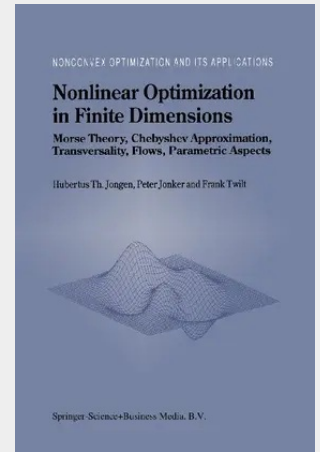


Nonlinear Optimization in Finite Dimensions

Morse Theory, Chebyshev Approximation, Transversality, Flows, Parametric Aspects

At the heart of the topology of global optimization lies Morse Theory: The study of the behaviour of lower level sets of functions as the level varies. Roughly speaking, the topology of lower level sets only may change when passing a level which corresponds to a stationary point (or Karush-Kuhn Tucker point). We study elements of Morse Theory, both in the unconstrained and constrained case. Special attention is paid to the degree of differentiability of the functions under consideration. The reader will become motivated to discuss the possible shapes and forms of functions that may possibly arise within a given problem framework. In a separate chapter we show how certain ideas may be carried over to nonsmooth items, such as problems of Chebyshev approximation type. We made this choice in order to show that a good understanding of regular smooth problems may lead to a straightforward treatment of "just" continuous problems by means of suitable perturbation techniques, taking a priori nonsmoothness into account. Moreover, we make a focal point analysis in order to emphasize the difference between inner product norms and, for example, the maximum norm. Then, specific tools from algebraic topology, in particular homology theory, are treated in some detail. However, this development is carried out only as far as it is needed to understand the relation between critical points of a function on a manifold with structured boundary. Then, we pay attention to three important subjects in nonlinear optimization.

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