

Network optimization problems

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0. Preliminaries on rectifiable and connected sets. Golab and Blaschke theorems. Rectifiability of sets of finite length. Topological theory of continua and curves (endpoints, loops, branching points, Menger n -Beinsatz, etc.).
1. The classical Steiner problem. Existence of solutions and equivalence of various problem settings. Structure of a generic solution. Nontrivial examples of solutions.
2. Optimal packing and optimal location of facilities. Hexagonal heuristics. Dynamic optimization problems: long term and short term planning. Optimal location in presence of both attraction and repulsion.
3. Average and maximum distance functionals. Existence and basic topological structure results. Structure of branching points, lack of regularity.
4. Optimal urban transportation networks. Preliminaries on optimal mass transportation. Network optimization among connected sets: reduction to average distance minimization. Disconnected optimal networks: the natural regularity.
5. Optimal pipeline problem. The horseshoe conjecture.
6. Compliance optimization problem. Existence of solutions. Monotonicity formula and the overview of regularity results for the penalized problem.