# Sharp Penalty Mapping Approach to Approximate Solution of Variational Inequalities and Discrete-time Lyapunov Theory for Optimization Processes

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Part 1. Sharp Penalty Mapping Approach to Approximate Solution of Variational Inequalities

We consider here a generalization of penalty functions approach to solution of variational inequalities, which is based on replacing a potential mapping, associated with the gradient field of a penalty function with the oriented field of a sharp penalty mapping. It gives an additional freedom in construction of iteration schemes for approximate solution with controllable accuracy of variational inequalities of high dimensionality, for instance for solving transportation equilibrium problems.

Part 2. Discrete-time Lyapunov Theory for Optimization Processes

This part is devoted to some new tools for studying convergence properties of iteration processes common in optimization and related areas. Despite proliferation and successes of a great number of heuristics in machine learning, automatic classification, discrete optimization and other subjects, there is an everlasting need for full verification of validity of such processes, which not only guarantees their correct application, but quite often shows the ways for the improvements. As a rule such analysis amounts to proofs of convergence of sequences of approximate solutions to the desirable exact solution and is based on Lyapunov-like statements about relaxation properties of a related sequences of values of convergence indicators. There are several general nontrivial methods for establishing such properties, but new problems in Big Data areas ask for a new approaches oriented in particular on algorithms for obtaining approximate solutions of huge-scale optimization and equilibrium problems. Some new ideas in area are discussed and demonstrated in this lecture.