**REVIEWS OF BOOKS PUBLISHED BY A.A. ASHIMOV**

**D. A. NOVIKOV. BOOK REVIEW:**

Ashimov A.A., Borovsky Yu.V., Iskakov N.A., Sultanov B.T., Ashimov As.A.

“Elements of the theory of parametric regulation of the evolution of the country’s economic system” M.: Fizmatlit, 2009, 96 pp.

Automation and telemechanics, No. 1, 2010 issue 1, pp. 187-188.

Within the framework of new ideas and directions in the field of theory and practice of managing nonlinear dynamic objects, you can consider the book “Elements of the theory of parametric regulation of the evolution of the country’s economic system” by authors A. A. Ashimov, Yu. V. Borovsky, N. A. Iskakov, B. Sultanov. T., Ashimova As.A.

This book is devoted to an urgent problem - the development of effective methods for regulating the development of a market economy.

The work is based on: a description of the country's economic system using systems of nonlinear ordinary differential equations; dependence of the solution (evolution) of the system of ordinary differential equations under consideration both on the vector of initial values and on the values of the vectors of controlled and uncontrolled parameters; correspondence of the properties of an object to the properties of the dynamic model describing it only in the case when this model has the property of roughness; which allowed the authors to propose a theory of parametric regulation of the evolution of the country's economic system. This theory contains the following components:

1. A set (library) of macroeconomic mathematical models aimed at describing various specific socio-economic situations.

2. Methods for assessing the conditions of roughness (invariance of the qualitative picture of trajectories with small, in a sense, disturbances on the right side of the system) of mathematical models of the country’s economic system from the library without parametric control.

3. Methods for assessing roughness conditions (structural stability), mathematical models of the country’s economic system from the library with parametric regulation.

4. Methods for selecting and synthesizing laws for parametric regulation of the development of a market economy.

5. Methods of controlling or suppressing the roughness (structural instability ) of mathematical models of the economic system.

6. Methods for clarifying restrictions on parametric regulation of the development of a market economy in the case of structural instability of mathematical models of the country’s economic system with parametric regulation.

7. Research methods and results of the analysis of bifurcations of extremals of problems in the calculus of variations for the selection of optimal laws of parametric control.

8. Recommendations for the development and implementation of effective state economic policy based on the theory of parametric regulation of the development of a market economy, taking into account specific socio-economic situations.

The first chapter presents the results of the application of general theorems on necessary and sufficient conditions for structural stability on a plane and Robinson’s theorem on sufficient conditions for weak structural stability on compact subsets of the phase space in mathematical models of the national economy, which are formulated in the form of corresponding statements about structural stability or instability with a parametric regulation and without it.

The second chapter outlines the theoretical foundations of the proposed original approach to finding the laws of change in controlled parameters (which can be various tax rates, government spending, etc.) in the form of extremals of the corresponding problems of the calculus of variations, which consists in choosing optimal sets of laws of parametric regulation in the environment given a finite set of algorithms. A proof of the statement about the existence of a solution to the specified problem of the calculus of variations is given. Based on a number of specific models of the country's economic system, examples of the application of the proposed approach at the level of one, two and three parameters are given.

The third chapter presents the results of a study of the effects of changes in uncontrolled parameters (parametric disturbances) on the results of solving problems of the calculus of variations, which consist in choosing optimal parametric control laws in the environment of a given finite set of algorithms. The phenomenon of bifurcation of the considered extremals is discovered and the statement about sufficient conditions for the existence of a bifurcation point of extremals is proven. The theoretical results obtained are illustrated by examples of finding bifurcation points of extremals when choosing optimal laws of parametric regulation of the process of evolution of a market economy.

The fourth chapter presents the results of applying the theory of parametric control to some applied problems of the evolution of dynamic systems.

The first task is multi-purpose regulation, when the area of functioning of the economic system is presented in the form of two sub-areas - acceptable and unacceptable. For each subarea, its own goals are formulated and its own regulatory laws are selected. This task is illustrated using the example of a mathematical model of the influence of the share of government spending in the gross domestic product and the interest rate on government loans. The second problem is the parametric regulation of a chaotic system using the example of the classical Lorentz model, which solves the problem of reducing the size of a chaotic attractor and transforming the chaotic trajectory of the system into trajectories tending to a stable singular point or to a limit cycle.

The book under review can undoubtedly be considered as some kind of response to the urgent need for tools that allow solving modern problems of effectively regulating the evolution of a market economy.

**I.G. POSPELOV.** **BOOK REVIEW:**

Ashimov A.A., Borovsky Yu.V., Sultanov B.T., Adilov Zh.M., Novikov D.A., Alshanov R.A., Ashimov As.A.

"Macroeconomic analysis and parametric regulation of the national economy" M.: Fizmatlit, 2011, 329 p. Automation and telemechanics, No. 10, 2011.

The book "Macroeconomic analysis and parametric regulation of the national economy" by Ashimov A.A., Borovsky Yu.V., Sultanova B.T., Adilov Zh.M., Novikova D.A., Alshanov R.A., Ashimov A. A. is devoted to the development of new methods for analyzing the economy and synthesizing recommendations for its regulation based on mathematical models.

In Chapter 1 of the book, the authors present an original theory of parametric control of dynamic systems that have the property of structural stability. The application of the proposed theory to the regulation of the national economy, taking into account various market situations, requires, according to the authors:

a) creating a library of mathematical models of the national economy;

b) providing this library with tools for assessing stability indicators and weak structural stability of models;

c) implementation of parametric control means for the corresponding mathematical models;

d) development of methods for developing recommendations for effective state economic policy based on analysis of the results of parametric regulation of models.

The original contribution of the authors is to solve problems b) and c). The authors pose the question of parametric control as the problem of choosing the optimal control law, i.e. as a specific problem in the calculus of variations. This problem differs from the problem of studying parametric perturbations of problems in the calculus of variations, where a parametric perturbation is used to obtain sufficient conditions for an extremum by constructing the corresponding S-functions and using the principle of removing restrictions1 or the question of conditions for the stability of solutions to problems in the calculus of variations2 is studied2.

For the purposes of parametric control, it is necessary to find regularity conditions under which the target functional of the perturbed problem has a minimum point close to the minimum point of the functional of the unperturbed problem3.

Further in Chapter 1, the following results of the theory of parametric control of continuous and discrete dynamic parameters developed by the authors are presented, including in the presence of additive noise:

1 Ioffe A.D., Tikhomirov V.M. Theory of extremal problems. M.: Nauka, 1974.

2 Ulam's problem. Ulam S. Unsolved mathematical problems. M.: Nauka, 1964.

3 See, for example, Bobylev N.A., Emelyanov S.V., Korovin S.K. Geometric methods in variational problems. M.: Master, 1998, where, in particular, a theorem was proven about the conditions for the existence of a bifurcation point for a problem in the calculus of variations, the functional of which is considered on the Sobolev space (Π) (2 ^р < ме) and depends on the scalar parameter А € [0, 1].

- numerical methods for assessing stability indicators of mathematical models;

- an algorithm for studying weak structural stability, based on Robinson’s theorem on sufficient conditions for weak structural stability;

- the theorem of the existence of solutions to problems of the calculus of variations by synthesis and selection (in the environment of a given finite set of algorithms) of optimal laws of parametric control;

- the theorem on the continuous dependence of the optimal values of the criteria for problems in the calculus of variations for the synthesis and selection of optimal laws of parametric control on the values of uncontrolled parameters;

- a theorem on sufficient conditions for the existence of a correspondingly defined bifurcation point of extremals of the problem of the calculus of variations under consideration.

In addition, in Chapter 1, the authors discuss a possible procedure for using the theory of parametric regulation to develop recommendations for effective state economic policy and the rules of interaction between decision makers in the development and implementation of effective state economic policy based on an information decision support system.

The first chapter ends with examples of the application of the theory of parametric regulation on a fairly wide range of mathematical models of the national economy.

Chapter 2 presents econometric estimates of some dependencies obtained based on the analysis of statistical data on the economy of the Republic of Kazakhstan. On the basis of these dependencies, traditional static models of the general economic equilibrium of a closed economy were built: 1B, LM, 1B-LM, the Keynes model, and also a static model of an open economy of a small country was described. The results of studies of the influence of economic instruments on equilibrium decisions within the framework of these models are presented.

Parametric regulation of the static equilibrium of the national economy comes down to solving a mathematical programming problem for estimating the optimal values of economic policy parameters. Such problems have been solved for the Keynes model and the model of an open economy of a small country. The results of a study of the dependences of optimal criteria values on a set of uncontrollable economic parameters are described.

The third chapter is devoted to the development of the theory of market cycles. The results of a study of the structural stability of mathematical models of the Kondratiev and Goodwin cycle and solutions to parametric control problems based on these mathematical models are presented.

Chapter 4 presents the results of parametric regulation of economic growth based on computable general equilibrium models. An algorithm for parametric model identification is proposed that takes into account the large dimension of the model and allows one to find the global extremum of a function of a large number (more than a thousand) variables. The algorithm uses two objective functions (two identification criteria - the main one and the additional one), which makes it possible to achieve the derivation of the values of the identified parameters from the vicinity of the points of local (and non-global) extrema, while maintaining the conditions of coordinated movement towards the global extremum.

The fourth chapter also describes the results of retrospective and medium-term analysis of multi-sector computable general equilibrium models involving the knowledge sector and the informal sector4. For these models, the results of a study of the elasticity of endogenous variables, sources of economic growth and the provisions of the theory of market cycles are presented. Solutions to problems of parametric regulation of economic growth are also given.

An important practical aspect of the book’s materials is the illustration of the possibilities of developing recommendations on economic policy. Thus, the identified dependence of the optimal values of the criteria for optimization problems for the Keynesian models and the small open economy of the country, the coefficients of which are estimated based on statistical data of the economy of the Republic of Kazakhstan, allows us to reasonably propose the found optimal values of economic parameters as recommendations for economic policy. As recommendations for economic policy for regulating the business cycle, one can consider the corresponding optimal laws of parametric regulation within the framework of the model of the evolution of market cycles. Even more detailed recommendations are obtained using computable general equilibrium models.

**I.G. Pospelov**

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