

Preface

This book is devoted to the elucidation of scientific achievements of academician Volodymyr Sergiyovych Mikhalevich, a well-known Ukrainian scientist and educator, and his role in the development of modern informatics. His 80th anniversary is an opportunity to think over his life, his strenuous work in science, and the influence of his ideas and personality on the becoming and development of the work to which he dedicated his life. The author was fortunate to work with V. S. Mikhalevich over a period of three decades and to witness his devotion to science as well as his vision for the future of Ukrainian informatics and mathematics. He was a talented scientist and a great organizer of science, a benevolent and generous teacher, and a kind-hearted and sensitive man. The combination of these features helped him to establish himself not only as a scientist but also as the founder of the world's well-known Ukrainian school of optimization theory. Professor Mikhalevich had many disciples who became worthy continuers of his noble cause. It is precisely scientific directions and some results of activity of Mikhalevich and representatives of his school that are considered in this book.

The author did not set himself the task of covering all lines of investigations (all the more, all works) of Mikhalevich. The list of his publications consists of several hundred works. It would be desirable to mention only the main (from the viewpoint of the author) works. For this reason, this work contains references (as required) to a part of the works of Mikhalevich and his disciples and colleagues. A comprehensive analysis of the scientific work of Mikhalevich, undoubtedly, deserves a separate exploration.

Professor Mikhalevich expired before his 65th birthday and did not realize many of his plans, but his achievements left an appreciable mark in science. It is necessary to emphasize that Mikhalevich could often determine prospects of scientific ideas and the path of development of some scientific direction or other, and could skillfully formulate mathematical statements of main problems better than anyone else. His high mathematical culture manifested itself through all his activities during the consideration of questions of formalization (adequate mathematical description) of complicated processes, choice of effective approaches to the solution of problems that arose in this case, scientific significance of the results

obtained, etc. He became the measure of a scientist not only to his colleagues (the author considers V. S. Mikhalevich to be one of his teachers in the field of optimization theory) but also for his numerous followers in Ukraine and abroad.

Mikhalevich had to work in times that were hard for cybernetics. He began his scientific career when the new science had not yet been recognized and accepted by the society. Only a few people managed to immediately understand and appreciate its importance for human development. Mikhalevich worked with academician V. M. Glushkov for a long time and was his staunch “comrade-in-arms” and one of the organizers of the development of cybernetics not only in Ukraine but also in the USSR as a whole. After the Glushkov’s death, Mikhalevich headed the Institute of Cybernetics of the National Academy of Sciences (NAS), Ukraine, for 12 years and made a considerable contribution to the development of cybernetic investigations and to the organization of professional training in cybernetics in higher education institutions of Ukraine. This earned him high appreciation by the society, and he was permanently supported by the presidium of NAS of Ukraine and well-known experts and organizers of science in the USSR such as academicians A. A. Dorodnitsyn, N. N. Bogolyubov, and M. V. Keldysh. This support helped to develop the Institute of Cybernetics (and the Cybernetic Center of NAS of Ukraine later on) and to organize the work on informatization in the country as a whole.

Nowadays, we are frequently faced with the following question: What scientific directions are topical such that they will have an impact on the development of our economy and scientific research in the near future? It is not easy to answer. Nevertheless, it becomes more and more obvious that one cannot do without full-scale informatization in this case. In particular, Barack H. Obama, the current president of the United States, emphasized the necessity of the active development of informatics as one of three most important scientific directions in the modern era at a meeting with scientists (at the very beginning of his presidency). We who work in this field always felt its importance to the life of society and the responsibility for it. This was bequeathed to us by our great preceptors V. M. Glushkov, A. A. Dorodnitsyn, and V. S. Mikhalevich who felt (better than anyone else) prospects for progress and saw the road of progress in the distant future.

In this work, the main accent is placed on the solution of problems of transcomputational complexity, i.e., problems that, within the framework of a definite model of calculations and some fixed software of a computer system, are characterized by ultrahigh values of complexity estimates. As a rule, mathematical formulations of these problems use 100,000 (and even ten million) variables and approximately the same number of various constraints. Examples of such problems are presented.

This work consists of five chapters in which scientific achievements of V. S. Mikhalevich and his disciples in the field of optimization theory, economic cybernetics, and construction of computer complexes and their software, in particular, packages of applied programs, are analyzed. Special attention is given to the construction of optimization methods for the solution of complicated problems in various statements. Problems of linear programming, problems of stochastic and discrete optimization, and also (partially) problems of integer programming are considered. By their very nature, such problems, as a rule, have transcomputational

complexity. It is obvious that the mentioned problems can be efficiently solved on supercomputers that have ultrahigh computational speed (this speed sometimes amounts to 100 and 1,000 billion operations per second) and corresponding memory sizes.

It is precisely the promising investigations in informatics with the direct participation of V. S. Mikhalevich that the author tries to stress, namely, the research and development activities that were initiated by him or some of these activities that were carried out under his scientific and methodical leadership. However, a considerable part of the works and results that are considered in this book have been accomplished by his disciples and followers already in recent years (1995–2010), i.e., without the participation of Mikhalevich.

In preparing this work for publication, the author has used materials and recommendations of many disciples and colleagues of V. S. Mikhalevich. Taking the opportunity, the author expresses his sincere gratitude to all of them.

Methods of Optimization and Systems Analysis for
Problems of Transcomputational Complexity

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2012, XIV, 226 p., Hardcover

ISBN: 978-1-4614-4210-3