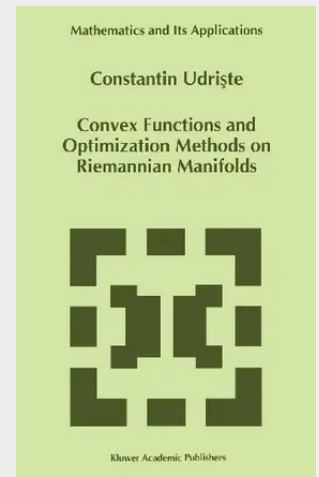


Convex Functions and Optimization Methods on Riemannian Manifolds

The object of this book is to present the basic facts of convex functions, standard dynamical systems, descent numerical algorithms and some computer programs on Riemannian manifolds in a form suitable for applied mathematicians, scientists and engineers. It contains mathematical information on these subjects and applications distributed in seven chapters whose topics are close to my own areas of research: Metric properties of Riemannian manifolds; First and second variations of the p-energy of a curve; Convex functions on Riemannian manifolds; Geometric examples of convex functions; Flows, convexity and energies; Semidefinite Hessians and applications; Minimization of functions on Riemannian manifolds. All the numerical algorithms, computer programs and the appendices (Riemannian convexity of functions $f: R \sim R$, Descent methods on the Poincare plane, Descent methods on the sphere, Completeness and convexity on Finsler manifolds) constitute an attempt to make accessible to all users of this book some basic computational techniques and implementation of geometric structures. To further aid the readers, this book also contains a part of the folklore about Riemannian geometry, convex functions and dynamical systems because it is unfortunately "nowhere" to be found in the same context; existing textbooks on convex functions on Euclidean spaces or on dynamical systems do not mention what happens in Riemannian geometry, while the papers dealing with Riemannian manifolds usually avoid discussing elementary facts. Usually a convex function on a Riemannian manifold is a real valued function whose restriction to every geodesic arc is convex.

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