Soviet Mathematics Circles

USSR Olympiad Problem Book. Selected problems and theorems of elementary mathematics. D. O. Shklarsky, N. N. Chentzov, and I. M. Yaglom. Translated by John Maykovich. Revised and edited by Irving Sussman. Freeman, San Francisco, Calif., 1962. xvi + 452 pp. $9.

One of the remarkable Soviet achievements in mathematics education is their program of extracurricular activities designed to discover and train future mathematicians and scientists at an early age. Mathematics clubs and other extracurricular activities are organized within the elementary and secondary schools. In addition, the mathematics departments in universities, polytechnic institutes, and pedagogical institutes often set up their own School Mathematics Circles for interested secondary school students in the area.

There has been a School Mathematics Circle at Moscow State University since 1935. Three outstanding mathematicians, L. G. Shnirelman, L. A. Lyusternik, and I. M. Gelfand, founded the circle, which has two main activities: every second Sunday professors and docents of the university deliver lectures in mathematics, and each Sunday evening over a dozen sections of the circle meet to solve and discuss problems. The sections are led by students of the mechanics-mathematics department of the university.

A result of the activities of the sections is a series of remarkable books, *The Library of the Mathematics Circle*, which are expanded versions of their work over a period of years. The first book in the series has been translated and published under the title *The USSR Olympiad Problem Book*. (Some others in the series are or soon will be available to American readers through various publishers.) This book is an anthology of 320 nonstandard problems in algebra, arithmetic, and elementary number theory (a few involve trigonometry). Solutions as well as hints and answers are given to all the problems.

Most of the problems were discussed at meetings of the School Mathematics Circle at Moscow State University, and nearly a quarter of them were given at the Moscow Mathematical Olympiads for secondary school students during the years 1935 to 1952. Solving such imaginative problems requires thorough analysis and concentrated effort, for the problems are by no means routine or superficial. Several contain the statement of important theorems, and some solutions involve techniques not used in high school mathematics.

The problems are, in general, independent of one another. For the majority of them, the Russian authors recommend that "the reader first attempt a solution by himself, without recourse to the hints. If this attempt is unsuccessful, the hint or answer can be referred to, as it may aid in arriving at a solution. If then the reader cannot solve a problem he should read the solution." According to the authors, the book's purpose "is not so much to reinforce and deepen the reader's knowledge acquired in school instruction as to acquaint him with a series of methods and ideas that will be new to him and to develop in him a taste for independent research."

The translation, which has been carefully edited, is well done. The English text reads smoothly, and the book appears in a handsome edition. Unfortunately, the original Russian title, *Selected Problems and Theorems of Elementary Mathematics*, was changed for the translation to *The USSR Olympiad Problem Book*. The new title is more appealing than accurate. In the first place, only some 80 of the 320 problems in the book have been used as Olympiad problems; in the second, these 80 problems represent but a small fraction of the many thousands of problems that have been used in the Soviet mathematical olympiads.

Some have never been published, some have appeared in the various volumes of *The Library of the Mathematics Circle*, and the rest are scattered about in other Russian books and periodicals. There is no single U.S.S.R. olympiad problem book. The use of such a misleading title for the English edition of a first-rate book seems wholly unnecessary.

Interested high school students in the upper grades and mathematics teachers should find this book a valuable addition to the scanty American literature available for use in extracurricular mathematical activities.

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Control Engineering

Computer Control Systems Technology. Cornelius T. Leondes, Ed. McGraw-Hill, New York, 1961. x + 649 pp. Illus. $16.

The material in this text, which is based on a series of 20 lectures sponsored by the University of California Engineering and Physical Sciences Extension Divisions, is divided into three sections: Computer Technology, Control Technology, and Applications to Complex Systems.

The first section covers both circuit design and programming information for digital and analog machines and also includes a chapter, by Charles Thompkins (University of California, Los Angeles) on error analysis in computation.

The second section on control technology includes a review of linear and nonlinear continuous feedback theory, as well as chapters on sampled data and random input systems. In the concluding chapter of this section, L. A. Zadeh (University of California, Berkeley) treats discrete time optimal control problems. The third section contains material on the applications of computers to problems of control in the fields of aerospace vehicle guidance, air traffic control, nuclear reactors, machine tools, and process industries and also includes a chapter on optimalizing control, by Y. T. Li (Massachusetts Institute of Technology).

The selection of material and the level of exposition make the book best suited for review and reference work. As might be expected in a work with 20 contributors, the several chapters depend on each other only in a superficial way, and no one chapter has both the completeness and the depth required in a textbook. For use as a reference volume, however, the book contains a wealth of useful information and could be read with profit by any control engineer. The mathematical level is approximately the same as that in Truxal's *Control System Synthesis*. Apart from the chapter by Zadeh, which is somewhat specialized, no reference is made to state variables and the rapidly growing area of optimal control in multivariable processes from the time domain point of view.

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