

(1.2.2)

(1.2.3)

$$\dot{\Phi}_*(t, t_0) = -A_0'(t)\Phi_*(t, t_0)$$

$$\mu \dot{\Psi}(t, t_0, \mu) = A_4(t)\Psi(t, t_0, \mu)$$

The Optimal Control Algorithms in Systems with Different Rates of Motion

The basic equations and formulas allow to obtain
a decision applying the method of moments.

The Optimal Control Algorithms in Systems with Different Rates of Motion

**Zamirbek Imanaliev
Zhyrgalbubu Barakova**

Published by
Science Publishing Group
1 Rockefeller Plaza, 10th and 11th Floors,
New York, NY 10020 U.S.A.
<http://www.sciencepublishinggroup.com>

ISBN: 978-1-940366-72-2



© Zamirbek Imanaliev 2022.
© Zhyrgalbubu Barakova 2022.

The book is published with open access by Science Publishing Group and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>) which permits any use, distribution, and reproduction in any medium, provided that the original author(s) and source are properly credited.

Preface

Methods of optimal control, namely, the moments method and the small parameter method are rarely used for the solution of economic problems. Using these methods to economic processes will make it possible to take into account certain influencing factors and their effects, as well as possible to evaluate the changes in the processes.

Application of the method of moments to problems of optimal control of linear, quasi-linear systems are considered in N. N. Krasovskiy N. N. [86], Butkovskiy A. G. [16], Albrecht E. G. [2, 3], Egorov A. I. [37]. Moreover, in those considering systems are used diversely optimized functions of time, linearity and norm.

The method of moments can often help to find the kind of control actions in a closed analytical form [16], and in cases where this is not possible, gives a single computational procedure for constructing the exact or approximate numerical solution of the problem. The complexity of this procedure does not depend on the number of control actions, it depends only on the order of the equation and the nature of the Eigen functions of problem. Application of the method of moments to the economic problems of optimal control singularly perturbed systems in domestic and foreign sources practically does not meet.

Small perturbations in problems of optimal control can be introduced artificially, and then perturbation theory appears as a method of research of the original problem [19]. In this sense, it can be applied to the study of the properties of the main of the trajectories and modes of development of the economic system.

The book is dedicated to two aspects: first aspect is proposed approximate method of decomposition of the original problem of optimal control, which allows

us to formulate it in the form of the problem of moment. It is a new direction in relation to the system under study in the theory of control. Second aspect is the studying of the results of dynamic processes optimal control of the economy.

Contents

Preface	III
Chapter 1 Decomposition in a Singularly Perturbed System.....	1
1.1 Integral Manifolds and Separation Movements.....	3
1.2 Matrix of Integral Manifolds	9
1.3 Matrix Transition of Singularly Perturbed System and Its Asymptotic Behavior.....	16
1.4 Converting Matrix Transition on the Integral Manifold.....	24
Chapter 2 Research Controllability and Dynamics of Movement Singularly Perturbed System	35
2.1 Controllability Singularly Perturbed Systems of Optimal Control with Constantly Acting External Forces.....	37
2.2 The Criterion Controllability of Movement of Singularly Perturbed System.....	46
2.3 Estimation of the Standard Deviation of the Trajectory of the System of Movement.....	57
Chapter 3 Method of Moments in the Theory of Singularly Perturbed Systems.....	65
3.1 Statement of The Problem on How to Manage the Problem of Moments	67
3.2 Control With Minimal Power.....	73
Chapter 4 Research Tasks of Optimal Control of Dynamic Processes Economy	89
4.1 Decomposition of an Extreme Problem of Interbranch Balance	91
4.2 Solution of Singularly Perturbed Problem on Optimal Economic Growth	94
4.3 Control In Single-Commodity Macroeconomic Dynamic Model for Different Optimality Criteria.....	102

4.4 Investigation of the Problem on Optimal Control in
Single-Commodity Macro Models Based on the Delay of
the Process of Investments 116

4.5 Estimation of Optimal Development of the Economy Based on
a Single-Commodity Optimization Model of With a
Small Parameter 131

References 149