



CONTROL SCIENCES

**Научно-технический
журнал**

6 номеров в год

ISSN 1819-3161

УЧРЕДИТЕЛЬ

Институт проблем управления
им. В.А. Трапезникова РАН

Главный редактор

Д.А. Новиков

Заместители главного
редактора

Л.П. Боровских, Ф.Ф. Пащенко

Редактор

Т.А. Гладкова

Выпускающий редактор

Л.В. Петракова

Издатель

ООО «СенСиДат-Контрол»

Адрес редакции
117997, ГСП-7, Москва,
ул. Профсоюзная, д. 65, к. 272.
Тел./факс (495) 334-92-00

E-mail: pu@ipu.ru
www.ipu.ru/period/ru

Оригинал-макет
и электронная версия
подготовлены
ООО «Адвансед Солюшнз»

Отпечатано с готовых диапозитивов
в типографии ГКС

Подписано в печать
5.06.2008 г.

Заказ № РВ408

Журнал зарегистрирован
в Министерстве
Российской Федерации
по делам печати,
телерадиовещания
и средств массовых
коммуникаций

Свидетельство о регистрации
ПИ №77-11963
от 06 марта 2002 г.

Журнал входит в Перечень ведущих
рецензируемых журналов и изданий,
в которых должны быть опубликованы
основные научные результаты
диссертаций на соискание ученой
степени доктора и кандидата наук

Подписные индексы:
80508 и **81708** в каталоге Роспечати
38006 в объединенном каталоге
«Пресса России»

ПРОБЛЕМЫ УПРАВЛЕНИЯ

4.2008

СОДЕРЖАНИЕ

Математические проблемы управления

Клещев А.С. Концепция банка математических знаний для научных исследований. Ч. 1. Метафора	2
Буркова И.В. Метод сетевого программирования в симметричной задаче коммивояжера	7
Агаев Р.П., Никифоров С.В., Андрюшина Н.А. О спектре матрицы смежности орграфа кольцевой структуры и его применении	11
Рыков А.С., Матвиенко М.Ю. Недифференцируемые овражные двумерные тест-функции	16

Анализ и синтез систем управления

Яковенко Г.Н. Управляемые системы, робастные по начальным данным	20
Соколов С.В., Кучеренко П.А. Обобщенные вероятностные критерии в задаче нелинейной параметрической идентификации	24

Управление в социально-экономических системах

Чеботарев П.Ю., Логинов А.К., Щодикова Я.Ю. и др. Анализ феноменов колlettivизма и эгоизма в контексте общественного благосостояния	30
Бурков В.Н., Исаков М.Б., Коргин Н.А. Применение обобщенных медианных схем для построения неманипулируемых механизмов много-критериальной активной экспертизы	38
Кувшинов Б.М., Челядин А.С., Ширяев В.И. Многокритериальная оценка конкурентоспособности и ранжирование экономических субъектов, функционирующих в разнородных условиях при наличии неопределенности	48
Байкин А.А., Иванов Е.Ю., Исаева О.В. Управление выбором производителя с учетом влияния конъюнктурной информации	55

Информационные технологии в управлении

Жевнеров В.А. Метод эволюции параметров в нелинейных сетевых задачах на примере оптимизации распределения входящих потоков нагрузки	65
---	----

Управление технологическими процессами

Кирик Ю.П., Затонский А.В., Беккер В.Ф., Краев С.Л. Идентификация технологических процессов производства губчатого титана.	71
--	----

Системный анализ и обработка данных

Дорофеюк Ю.А. Структурно-классификационные методы анализа и прогнозирования в крупномасштабных системах управления	78
--	----

* * *

Contents and abstracts	84
----------------------------------	----



CONTENTS & ABSTRACTS

A CONCEPT OF A MATHEMATICAL KNOWLEDGE BANK
FOR SCIENTIFIC RESEARCH. P. I. A METAPHOR 2
Kleshev A.S.

Basis on an extendable internal model of mathematical practice and of a model for the analogy between proofs, a concept of a computer support system for scientific research in the field of mathematics and its mechanisms is offered. A system metaphor and the structure of an external model of mathematical practice are presented.

NETWORK PROGRAMMING TECHNIQUE IN THE
SYMMETRIC TRAVELING SALESMAN PROBLEM 7
Burkova I.V.

A dual problem is formulated where the constraints are split into 2 groups with corresponding division of arcs into 2 parts and solution of the resulting 2 evaluation problems. The sum of the objective functions of optimal solutions to the evaluation problems gives the lower bound for the original problem. The solution of the evaluation task is reduced to the design of the shortest i -trees. A new method for building the lower bounds for evaluation problems underlain by the shortest-distance tree design is proposed. The paper shows that the design of i -trees and the shortest-distance tree for the original distance matrix would not deliver an optimal solution to the dual problem.

ON THE SPECTRUM OF A RING-STRUCTURED
DIRECTED GRAPH'S ADJACENCY MATRIX
AND ITS APPLICATION 11
Agaev R.P., Nikiforov S.V., Andryushina N.A.

In the paper, it was investigated that if 2 arcs were removed from ring-structured directed graph with 2 Hamilton circuits, its spectrum would remain real if and only if the number of nodes were even, and the «distance between the arcs» removed from one cyclic path were maximal. The applicability of the results to fault-tolerance estimation of ring topology networks is examined.

NON-DIFFERENTIABLE 2-D RAVINE TEST
FUNCTIONS 16
Rykov A.S., Matvienko M.Yu.

The paper discusses the design of two-dimensional ravine functions for testing optimization techniques. These demonstrate a new type of non-differentiable test-functions featuring the ravines with acute piecewise-linear ravine bottom and piecewise-linear slopes. The algorithm for designing ravine test functions with desirable properties is offered.

CONTROLLABLE SYSTEMS ROBUST WITH RESPECT
TO INITIAL DATA 20
Yakovenko G.N.

A concept of robustness with respect to initial data is proposed: several control impacts transfer a system from a fixed initial state to a same finite state; the same controls transfer the system from any other initial state to a same finite state. A theorem is proved: a controllable system is robust w. r. t. initial conditions if and only if it allows the maximal group of state symmetries. Case studies of various controllable systems robustness investigation are included.

GENERALIZED PROBABILISTIC CRITERIA
IN THE NONLINEAR PARAMETRIC IDENTIFICATION
PROBLEM 24
Sokolov S.V., Kucherenko P.A.

The topicality of investigating new and enhancing the existing methods of nonlinear stochastic parametric identification is shown. A solution to an identification problem based on applying the generalized probability criteria explicitly dependent on a posteriori density function is proposed. An identification algorithm is synthesized using the criterion of minimum estimation error probability. A numerical example illustrating the effectiveness of the approach proposed is included. The method proposed can be effectively applied in various fields such as communication, control, measurement, etc.

ANALYSIS OF COLLECTIVISM AND EGOISM
IN THE CONTEXT OF SOCIAL WELFARE 30
**Chebotarev P.Yu., Loginov A.K., Tsodikova Ya.Yu.,
Lezina Z.M., Borzenko V.I.**

Comparative utility of major behavioral patterns including collectivism and egoism is investigated in the context of group decision making.

APPLICATION OF GENERALIZED MEDIAN SCHEMES FOR
THE DESIGN OF STRATEGY-PROOF MULTICRITERION
ACTIVE EXPERTISE MECHANISMS 38
Burkov V.N., Iskakov M.B., Korghin N.A.

Multicriterion active expertise mechanisms are represented as generalized median voter schemes in terms of right/left coalitions systems. This allows to apply the results of the public choice theory to the design of strategy-proof mechanisms.

MULTICRITERION COMPETITIVENESS EVALUATION
AND THE RANKING OF ECONOMIC OBJECTS OPERATING
UNDER VARIOUS UNCERTAINTY CONDITIONS 48
Kuvshinov B.M., Chelyadin A.S., Shiryaev V.I.

An approach to multiple criteria estimation of competitiveness of economical objects and to their ranking is proposed. The approach is based on estimating their economic potential. Pattern recognition techniques is used to estimate the competitiveness. The peculiarities of the economic potential estimation problem as well as those of the interval estimates comparison under uncertain source information are examined.

VENDOR SELECTION MANAGEMENT SUBJECT
TO MARKET INFORMATION INFLUENCE 55
Baikin A.A., Ivanov E.Yu., Isaeva O.V.

This paper presents the investigation results of a vendor selection model modified subject to information cost. The investigation was undertaken for several types of production functions, such as linear, Leontieff, Cobb-Douglas, Stone, CES, and Philippov. The estimates of the nature and the influence of supplemental market information on the structure and volumes of the resources used by the company are presented.

PARAMETERS EVOLUTION TECHNIQUES IN NONLINEAR
NETWORK PROBLEMS WITH A CASE STUDY
OF THE OPTIMIZATION OF INCOMING LOAD FLOWS
DISTRIBUTION 65
Zhevnerov V.A.

Parameters evolution techniques is proposed to apply in nonlinear network optimization tasks. The application features are demonstrated in a case study of optimal distribution of incoming load flows in a data communication network. The paper shows that the method ensures significant problem time reduction as against the known algorithms under comparable implementation costs.

PROCESS IDENTIFICATION PROBLEMS IN SPONGY
TITANIUM PRODUCTION 71
Kirin Yu.P., Zatonsky A.V., Bekker V.F., Kraev S.L.

The features of spongy titanium recovery and vacuum separation process modeling are discussed. The paper suggests to describe processes dynamics with differential equations with variable coefficients. The methods of model dynamics identification in positional control systems are included.

STRUCTURALLY-CLASSIFICATION METHODS
FOR ANALYSIS AND FORECASTING IN LARGE-SCALE
CONTROL SYSTEMS 78
Dorofeyuk J.A.

The method for solving analysis and forecasting problems in large-scale control systems is presented. A markovian chain with r states, where r — the number of structural units (classes) was used as a forecasting model. For the effective realization of presented method the complex classification algorithm was developed.