



Seminar Hora Informaticae

Institute of Computer Science, Prague

Tuesday, May 26, 2026, 13.30 – 15.30 (1.30 – 3:30 PM) CEST

Meeting Room 318, Address: Pod Vodárenskou věží 2, Prague 8

Meeting ID: 914 0834 4018, Passcode: 668534



<https://cesnet.zoom.us/j/91408344018?pwd=x2QlZ4F42BxlMSmWc1HOwHHA7Uw7PN.1>

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Multi-Objective Optimization for Expensive Engineering Problems.

In many engineering applications, optimization requires computationally expensive numerical simulations while balancing multiple competing performance objectives. Since only a limited number of evaluations can typically be afforded, standard optimization approaches often become ineffective. This lecture introduces hydraulic pump design optimization as a representative application, where candidate designs are evaluated using computational fluid dynamics (CFD) simulations with substantial computational cost. To solve the problem, reducing the number of evaluations is crucial. In this context, Bayesian optimization based on probabilistic surrogate models offers an efficient optimization strategy. These models approximate the underlying objective functions while providing uncertainty estimates that guide the search toward promising design configurations. Practical challenges such as failed CFD simulations and the integration of decision-maker preferences into the optimization process will be addressed.

References:

- [1] Burkotová, J., Pour, P.A., Krátký, T., Miettinen, K.: Interactive multiobjective optimization of an extremely computationally expensive pump design problem. *Engineering Optimization* 56(8), 1318–1333 (2024).
- [2] Mazumdar, A., Burkotová, J., Krátký, T., Chugh, T., Miettinen, K.: Handling simulation failures of a computationally expensive multiobjective optimization problem in pump design. *Engineering Applications of Artificial Intelligence* 136, 108897 (2024).
- [3] Chugh, T., Jin, Y., Miettinen, K., Hakanen, K., Sindhya, K.: A Surrogate-Assisted Reference Vector Guided Evolutionary Algorithm for Computationally Expensive Many-Objective Optimization. *IEEE Transactions on Evolutionary Computation* 22(1), 129–142 (2018).

Jana Burkotová, Ph.D., (<https://kma.upol.cz/en/katedra/vizitka/burkotova/>) is an Assistant Professor at the Department of Mathematical Analysis and Applications of Mathematics, Faculty of Science, Palacký University Olomouc, Czech Republic, where she also serves as Deputy Head of the Department for Academic Affairs. She received her PhD in Mathematical Analysis. Her expertise lies at the intersection of optimization, differential equations, and numerical methods, with connections to statistics. Currently, she focuses on multiobjective optimization, particularly for computationally expensive problems involving numerical simulations and surrogate-assisted approaches in the Bayesian optimization framework. She has been involved in several research projects aimed at enhancing optimization methods and computational efficiency with applications in industrial contexts.

HORA INFORMATICAЕ (meaning: TIME FOR INFORMATICS) is a broad-spectrum scientific seminar devoted to all core areas of computer science and its interdisciplinary interfaces with other sciences and applied domains. Original contributions addressing classical and emerging topics are welcome. Founded by Jiří Wiedermann, the seminar is running since 1994 at the Institute of Computer Science of the Czech Academy of Sciences in Prague.

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