# Mathematical heuristics for combinatorial optimization problems

Yu. Kochetov

Sobolev Institute of Mathematics, Novosibirsk

In the last decades metaheuristics have demonstrated the ability to solve hard combinatorial problems of practical sizes within reasonable computational time. Simulated Annealing, Tabu Search, Variable Neighborhood Search, GRASP, evolutionary inspired algorithms like Genetic Algorithms, Ant Colony Optimization and several other paradigms have established their value in various application areas: facility location, vehicle routing, scheduling and others. In this tutorial we will discuss the main ideas of some metaheuristics and their hybrids, in particular, with the classical mathematical programming methods, so-called matheuristics. Specifically, we will describe the follower hybrid methods:

- Local Branching
- Core Concepts
- Feasible Pump
- Relaxation Induced Neighborhood Search (RINS)
- Large Neighborhoods and some others.

Application of the methods for NP-hard problems in combinatorial optimization and bi-level programming will be discussed as well.