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János Kertész Imre Kondor (Eds.)

# Advances in Computer Simulation

Lectures Held at the Eötvös Summer School  
in Budapest, Hungary, 16–20 July 1996



Springer

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# Preface

The dramatic development in computation has changed physics substantially. Besides the traditional methodological branches of the discipline, experimental and theoretical physics, a third branch has emerged: Computational Physics. This is not to say that computers are not used in other branches of physics as well, but in computational physics they have become the *main instrument* for exploring the laws of nature.

Statistical physics is one of the fields where the impact of modern computers has been enormous. Simulations of many-body systems has become a standard tool for research. In several classes of problems it is crucial to push the number of particles simulated to the limit, in particular, when there is no characteristic length in the system, such as for scaling phenomena, or when there are many characteristic lengths as, for example, in the case of granular systems. An important lesson learnt during the last two decades is that improving our simulation techniques via physical insight is at least as important as the experienced faster-than-exponential growth in hardware capacity for the purposes of achieving large-scale simulations.

Advances in computer simulation was a meeting held in Budapest in July 1996, as one of the series of Eötvös Summer Schools. After a general introduction, the discussion was centered around recent developments in physics-based algorithmic advances. The main emphasis of the school was on Monte Carlo techniques applied to many body systems, but topics from molecular dynamics, stochastic differential equations and optimization were also touched upon. Both lecturers and students found the school so useful that we decided to publish the lectures – resulting in the present volume. We hope it will contribute to the spreading of contemporary ideas in simulational statistical physics.

Finally, we would like to thank B. Bakó, I. M. Kondor, and T. N. Townsend for their help with the editing of this volume; and the Soros Foundation, the International Workshop on Theoretical Physics, and the Hungarian Academy of Sciences for their financial assistance towards the school.

Budapest, July 1997

János Kertész  
Imre Kondor

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