

**The Hong Kong Polytechnic University
Department of Applied Mathematics**

Seminar

Universality, the new trend in development of Optimization Schemes

By

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Abstract

In the early years of Optimization, the first classical schemes were derived from an abstract concept of approximation (e.g. Gradient method, Newton's methods, etc.). However, since the development of Complexity Theory for Convex Optimization (Nemirovsky, Yudin 1970's), the most powerful approaches for constructing efficient (optimal) methods are based on the model of the objective function. This model incorporates the characteristic properties of the corresponding problem class and provides us with a comprehensive information on the behavior of the objective. At the same time, it helps in deriving theoretically unimprovable complexity bounds for the target class.

However, every objective function belongs, at the same time, to many different problem classes. Hence, it should be treated by a method developed for the most appropriate class of problems. However, for the real-life problems, such a choice is hardly feasible.

In this talk, we discuss several ideas for constructing universal methods, which automatically ensure the best possible convergence rate among appropriate problem classes. Our most promising super-universal method works properly for a wide range of problems, starting from the functions with bounded variation of Hessian up to the functions with Lipschitz continuous third derivative. Being a second-order scheme, it covers all diversity of problems, from the problems traditionally treated by the first-order methods, up to the problems, which are usually attributed to the third-order schemes. No preliminary information on the objective function is needed.

Biography

Yurii Nesterov is a professor at Center for Operations Research and Econometrics (CORE) in Catholic University of Louvain (UCL), Belgium. He received Ph.D. degree (Applied Mathematics) in 1984 at Institute of Control Sciences, Moscow. Starting from 1993 he works at CORE.

His research interests are related to complexity issues and efficient methods for solving various optimization problems. The main results are obtained in Convex Optimization (optimal methods for smooth problems, polynomial-time interior-point methods, smoothing technique for structural optimization, complexity theory for second-order methods, optimization methods for huge-scale problems). He is an author of 6 monographs and more than 150 refereed papers in the leading optimization journals. He got several international prizes and recognitions, among them there are

- Dantzig Prize from SIAM and Mathematical Programming society (2000),
- von Neumann Theory Prize from INFORMS (2009),
- SIAM Outstanding paper award (2014)
- Euro Gold Medal from Association of European Operations Research Societies (2016).
- Member of Academia Europaea (2021) and National Academy of Sciences (USA, 2022).
- Lanchester prize from INFORMS (2022).

In 2023, he got the award of World Laureates Association in Computer Sciences or Mathematics.

Date: 12 December 2023 (Tuesday)

Time: 10:30-12:00 noon (Hong Kong Standard Time GMT +8)

Venue: Y301, Core Y

Speaker: Prof Yurii Nesterov, CORE/INMA, Catholic University of Louvain (UCLouvain), Belgium

Host: Prof Xiaojun Chen, The Hong Kong Polytechnic University

*** * * ALL ARE WELCOME * * ***