

Book Review

Vincent Acary and Bernard Brogliato, *Numerical Methods for Nonsmooth Dynamical Systems. Applications in Mechanics and electronics*, Lecture Notes in Applied and Computations Mechanics, Vol. 35, Springer-Verlag Berlin Heidelberg New York 2008, XXII, 526 p., 96 illus., Hardcover, ISBN 978-3-540-75391-9

“This book concerns the numerical simulation of dynamical systems whose trajectories may not be differentiable everywhere. They are named *nonsmooth* dynamical systems.” This characterization – which precisely describes the content of the book – is given by the authors at the very beginning.

Whereas the convex and nonsmooth analysis has a long tradition (in particular in France) and many basic problems at least for nonsmooth ODEs are solved, the development of efficient algorithms is still an active area of research; the current state-of-the-art is collected in this monograph.

This book consists of four parts (and an appendix on background material in mathematical analysis). The first part (covering nearly half of the book) is devoted to modeling aspects (presenting nonsmooth models in mechanics, electronics, and control). In terms of convex and nonsmooth analysis they are formulated as differential inclusions, variational inequalities, complementarity systems, or as a projected dynamical system.

The next two parts consider numerical aspects. In Part II numerical time integration schemes are introduced, and Part III considers one-step numerical methods for the arising incremental nonsmooth problems (containing a summary of 70 pages on the basics of mathematical programming).

Finally, the implementation of algorithms for nonsmooth ODEs is discussed by introducing the software platform Siconos. The features, interfaces, and methods of this software are explained, and its performance is demonstrated by a couple of examples.

This monograph is a valuable and concise contribution to the numerics of nonsmooth ODEs with an up-to-date reference list of 27 pages. It is clearly designed for engineering applications in computational mechanics, and the main concern is the discussion of the construction of algorithms and their properties; it is not intended to cover topics of numerical analysis as well. Nevertheless, many parts are written in a formal mathematical style with precise definitions, followed by results stated as Lemma, Proposition, or Theorem (and references to the literature for the proofs). This makes the overall work accessible for both, researchers in mechanics and in mathematics.

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