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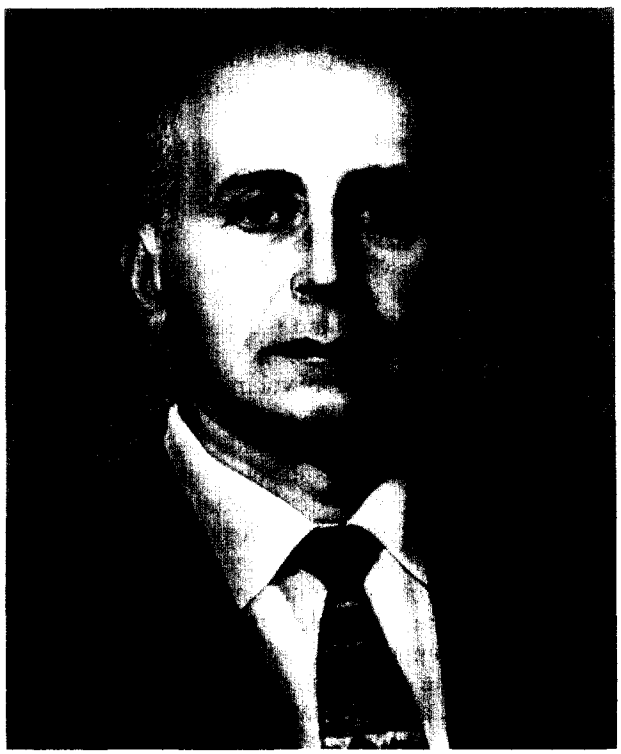
ON THE SIXTIETH BIRTHDAY OF FELIX LEONIDOVICH CHERNOUS'KO†



On 16 May 1998, Felix Leonidovich Chernous'ko, a leading scientist in the field of mechanics and control theory, celebrated his sixtieth birthday.

The wide range of his research interests and achievements covers the dynamics of rigid bodies containing cavities with a liquid or movable internal masses, the theory of optimal control, the theory of differential games, vibration theory, the theory of the estimation of the state of dynamical systems, computational methods of variational calculus and optimal control, and robotics. The important results he obtained in these areas have been recognized both in Russia and abroad.

During the 1960s, he carried out a large series of researches on the dynamics of a rigid body with cavities containing a liquid. Using the classical methods of separation of motions, he studied the angular motion of the body depending on the shape of the cavity, the extent to which it was filled, and the viscosity of the liquid. These investigations were quickly recognized, earning him the reputation of a talented scientist in mechanics. His results were of great value in the design of spacecraft, which were being intensively developed at that time.

Felix Leonidovich Chernous'ko has made a considerable contribution to the theory of optimal control. His efforts were focused mainly on optimal control algorithms intended for use in control engineering. He suggested that the small-parameter methods of non-linear mechanics could be used to solve optimal control problems and developed a small-parameter technique for weakly controllable systems, which enabled closed-form analytical approximations to optimal controls to be constructed. This method was used to optimize the control of spacecraft. He suggested the method of successive approximations for solving optimal control problems and the method of local variations, which enabled a wide class of variational problems in mechanics and control to be solved. The method of successive approximations was the first computational algorithm based on Pontryagin's maximum principle.

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He obtained important results in the theory of control with incomplete information and under conflict conditions. For 1968 onwards, he solved a number of typical problems of the control of motion under conditions of uncertainty, which were not amenable to the conventional general methods of differential games and demonstrated essential aspects of this new area of control theory. He was the first to formulate and solve the differential game of pursuit with delayed information, which is of practical importance. He solved a complicated problem of the evasion of an object from a group of pursuers, designing the evasion strategy and indicating a lower bound for the minimum distance between the evader and pursuers. He formulated and solved the problem of searching for a moving object by another moving object under conditions of limited visibility, when either the observation distance is limited or there is an obstacle in the way. Search strategies were developed and the conditions for successful search were given. In the optimal control of stochastic systems, he stated and solved the problem of optimizing the observation process when the total duration of the observation is constrained, as well as the self-similar problem of the optimal correction of motion under random disturbances. Both these pioneering works initiated a number of investigations.

Felix Leonidovich Chernous'ko developed an effective method of constructing feedback controls for non-linear mechanical systems governed by Lagrange's equations. The method involves the decomposition of the input multi-degree-of-freedom system into simple single-degree-of-freedom systems which can be controlled independently. It enables one to drive the system to the desired state in a finite time, taking into account uncontrollable disturbances and the constraints imposed on the control.

Felix Leonidovich Chernous'ko made a considerable contribution to developing the theory of guaranteed estimation and constructed optimal (in terms of volume) bilateral (external and internal) estimates for attainable sets of controlled systems. These studies, which he began in 1980, resulted in a monograph in which he presented the theory of the method of ellipsoids for the optimal evaluation of the attainable sets of discrete-time and continuous-time systems and generalized this theory to non-linear systems and to the case of several ellipsoids used to approximate the attainable set. The estimates obtained reduce the construction of external and internal ellipsoidal approximations of the attainable sets of controlled systems to the solution of initial-value problems for a special sort of non-linear systems of differential equations. He investigated the properties of these equations and gave their solution in a number of cases. The ellipsoidal estimates suggested for the attainable sets enable one to construct approximate solutions and bilateral estimates in a number of important problems of control and estimation, including those of controllability and optimal control, the evaluation of the influence of perturbations on the motion of mechanical systems, differential games, and the guaranteed filtering of the results of observations. His research on the method of ellipsoids has been widely recognized both in Russia and abroad. His publications on this topic are frequently cited and used in theoretical and applied investigations.

Felix Leonidovich Chernous'ko is the author of nine monographs and more than 250 scientific papers. His publications are distinguished by the scientific and practical topicality of the problems being solved, the rigour of his analysis, the clarity of the formulation, and the brilliant style of presentation.

Throughout his life in science Felix Leonidovich Chernous'ko has fruitfully combined research and teaching activity. He lectures at the Moscow Institute of Physics and Technology and supervises the research work of undergraduate and graduate students. He founded a scientific school in control theory and the mechanics of controlled systems, which is a leading one in Russia. Among his former students, there are 14 who were awarded the degree of Doctor of Science and over 30 on whom a PhD degree was conferred.

He manages much work on the organization of research. He is the Head of Department of Control of Mechanical Systems at the Institute for Problems in Mechanics of the Russian Academy of Sciences and a member of the editorial boards of leading Russian and international journals in the field of mechanics and control theory. He does a considerable amount of work on organizing national and international scientific conferences. He was the initiator of All-Union conferences on optimal control in mechanical systems. These conferences have been regularly held for many years, being a representative forum for theorists and engineers in control.

His achievements in science have been recognized in Russia and abroad. He is a full member of the Russian Academy of Sciences and a number of foreign academies. He was awarded the Lenin Komosomol Prize, the State Prize of the USSR, and the State Prize of the Russian Federation in the field of science and technology. He is the recipient of the Koerber Prize for the development of European science and the Humboldt Prize (Germany).

The editorial board and the editors of this journal, his colleagues and students cordially congratulate him on his birthday and wish him health, long life, and fruitful creative work in science.

Translated by R.L.