithm for optimal tree search / Abstracts of the 25th Conference of European Chapter of Combinatorial Optimization (ECCO'2012). 26-69 April 2012. P. 24-25.

Lower-bound Estimate for Cost-sensitive Decision Trees // Preprints of the 18th IFAC World Congress, Milano (Italy), August 28 - September 2, 2011. P. 9005-9010.

(with Burkov V.N.) Combining Incentive Schemes with Mechanisms of Counter Planning and Plan Adjustment // Game theory and Management. Collected abstracts of papers presented on the Fifth International Conference Game theory and Management. SPb.: Graduate School of Management SPbU, 2011. P. 40-42.

(with Danilenko A. I.) An automated routine for menu structure optimization // Proceedings of the 2nd ACM SIGCHI symposium on Engineering interactive computing systems, Berlin, Germany, June 19-23, 2010. p. 67-76. (acceptance rate 29%)

Models of Network Formation Game Control // Game Theory and Management. Collected abstracts of papers, presented in the IV International Conference "Game Theory and Management", Gradual School of Management, SPbU, 2010. pp. 64-67.

(with Novikov D.) Game-theoretical Models and Methods of the Organizational Systems Control Theory // Game Theory and Management. Collected abstracts of papers, presented in the International Conference "Game Theory and Management", Gradual School of Management, SPbU, 2008.

(with Mishin S.) Optimal Hierarchies in Firms: a Theoretical Model // Proceedings of the 17th World Congress of the IFAC, Seoul, Korea, July 6-11, 2008. P. 2962-2967.

(with Mishin S.) Models of Optimal Organizational Hierarchies // Game Theory and Management. Collected abstracts of papers, presented in the International Conference "Game Theory and Management", Gradual School of Management, SPbU, 2008. p.132-134.

(with Novikov D.A.) Magement in organizations: collective decision-making / Proceedings of the 16-th International Conference on Systems Engineering, Coventry, 2004. Vol. 2, P. 515 – 519.

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In Russian:

Губко М.В. Спектральные нижние оценки затрат связывающей сети // Труды XII Всероссийского совещания по проблемам управления (ВСПУ-2014), Москва, 16-19 июня 2014 г. С. 1959-1970.

Интерактивные системы оптимизации иерархических структур // Управление большими системами. Материалы VII Всероссийской школы-конференции молодых ученых. Том 2. Пермь: Издательство ПГТУ. 2010. С. 236-243.

Формирование бизнес-схем в транснациональных корпорациях / Теория активных систем. Труды международной научно-практической конференции. Том 1. - М.: ИПУ РАН, 2003. С. 26-28

(совместно с Мишиным С.П.) Оптимальная структура системы управления технологическими связями / Материалы международной научной конференции «Современные сложные системы управления». Старый Оскол: СТИ, 2002. С. 50 – 54.

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