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Book review

Domains and Lambda-Calculi by R. M. Amadio and P-L. Curien, Springer Verlag, 1999, ISBN 0521587751.

This book is an encyclopedic compilation of facts and results in domain theory, the branch of mathematics used to describe the denotational semantics of programming languages, simplified to lambda-calculi.

The book situates itself within the European tradition of theoretical computer science: having acknowledged in the preface the origins of domain theory as a theory to explain the semantics of programming languages, from then on, domain theory is taken as a purely mathematical object of study. Sure enough, we go back to the motivation several times, but firmly from the perspective of a mathematical theory: the body of the text consists of definition, lemmas, theorems and proofs. Very little is given in terms of raw intuition.

This would not be a serious problem if the exposition of the material lent itself easily to a structured explanation. As it is, if you're an expert, this book is very useful: it collects together results dispersed in the literature. However, if you're a novice, it gives no help in introducing and mastering the subject: it is written in the style of 'dipping in at the deeper end', and there is no consistent pedagogical progression.

The pace of the book is fast. The first chapter (around 20 pages) covers almost all of the material in more traditional treatments of semantics (e.g. *The Formal Semantics of Programming Languages: An Introduction* by G. Winskel).

The order in which items are covered is at times strange: the semantics of lambda-calculus (Chapter 1) comes before its introduction, in a proper fashion (Chapter 2). The rationale is that some intuitive idea of lambda calculus was already in place, which allows the authors to be very concise and innovative, with the emphasis given to the connections between computability and topology.

The book is not afraid to tackle theorems considered difficult in introductory texts on lambda-calculus. Thus Lévy's labelled λ-calculus and Boehm's theorem are both discussed. Some very recent work (e.g. on optimal reductions and on the solution to the full abstraction problem for PCF using games) is brought in to make proofs shorter/more perspicuous, or simply to indicate where this area of research is going. Again, this makes the book much more interesting for the specialist, but a harder one for novices. Labelling 'advanced' sections with stars is not much help when the remaining unstarred sections do not form an orderly progression.

Summarizing, this book is a very useful reference book. Almost everything important that has happened in this branch of theoretical computer science within the last 20 years is at least briefly mentioned. But as usual with encyclopedic reference works, it leaves much to be desired as an 'elementary and unified introduction' to the area.

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