===== **SPECIAL ISSUE** =====

To the 90th Anniversary of Boris Polyak

(May 4, 1935–February 3, 2023)

This year commemorates the 90th anniversary of Boris Teodorovich Polyak, a brilliant mathematician and remarkable individual who passed away two years ago.

A pioneer in the theory and methods of optimization in the USSR, he gained worldwide recognition by the mid-1970s and worked for over half a century at the Trapeznikov Institute of Control Sciences. Polyak's research interests expanded far beyond optimization problems. He investigated a diverse range of topics with great enthusiasm, including chaos control, spacecraft stabilization at Lagrange points, peak effects in differential and difference equations, synchronization of oscillators, randomized versions of the PageRank problem, and the stability of power grids.

Polyak's research into mathematical optimization and control theory has exerted a strong influence on the development of these disciplines and has found applications, often unexpected, in practical problems.

Among the multitude of his remarkable results, we highlight some of the most prominent ones:
- the heavy ball method,
- the stochastic approximation method with averaging,
- the conjugate gradient method,
- nonconvex optimization algorithms under the Polyak–Łojasiewicz condition,
- adaptive step-size choice in subgradient methods,
- the sequential projection method,
- the conditional gradient method,
- Newton's method with cubic regularization,
- convexity/nonconvexity certificates for quadratic mappings,
- results on the parametric robustness of linear systems (including the Tsypkin–Polyak plot),

- new versions of random walk methods,
- results on ellipsoidal estimation and the invariant ellipsoid method.

The breadth of Polyak's scientific purview is well illustrated by the diversity of the journals in which he published:

Journal of Computational Mathematics and Mathematical Physics, *Sbornik: Mathematics*, *Journal of Optimization Theory and Applications*, *Mathematical Programming*, *SIAM Journal on Control and Optimization*, *Theory of Probability and Its Applications*, *Automation and Remote Control*, *International Journal of Robust and Nonlinear Control*, *IEEE Transactions on Automatic Control*, *Automatica*, *European Journal of Control*, *Systems and Control Letters*, and many others.

Polyak's personal traits—optimism, genuine humanity, as well as sharp and kind wit—always attracted colleagues and young researchers. Dozens of his students and their followers are now productively working at universities and research centers in many parts of the world. Furthermore, the Traditional Young Scientists School "Control, Information, and Optimization" founded by Boris, has been held with consistent success for over 15 years.

In honor of this anniversary, a special issue of *Automation and Remote Control* has been prepared. It includes articles by Polyak's students and colleagues from Russia (Moscow, St. Petersburg, Nizhny Novgorod, and Syktyvkar) as well as from England, Spain, Italy, France, and the United States. The scope of the special issue is exceptionally broad, ranging from classical optimization methods to probabilistic set approximations on the one hand, and from network flow optimization to robust estimation and robust control of linear systems on the other. Despite this wide range of topics, all of them are connected, in one way or another, to Polyak's research interests.

With deep gratitude, we list the authors who have kindly agreed to contribute their research to this special issue, and the reviewers whose expertise has been invaluable:

A. Ablaev, A. Akhavan, I. Akinfiev, T. Alamo, M. Alkousa, M. Balashov, Y. Bekri, R. Biryukov, S. Boyd, F. Dabbene, P. Dvurechensky, M. Fedotov, A. Gasnikov, O. Granichin, R. Hildebrand, A. Juditsky, M. Kogan, A. Lukashevich, M. Mammarella, N. Mashalov, V. Mirasierra, S. Nazin, A. Nemirovski, S. Parsegov, O. Savchuk, V. Sokolov, F. Stonyakin, E. Tarasova, T. Chikake Mapungwana, A. Tsybakov, D. Yarmoshik, and F. Zhang.

Special thanks go to A. Mazurov who put significant effort to translating the submitted manuscripts to and from English.

Similar to the 2024 special issue dedicated to Boris Polyak, three articles will be published in the next issue due to the monthly page limit of *Automation and Remote Control*.

Editor of the special issue
P.S. Shcherbakov