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Nota di contenuto	Prologue: Aims, Themes, and Motivations -- Prologue: Aims, Themes, and Motivations -- Mathematical Framework: Iterated Relations and Composition -- Dynamics of Relations -- Dynamics of Composed Relations -- Abstract Complexity: Abstraction, Invariance, Attraction -- Abstract Observation of Dynamics -- Invariance, Attraction, Complexity -- Abstract Compositional Analysis of Systems: Dynamics and Computations -- Compositional Analysis of Dynamical Properties -- Case Studies: Compositional Analysis of Dynamics -- Experimental Compositional Analysis of Cellular Automata -- Compositional Analysis of Computational Properties -- Epilogue: Conclusions and Directions for Future Work.
Sommario/riassunto	State-transition systems model machines, programs, and specifications [20, 23,284,329],butalsothegrowthanddeclineofantpopulations,?nancial markets, diseases and crystals [22, 35, 178, 209, 279]. In the last decade, thegrowinguseofdigitalcontrollersinvariousenvironmentshasentailed

the convergence of control theory and real-time systems toward hybrid systems [16] by combining both discrete-event facets of reality with Nature's continuous-time aspects. The computing scientist and the mathematician have re-discovered each other. Indeed, in the late sixties, the programming language Simula, "father" of modern object-oriented languages, had already been specifically designed to model dynamical systems [76]. Today, the importance of computer-based systems in banks, telecommunication systems, TVs, planes and cars results in larger and increasingly complex models. Two techniques had to be developed and are now fruitfully used to keep analytic and synthetic processes feasible: composition and abstraction.

A compositional approach builds systems by composing subsystems that are smaller and more easily understood or built. Abstraction simplifies unimportant matters and puts the emphasis on crucial parameters of systems. In order to deal with the complexity of some state-transition systems and to better understand complex or chaotic phenomena emerging out of the behavior of some dynamical systems, the aim of this monograph is to present a first step toward the integrated study of composition and abstraction in dynamical systems defined by iterated relations.

The main insights and results of this work concern a structural form of complexity obtained by composition of simple interacting systems presenting opposed attracting behaviors. This complexity expresses itself in the evolution of composed systems, i.e., their dynamics, and in the relations between their initial and final states, i.e., the computations they realize. The theoretical results presented in the monograph are then validated by the analysis of dynamical and computational properties of low-dimensional prototypes of chaotic systems (e.g. Smale horseshoe map, Cantor relation, logistic map), high-dimensional spatiotemporally complex systems (e.g. cellular automata), and formal systems (e.g. paperfoldings, Turing machines). Acknowledgements.

This monograph is a revision of my PhD thesis which was completed at the Université catholique de Louvain (Belgium) in March 1996. VIII Preface
The results presented here have been influenced by many people and I would like to take this opportunity to thank them all.
