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Interdisciplinary Systems Research
Analysis – Modelling – Simulation

The system science has been developed from several scientific fields: control and communication theory, model theory and computer science. Nowadays it fulfills the requirements which Norbert Wiener formulated originally for cybernetics; and were not feasible at his time, because of insufficient development of computer science in the past.

Research and practical application of system science involve works of specialists of system science as well as of those from various fields of application. Up to now, the efficiency of this co-operation has been proved in many theoretical and practical works.

The series 'Interdisciplinary Systems Research' is intended to be a source of information for university students and scientists involved in theoretical and applied systems research. The reader shall be informed about the most advanced state of the art in research, application, lecturing and metatheoretical criticism in this area. It is also intended to enlarge this area by including diverse mathematical modeling procedures developed in many decades for the description and optimization of systems.

In contrast to the former tradition, which restricted the theoretical control and computer science to mathematicians, physicists and engineers, the present series emphasizes the interdisciplinarity which system science has reached until now, and which tends to expand. City and regional planners, psychologists, physiologists, economists, ecologists, food scientists, sociologists, political scientists, lawyers, pedagogues, philologists, managers, diplomats, military scientists and other specialists are increasingly confronted or even charged with problems of system science.

The ISR series will contain research reports – including PhD-theses – lecture notes, readers for lectures and proceedings of scientific symposia. The use of less expensive printing methods is provided to assure that the authors' results may be offered for discussion in the shortest time to a broad, interested community. In order to assure the reproducibility of the published results the coding lists of the used programs should be included in reports about computer simulation.

The international character of this series is intended to be accomplished by including reports in German, English and French, both from universities and research centers in the whole world. To assure this goal, the editors' board will be composed of representatives of the different countries and areas of interest.

Interdisziplinäre Systemforschung
Analyse – Formalisierung – Simulation

Die Systemwissenschaft hat sich aus der Verbindung mehrerer Wissenschaftszweige entwickelt: der Regelungs- und Steuerungstheorie, der Kommunikationswissenschaft, der Modelltheorie und der Informatik. Sie erfüllt heute das Programm, das Norbert Wiener mit seiner Definition von Kybernetik ursprünglich vorgelegt hat und dessen Durchführung zu seiner Zeit durch die noch ungenügend entwickelte Computerwissenschaft stark eingeschränkt war.

Die Forschung und die praktische Anwendung der Systemwissenschaft bezieht heute sowohl die Fachleute der Systemwissenschaft als auch die Spezialisten der Anwendungsgebiete ein. In vielen Bereichen hat sich diese Zusammenarbeit mittlerweile bewährt.

Die Reihe «Interdisziplinäre Systemforschung» setzt sich zum Ziel, dem Studenten, dem Theoretiker und dem Praktiker über den neuesten Stand aus Lehre und Forschung, aus der Anwendung und der metatheoretischen Kritik dieser Wissenschaft zu berichten.

Dieser Rahmen soll noch insofern erweitert werden, als die Reihe in ihren Publikationen die mathematischen Modellierungsverfahren mit einbezieht, die in verschiedensten Wissenschaften in vielen Jahrzehnten zur Beschreibung und Optimierung von Systemen erarbeitet wurden.

Entgegen der früheren Tradition, in der die theoretische Regelungs- und Computerwissenschaft auf den Kreis der Mathematiker, Physiker und Ingenieure beschränkt war, liegt die Betonung dieser Reihe auf der Interdisziplinarität, die die Systemwissenschaft mittlerweile erreicht hat und weiter anstrebt. Stadt- und Regionalplaner, Psychologen, Physiologen, Betriebswirte, Volkswirtschaftler, Ökologen, Ernährungswissenschaftler, Soziologen, Politologen, Juristen, Pädagogen, Manager, Diplomaten, Militärwissenschaftler und andere Fachleute sehen sich zunehmend mit Aufgaben der Systemforschung konfrontiert oder sogar beauftragt.

Die ISR-Reihe wird Forschungsberichte – einschliesslich Dissertationen –, Vorlesungsskripten, Readers zu Vorlesungen und Tagungsberichte enthalten. Die Verwendung wenig aufwendiger Herstellungsverfahren soll dazu dienen, die Ergebnisse der Autoren in kürzester Frist einer möglichst breiten, interessierten Öffentlichkeit zur Diskussion zu stellen. Um auch die Reproduzierbarkeit der Ergebnisse zu gewährleisten, werden in Berichten über Arbeiten mit dem Computer wenn immer möglich auch die Befehlslisten im Anhang mitgedruckt.

Der internationale Charakter der Reihe soll durch die Aufnahme von Arbeiten in Deutsch, Englisch und Französisch aus Hochschulen und Forschungszentren aus aller Welt verwirklicht werden. Dafür soll eine entsprechende Zusammensetzung des Herausgeberremiums sorgen.

ISR 20

**Interdisciplinary Systems Research
Interdisziplinäre Systemforschung**

**Hartmut Bossel
Salomon Klaczko
Norbert Müller**

Systems Theory in the Social Sciences

**Stochastic and Control Systems
Pattern Recognition
Fuzzy Analysis
Simulation
Behavioral Models**

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Foreword

In an ever more complex and interrelated world, a better understanding of social systems and of the dynamics of their behavior is of crucial importance. Many of the tools holding promise of potentially significant contributions to the analysis of social systems have been, or are being developed outside of the social sciences proper, mostly the loose collection of diverse scientific approaches called 'systems science' or 'systems theory'.

The editors - all of whom are involved in social systems analysis - have made an attempt in this volume to pull together several aspects of systems science which appear to them to be of particular relevance to the study of social systems: Control systems, stochastic systems, pattern recognition, fuzzy analysis, simulation, and behavioral models. 29 authors from the disciplines of sociology, social psychology, political science, management science, history, behavioral science, economics, mathematics, engineering, and systems science have contributed to this truly interdisciplinary effort. All of them have made the attempt to write in a manner understandable by the non-specialist.

It is hoped that this volume will be of particular usefulness to students in the social sciences. Most of the articles are too short to provide much more than an initial stimulation. We trust that the references provided by the authors will allow deeper penetration into particular areas.

The book grew out of an interdisciplinary workshop sponsored and financed by, and held at, Zentrum für interdisziplinäre Forschung (ZiF; Center for Interdisciplinary Research) of the University of Bielefeld, Federal Republic of Germany, on 1 - 4 April, 1975. Most of the contributors attended the workshop; a few were recruited later to round out the presentations.

The editors record their appreciation to the directors of ZiF, to the individual authors who adhered to a tight schedule, and to Mrs. Dietlind Dippel who assisted in the editorial chores and did much of the typing.

August 1975

H. Bossel

S. Klaczko

N. Müller

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