

Knihy došlé do redakce / (Books received)

Self-Steering and Cognition in Complex Systems — Toward a New Cybernetics (*Francis Heylighen, Eric Rosseel, Frank Demeyere, eds.*). (Studies in Cybernetics 22.) Gordon and Breach Science Publishers, New York—London—Paris—Montreux—Tokyo—Melbourne 1990. xvi + 431 pages; \$ 57,—.

Multivariate Approximation and Interpolation — Proceedings of an International Workshop held at the University of Duisburg, August 14—18, 1989 (*W. Haussmann, K. Jetter, eds.*). (ISNM 94: International Series of Numerical Mathematics, Vol. 94.) Birkhäuser Verlag, Basel—Boston—Berlin 1990. xiv + 324 pages; 108 sFr.

P. P. Vypov, L. I. Salamatina: Konstruivovanie i funkcionirovanie programmnoho obespečenija dlja ASU. (Akademia nauk Ukrainkoj SSR — Institut ekonomiki promyšlennosti.) Naukova dumka, Kiev 1990. 156 stran; cena 1,60 Rb.

V. I. Skurichin, V. G. Kvačev, Ju. R. Valkman, L. P. Jakovenko: Informacionnye tehnologii v ispytanjach složnych objektov: metody i sredstva. (Akademija nauk Ukrainkoj SSR — Institut kibernetiki imeni V. M. Gluškova.) Naukova dumka, Kiev, 1990. 318 stran; cena 5.20 Rb.

V. M. Gluškov: Kibernetika, vyčislitel'naja tehnika, informatika — izbrannye trudy. Tom 3: Kibernetika i jejo priměnenija v narodnom chozjajstvě. (Akademija nauk Ukrainkoj SSR — Institut kibernetiki im. V. M. Gluškova.) Naukova dumka, Kiev 1990. 224 stran; cena 4,— Rb.

V. I. Gricenko, V. A. Bogemskij, A. A. Pančenko: Promyšlennyj transport. (Akademija nauk Ukrainkoj SSR — Institut kibernetiki imeni V. M. Gluškova.) Naukova dumka, Kiev 1990. 200 stran; cena 3,20 Rb.

Marián Zajko, Peter Závodný, Mojmir Kokleš: Technické prostriedky automatizácie systémov riadenia. Vydavateľstvo ALFA, Bratislava 1991. 344 strán; 20 tabuliek, 141 obrázkov; cena 28,— Kčs.

Gunter Schwarze: Digitale Simulation: Konzepte — Werkzeuge — Applikationen. (Informatik — Kybernetik — Rechentechnik 26.) Akademie-Verlag, Berlin 1990. 276 Seiten, 68 Abbildungen, 9 Tabellen; DM 54,—.

A. F. Katkov: Cifrovye modělirujuščie avtomaty. (Akademia Nauk Ukrainkoj SSR — Institut problem modelirovanija v energetike.) Naukova dumka, Kiev, 1990. 224 stran; cena 3,30 Rb.

József Varga: Angewandte Optimierung (Titel der ungarischen Originalausgabe: Alkalmazott programozás, Tankönyvkiadó, Budapest.) Akadémiai Kiadó, Budapest 1991. 378 Seiten; \$ 34,—.

JAMES S. ROYER

A Connotational Theory of Program Structure

Lecture Notes in Computer Science 273.

Springer-Verlag, Berlin—Heidelberg—New York—Paris—Tokyo 1987.

V + 186 pages; DM 31.50.

Investigation in language independent theory of program structure started at the beginning of eighties and fundamental results have been achieved since that time. A notion of control structure, the key notion of the monograph under review, is here much broader than in other theories,

such as program schemes by S. Greibach or denotational semantics by Scott and Stoy. It is well known, that program structure may be defined in arbitrary effective numberings, which represent in essence the class of all theoretically possible programming languages. A special subclass called acceptable numberings is a central concern of this monograph. Acceptable numberings are exactly those effective numberings, in which every control structure has an implementation. But which are the criteria for preferring one acceptable numbering to another? It is shown, that the complexity of control structure implementation provides a good measure of preference.

The whole treatise is divided into six chapters. In the first chapter the motivations, theoretical background of the theory of recursive functions and effective enumerations, including basic definitions, are given. In the second chapter the similarities between the structure of the Rogers semilattice and the upper semilattice of the recursively enumerable m -degrees are discovered. The technique of completions, often used when constructing effective numeration of various classes, is introduced. Typically, when defining a programming language, one defines a set of "base programs" and a finite set of basic control structure constructs. The language defined is a result of completing the base programs with respect to the predefined control structure constructs. Chapter 3 contains an important result introducing several effective numerations used in the rest of the treatise. Particular sets of control structure which characterize acceptability are introduced in the fourth chapter. Intuitively a characterization of acceptability with an independent set of control structure gives a kind of decomposition of the expressive power of acceptability into independent parts. These characterizations are fairly constructive. Chapter 5 deals with control structure independence. Interesting sets of structures are shown to be independent, all of them of size two, with exception of the set {loop, primitive recursion, conditional}. Question, whether this set characterizes acceptability remains however unanswered. The monograph is ended by considerations on programming properties of effective numbering of subrecursive classes.

The whole treatise is written with a high degree of mathematical preciseness, which necessary requires a certain degree of mathematical maturity of reader. The beginner will probably take profit of going through the first chapter, the advanced reader will find here a large amount of new results as well as the comprehensive references to the related literature.

Pavel Trska

HANS-MICHAEL VOIGT

Evolution and Optimization

An Introduction to Solving Complex Problems by Replicator Networks

Akademie-Verlag, Berlin 1989.

236 pages; 83 figs.; M 45,—.

The book, written in the research report style, is from the Mathematical Ecology Series. From the author's preface: "The primary goal of this work is to present an introduction to solving complex problems by selection pressure controlled replicator networks". A replicator equation $dx_i/dt = x_i((Gx)_i - (x, Gx))$ describes that the reproduction rate of x_i equals the score for strategy i minus the mean score for the total population. The controlled replicator equation has on the right hand side moreover an additive term $x_i(u_i x_i - \sum_j u_j x_j^2)$. By the means of the control variables u_i , the self-replication rates can be controlled completely independently. The application to graph partitioning problem, the module placement problem, and the travelling salesman problem are shown. The monograph culminates with design of integrated circuits and mapping strategies for multiprocessor systems. In the three appendices there are described the program for the travelling salesman problem, the program for the module placement problem, and the multilayer replicator network algorithms.

Antonin Vaněček

MARIE DUFLO

Méthodes récursives aléatoires

Mason, Paris—Milan—Barcelone—Mexico 1990.
359 pages, bibliography, index.

The book treats numerous topics from the identification and the control of stochastic systems in a rigorous way taking into account recent contributions to the theory.

The stochastic approximation methods form the basis to which the origin of the main tools for proving the convergence of recursive methods and their speed can be traced. In these tools the application of martingales is essential. The theory of vector martingales presented in the book contains first the laws of large numbers in a form suitable for proving the consistency of parameter estimates in general regression models and in linear systems, particularly in multidimensional ARMA models with exogeneous variables. The chapter entitled "Speeds" concentrates on additional information about the convergence of the estimation algorithms. The central limit theorem, the law of the iterated logarithm and their functional versions play here the important role. The stability of a model is introduced to mean the weak convergence of empirical measures to the stationary distribution. This notion of stability is applied to Markov chains in their particular instances: the functional autoregressive model and the iterative model. Kernel estimates of densities in the former model are covered. Controlled processes are dealt with in two chapters containing general results about controlled Markov chains, linear systems with a quadratic criterion, learning models and about the multiarmed bandit problem. The controlled functional autoregressive models are used to illustrate self-tuning controls based on nonparametric estimation.

By accumulating an extensive material around the theme of stochastic recursive procedures the author has produced a self-contained and original presentation of the subject. This together with 17 pages of references and bibliographical comments at the end of each section makes the monograph a valuable reference book.

Petr Mandl

ANDREAS BRANDT, PETER FRANKEN, BERND LISEK

Stationary Stochastic Models

Akademie-Verlag, Berlin, 1990.
344 pages, 4 illustrations; M 78,—.

Many probabilists have been appreciating the queuing theory as a discipline embracing many fine examples of intuitive probabilistic reasoning accumulated during the years elapsed from the invention of the Pollaczek-Kchintchine formula to the theory of queuing networks. Others insist on having all probabilistic theories incorporated into the measure-theoretical framework of the axiomatic approach. They are ready to sacrifice clarity and simplicity to their inclination to work with mathematically defined objects like sequences of numbers, mappings etc. instead of customers and machines. This is also the approach of the authors of *Stationary Stochastic Models*.

First two chapters of the book contain a very extensive study of the important recursive equation $X_{n+1} = f(X_n, U_n)$, where $\{U_n\}$ is a random sequence. The concept of a strong and a weak solution is introduced. Particular attention is paid to the Markovian case, when the disturbances are mutually independent and identically distributed. The inputs to queuing models are dealt with as marked point processes in Chapter 3. Then the transition from random sequences to processes in continuous time is described.

The second half of the monograph is devoted to $G/G/m/r$ queueing models. G/G means that the pairs of interarrival times and service times form a stationary sequence. There are $m \leq \infty$ servers and $r \leq \infty$ waiting places. Chapter 5 is devoted to existence theorems. Several known formulae (Little, Pollaczek - Kchintchine, Takács) are proved in Chapter 6 under general conditions. Systems with batch arrivals are treated next. The chapter on the continuity of queueing models explains the dependence of the probability distribution of the model on the distribution of the input process. The linear equation $X_{n+1} = B_n X_n + C_n$ with stationary coefficients is treated in the last chapter. A survey of main properties of stationary sequences and of the convergence in distribution is given in the Appendix. The list of references contains almost 300 items.

The monograph will be useful as a reference book for detailed proofs of facts often used in queueing theory.

Petr Mandl

GENNADIJ A. LEONOV, VOLKER REITMANN, WERNER TIMMERMANN, Eds.

Nonlinear Dynamics and Quantum Dynamical Systems

**Contributions to the International Seminar ISAM-90 held in Gaussig (GDR),
March 19—23, 1990**

Mathematical Research 59.
Akademie-Verlag, Berlin 1990.
168 pages; DM 24,—.

These Contributions to the International Seminar ISAM-90 were published as Vol. 59 of Mathematical Research. Aulbach and Hilger in Linear Dynamic Processes with Inhomogeneous Time Scale present a calculus which provides a smooth transition from the discrete- to the continuous-case. Belykh in Bifurcations and Attractors of Phase Systems consider esp. the Lorentz equation in the system rotator-oscillator. Hudetz in Algebraic Topological Entropy is concerned both with topological and algebraic variational principle. Kästner and Zylka in An Application of Majorization in the Theory of Dynamical Systems are concerned with accessibility problem. Kokschi's paper both title and summary is On Application of Ljapunov Functions and Comparison Systems to Analysis of Stability for Nonlinear Ordinary Differential Equations. Leonov in Orbital Stability and Problems of Nonlocal Dynamics is concerned with strong orbital instability as a characteristic of strangeness of attractors with application to Lorentz equation. Moebius in About the Structure of Conserved Quantities of Special Many-Body Systems, the special means one-dimensional particles. Narnhofer in K -Automorphisms in Quantum Theory is concerned with mixing properties. Quasthoff and Schüler in Cellular Automata and Symbolic Dynamics are considering onesided, one dimensional such automata. Reich's On a Geometric Characterization of Differential-Algebraic Equations was inspired by nonlinear electrical networks. Reitemann in Asymptotic Behaviours of Trajectories of Dynamical Systems on the Cylinder considers such systems as models of physe synchronization, coupled Josephson junctions and other systems with angular coordinates and introduces the feedback into such systems. Schneider and Wegner — On the Limits of Periods of Closed Trajectories Contracting to an Equilibrium Point contribute to the Hopf Bifurcation. Smirnova in Stability of Singular Distributed Dynamical Systems with Angular Coordinates was inspired by phase-lock loops and synchronous electric motors described by Volterra equations. Timmermann in Quantum Dynamics and Algebras of Unbounded Operators concentrates on the dissipative operators. Finally, Wunsch in his Mechanics from a System Theoretic Point of View is concerned with Markov processes.

Antonin Vaněček

G. P. MELNIKOV

Systemology and Linguistic Aspects of Cybernetics

Studies in Cybernetics 16.

Translation of: *Sistemologiya i yazikovye aspekty kibernetiki*, Soviet Radio, Moscow 1978.
Gordon and Breach Science Publishers, New York—London—Paris—Montreux—Tokyo—Melbourne 1988.

XIV + 440 pages; 9 figures; 212 bibl. ref.; \$ 198,—.

The book has three parts: Part I. The Essence of Systemology and its Concepts; Part II. Adaptivity and Reflection; Part III. Semiotics, Natural Language and Man-Machine Inter-course.

In Part I the author gives a detailed but concise explanation of the basic concepts related to systems as corporeal objects and their properties. These objects are formed by elements connected by links. The scheme of these links is the structure of the system. The nodes of this scheme represent the function of the individual elements of the system. The author gives precise terminological definitions and many deep and unusual interpretations, e.g. considering the link itself as a breach (or violation limit) of the boundaries between the elements (parts) of the object, or giving a flow interpretation of a link between these objects where the exchanged units are elements of certain deep-tiers of linked objects. Let us remark that the concepts studied are actual today where there is an interest focused on neural networks and on large-scale systems with interconnected centers. The author mentions the particular case of cellular structures. In general he defines the property of an object as its inherent ability to support (in certain circumstances) some types of links between objects and to hinder the realisation of other types of links. In many cases he finds convenient to speak of an object's properties as of its valencies, i.e. the capacities to participate in linking processes with other objects. Correlation between quality, quantity, form and structure of a system are discussed. Particularly important is the author's interpretation of adaptive systems: Let a meta-object (system) B be linked in the linkage network with a smaller intruded object A which maintains links also with other objects. When now the object A is torn away from B, a vacancy appears in B, which may then be filled up by another object C with its field of possible states, different from that of A. The object C has then to adapt to its function in the vacant junction of object B and B has to adapt to C in order to maintain its function in a higher meta-meta-system. Let us remark that this concept of adaptivity may be actual also in the renewal theory of impaired complex systems, in traumatology, teratology and modelling of growth and evolution. The author discusses the notion of the essence of the system, the system's determinants, the principles of system comparison, the problem of necessity and chance in the interaction of systems and presents the category of necessary functioning condition of a system. In this connection he shows that the essence of a forming system (in our terminology: of a formator) obtains its final definitions only when conditions for the creation and functioning of a system are realised after the development of a foundation. Other examined categories are the comparability, functionality, essentiality and use (utilitarian properties) of systems.

Part II deals with adaptivity and reflection as properties of systems. The system is the reflecting object, the change of any state of it as the effect of the influence on it of a reflected object is called the reflection. The primary deformation of the system is the direct imprint, an indirect imprint is the result of secondary deformation. The author discusses reflection as a property of adaptive systems and studies in detail the anticipation and advance reflection, particularly the resonance advance reflection of dynamic objects and quotes P. K. Anokhin's demonstration of the principle of advance reflection in the example of chemical processes in a living cell, and certain other conceptions. Further topics are e.g. the adaptive intensification of reflective properties, the objectivity and subjectivity of reflection, and mainly the differentiation of the "a priori gestalt" as an internal intentional pattern, which is inborn (or built into the automatic device) and of the

“a posteriori gestalt”. The author then treats symbols for designating objects and their properties in acts of reflection and functioning and formal methods of designating static characteristics of patterns and original patterns, the resemblance and contiguity relationships and types of associations and methods of designating them. Seventeen initial rules of reflection are given as well the rules of reflection of multi-component original patterns. Part II ends with considerations of abstractions, mainly of form \bar{o} logical abstractions and essence abstractions as forms of reflections and of their distinction and with views concerning the interaction of the identification and recognition processes.

Part III has five chapters: the first deals with the systemisation of basic concepts of semiotics. The author describes the scheme of the formation in an interpreter of a gestalt by resonant association with an occasional imprint of an observed object mediated by the interpreter's receptors and uses it to explain the sign, the denoter, and the sign situation. A classification of individual signs is given and isaesthetic interpreters, izogenic patterns and reversible simulations and reflections are explained. Then the communicative situation and the communicative act are described and types of communicative arcs and links, and abstract and concrete links presented. An interesting discussion concerns the pre-sign and the simplest communicative sign situation. For the latter a “pentagonal” scheme at least is necessary including the pattern of the sign in each of the interpreters and an example of the sign obtained as a result of reversible reflection. Let us remark that when dealing with the simplest sign situation (without the adjective communicative), the author uses the “quadrilateral” scheme: the sign, the denoter, the pattern of the sign and the pattern of the denoter associated with it (and not a “triangular” scheme).

The second chapter presents the types of communicative systems, starting with the simplest ones: the nomenclature and the calculations. The author then proceeds to the most complex ones, the natural languages. He uses this to explain the meaning, the sense, the linguistic sign, the speech sign, the moneme and comes to the first formulation of differences between artificial languages and communicative systems represented by natural languages. A deep discussion is devoted to questions of secondariness (regarding the observable reality) and of the material nature of signs and meanings.

The third chapter is concerned with the relation of language as a communicative mechanism to consciousness as an instrument of recognition and prognostication. Starting with meanings as specific communicative abstractions, the author discusses the concept of linguistic thinking, language and speech, the categories of linguistic form, substance and material. He makes abundant reference to the linguistic classics. The linguistic lexicological categories as polysemy, synonymy, homonymy etc. are explained on a three-dimensional Boolean cube of synsemic relations.

The fourth chapter considers the categories of the syntax and morphology of natural language and other occasional communicative systems. Cognominative syntactic meanings and senses are explained, as well as the predicative sense and predicative meaning. The principles of the division of communication into theme and reme, the nature of the parts of a sentence, the structure of a link text and parts of a speech are treated.

The fifth chapter deals with natural language and meaningful machine intercourse. The importance of structural modelling, the most widespread type of which is sign modelling, is stressed and the methodology of structuralism explained. The process of choosing the model and interpreting the sense of the model constructs is recognized as a creative part of researcher's work. The principles of translation of natural language texts by means of an information computer are explained. Conditions of the formal deductibility of senses and prime sources of the compatibility of senses of elementary utterances are discussed. The conditions for realizing meaningful discourse with a machine are treated on the example of so-called automated control system of an industrial enterprise, including the problem of sense revelation of the properties of economics texts denoters.

In conclusion the author pleads for: 1) formal structural modelling in the systemic approach

to a problem, 2) the re-checking of the essential conditions for structural modelling, 3) the confrontation of results of the formal solution with the structure and the substantial and material determinants of the object (system) by man (researcher, constructor). In such a way better solutions during creative work than by purely intuitive approach can be obtained by persons. The author sees in this principle the future of cybernetic automatic machines to produce creative acts and of the use of natural language in man-machine conversation.

The book can be recommended to all who are dealing with problems of communication and the interaction of man and machines (artefacts) in the wide field of Cybernetics. It provides a systematic insight into an area where (even if the very essence of man's thinking is not yet elucidated) the frontiers of knowledge are advancing.

Jiří Beneš

F. HEYLIGHEN, E. ROSSEEL, F. DEMEYERE, Eds.

Self-Steering and Cognition in Complex Systems. Toward a New Cybernetics

Gordon and Breach Science Publishers, New York—Philadelphia—London—Paris—Montreux—Tokyo—Melbourne 1990.

xvi + 431 pages; 73 figures; 644 bibl. ref., price \$ 57,—.

This is a collection of 26 papers, well editorially homogenized and meaningfully classified into six sections, stemming mostly from presentations at an international symposium of the same name in May 1987. Its organizers were the editors, all members of the Transdisciplinary Research Group of the Free University of Brussels. Among the contributors are Lars Löfgren (Sweden), Humberto Maturana (Chile), Gordon Pask (United Kingdom) and others.

The book is the expression of the quest for the creation of a new transdisciplinary paradigm, centred around self-organization in complex systems, embodying the faculty of self-steering and cognition, which would provide for an emerging "new Cybernetics". Of course, there are differences of opinions and views among the contributions, which makes the book valuable. Let us remark right, that even till now Cybernetics was concerned with self-organizing systems on which a wealth of ideas and knowledge has been accumulated.

Still, as F. Heylighen (Brussels) points out in his introductory paper in Section I, there are two at first sight opposing views about the relation between cognition and autonomy: the paradigm of "artificial" systems in the sense of H. Simon, the behaviour of which is almost completely determined by the complexity of the environment to which they are adapted, and the paradigm of "autopoietic" systems (in the sense of H. Maturana and F. Varela) the behaviour of which is primarily determined by their internal organization and not by their input. The peculiarities of complex systems with their multitude of elements and their interconnections, which are subject both to strong internal interactions between the "self" and the production processes and to weak external (input and output) interactions, lead toward the new integrative paradigm of self-organization in complex systems, which could be, as F. Heylighen concludes, a basis of a science of complexity, integrating existing approaches such as Cybernetics, systems theory, cognitive science, artificial intelligence, theories of self-organization and autopoiesis a.o. At this moment, the referee wishes to remark that the main problem in self-organization, that of the essence of the "self", still remains frankly open — this is one reason of the attractiveness of the book trying to shed some light from different sides upon its manifestations. A second introductory paper, that of E. Rosseel (Brussels) is concerned with new Cybernetics and Social sciences, formulating also some own vision of the society of the future with lessening role of supra-individual institutions such as firms, families and schools and increasing individual's autonomy, and discussing problems of social interaction. A panel discussion on Old and New Cybernetics concludes the general introduction to the problem domain.

Section II is devoted to System-Theoretical foundations of Self and Cognition and contains

six papers. That of L. Löfgren (Lund) considers self-reference and autonomies as linguistic phenomena. Interesting are his views on viral self-description in genetic language and on self-repair, applied to DNA, perhaps conceivable as an autolinguistic phenomenon. W. v. Lucadou (Utrecht) considers the similarity in the formalism of quantum theory and of the formal description of complex systems and argues that only autonomous systems, exceeding a certain degree of complexity may show "quantum-like" features in their behaviour. F. Heylighen presents autonomy and cognition as the maintenance and processing of distinctions. R. Glanville (Amsterdam) examines in detail the generation of the concepts of "the self" and of "the other". E. Rosseel analyses Selves and Egos of social systems and the concept of self-steering. K. and C. James (U.K.) describe the cybernetics of the drawing process (the fundamental graphic act), stressing the direct visual perception.

Section III contains contributions about Self-Organization Models of Cognition. M. Stadler and P. Kruse (Bremen) analyse the relations between the principles of self-organization — especially of cognitive systems — and Gestalt theory. R. Maurer and Z. Schreter (Geneva) give an excellent paper on sensory-motor spatial learning in connectionist artificial organisms, quoting the importance of neural networks for connectionist robots and simulating the behaviour and ability to learn spatial relations by ethological experiments on golden hamsters. D. M. Dubois (Louvain-La-Neuve) describes a generative model with 7 levels of the development of intelligence by self-learning.

Section IV concerns Interpersonal Interaction. Two papers deal with problems of psychotherapy: one by V. Kenny (Dublin) analyzing the organization of psychotherapeutic conversations in such a way, that the therapist conserves his identity and avoids being steered by the patient's transferences, and the second by A. Goudsmit (Groningen) concerning in detail the occurrence of organizational closure in psychotherapeutic interactions. G. Van der Linden (Brussels) deals with empirical investigation of cognitive shifts during a negotiation situation. G. Pask develops certain formal features of conversation theory and of a protolanguage able to express knowledge and belief consisting in concepts that are shared (exchanged between participants) and their relations.

Section V contains four papers about Interactive Decision-Making and Computer Models. Among them, the paper of M. Despontin (Brussels) uses multi-objective linear programming models in problems of quantitative economic policy. J. Klabbers and W. Scheper (Utrecht) discuss design methods for the improvement of self-steering of social systems. B. R. Hornung (Marburg) considers culture as the collective cognitive system of a society and treats cognitive steering and control mechanisms in social systems.

Section VI deals with Cybernetics of social systems. In six papers problems of Socio-Cybernetics, of autopoiesis of social systems, of self-reference in social studies of Science a.s.o. are treated in an erudite but comprehensible way, including an attempt to clarify the notion of a "social system". Among them the paper by R. Starkermann (New Brunswick) about "War of everybody against everybody — Mathematical Model" deserves special attention. It studies a three-party system with mutual communication, where each party strives towards its own goal and the mutual relationships may be devotional, aggressive or destructive. The structural diagram of this system is analogous to a multivariable servomechanism. The stability domains are studied on three-dimensional diagrams and the results are very illustrative, e.g. in the form of fatal outcome if everybody is strongly against everybody a.s. o. A valuable paper is also that of W. Kohn and G. Küppers (Bielefeld) treating Science as a self-organizing system.

The book encompasses a large area of knowledge and of new ideas concerning self-organization in complex systems, which may be considered as a progressive trend in Cybernetics. It can be recommended to those who deal with self-organizing complex systems both in natural sciences and in social sciences and to all who wish to get insight into the development of viewpoints and ideas in Cybernetics.

Jiří Beneš

KEN PEDERSEN

Expert Systems Programming – Practical Techniques for Rule-Based Systems

J. Wiley, New York—Chichester—Brisbane—Toronto—Singapore 1989.

Strán XVII + 298; 40 obrázkov, 5 tabuliek; cena 34,— DM.

Kniha je adresovaná návrhárom expertných systémov či už z oblasti obchodnej, priemyselnej alebo vedeckej, ktorým je postupne vysvetľovaný proces získavania a štruktúrovania poznatkov do aktuálneho expertného systému. Obsah knihy sa sústreďuje najmä na

- prototypový prístup z hľadiska včasného podchytenia kritických problémov
- možnosť používania faktora neurčitosti
- jednoduché ale efektívne modely procesu získavania poznatkov
- organizovanie bázy poznatkov a písanie „dobre štruktúrovaných pravidiel“.

Publikácia je rozdelená do troch častí. Úvodná časť oboznamuje čitateľov s predmetom expertných systémov, definuje základnú terminológiu, definuje základné komponenty expertných systémov, radí pri výbere poznatkov a vysvetľuje základné bloky a atribúty pravidlovo orientovaných systémov. V tejto časti je poukazané na to, že proces spätného reťazenia nie vždy predstavuje vhodnú stratégiu prehľadávania pravidiel. Na príkladoch je ukázaný postup priameho reťazenia a tiež aj zmiešaného reťazenia.

V druhej časti sa skúmajú špecifické problémy, ktoré vznikajú pri vytváraní expertného systému. Sú to: zdôvodňovanie informácií typu KNOWN a UNKNOWN, reprezentovanie viachodnotových informácií, používanie faktora neurčitosti a väzby expertného systému s okolím.

Tretia časť opisuje proces tvorby bázy poznatkov počnúc získaním poznatkov a ich translácie do prototypu až po organizáciu a techniky testovania bázy poznatkov. Sú tu ukázané metódy písania štruktúrovaných pravidiel, ktoré vyplývajú z princípov štruktúrovaného programovania.

V appendixe je podrobne uvedená štruktúra pravidla s použitím faktora neurčitosti a s použitím informácie typu KNOWN a UNKNOWN. Sú ukázané aj príklady viacerých systémov s odlišne definovaným faktorom neurčitosti. Zrozumiteľný výklad knihy dotvára slovník použitých pojmov s popisom ich významu.

Uvedené dielo zaplňa medzeru medzi teóriou o expertných systémoch a ich praktickým používaním a slúži ako sprievodca pre tvorcov pravidlovo orientovaných systémov.

Jana Parížková

D. H. NORRIE, H. W. SIX, Eds.

Computer Assisted Learning

3rd International Conference ICCAL, 90, Hagen, FRG, June 1990. Proceedings

Lecture Notes in Computer Science 438.

Springer-Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo—Hong Kong 1990.

Strán vii + 466; DM 76,—.

Medzinárodná konferencia o počítačom podporenom učení ICCAL' 90 je už v poradí treťou konferenciou. Konala sa v júni 1990 na univerzite v Hagene. Prvá konferencia sa uskutočnila v roku 1987 na univerzite v Calgary, druhá bola v roku 1989 na univerzite v Texase. Programový výbor tvorili najmä pracovníci univerzít z rôznych štátov (Taliansko, V. Británia, Francúzsko, Maďarsko, Nemecko, Rakúsko, Afrika, India, Nórsko, USA, Kanada).

Zborník obsahuje 30 príspevkov, ktoré pokrývajú široký okruh témy o učení za podpory počítača (CAL). Príspevky sú rozdelené do nasledujúcich skupín: Invited Papers, AI Applications in CAL, Simulation Tools, Models of Reasoning and Learning, Student Modelling, CAL Tools, Hypermedia Environments and Instruction, Evaluation of Learning Environments, General CAL, Intelligent Educational Systems, Media Based CAL.

V úvodnej skupine príspevkov sa hovorí na všeobecnej úrovni o mieste počítačov vo vyučovaní, o stále nedostatočnom programovom vybavení pre učiteľov a študentov a potrebe tvorby databázy výučbového materiálu.

V druhej skupine príspevkov je opísaný interaktívny systém pre plánovanie vizuálnych programov a systém na manipuláciu s grafickými objektami. Ďalší príspevok prezentuje program na dokazovanie viet v logike 1. rádu.

Tretia skupina príspevkov sa dotýka experimentálnych simulačných produktov.

V ďalšej skupine príspevkov sa opisujú modely na získavanie poznatkov najmä na vizuálnom podklade.

V príspevkoch, ktoré sa zaoberajú modelovaním študenta, sa niektorí autori opierajú o kognitívnu teóriu ľudského učenia a pamätania, aby mohli vytvoriť model študenta, iní analyzujú rôzne techniky modelovania študenta.

V skupine príspevkov venovanej prostriedkom tvorby výučbových systémov CAL je opísaný program umožňujúci študentovi analyzovať a kritizovať napísaný text. Program je vytvorený podľa princípov návrhu výučbových systémov CAL a obzvlášť sa opiera o "myslenie kritikou", ktoré je používaným pojmom v pedagogickej teórii (str. 214). Ďalší autor skúma spotrebu času počas činnosti systému CAL, ktorá je závislá aj od technickej konfigurácie počítača. P. Gillard opisuje príklad jazykového prostriedku, implementovaného prirodzenejším spôsobom, než poskytuje menu alebo hypertext. Ovšem ďalšie tri príspevky sa venujú práve hypertextom, ktoré sú odporúčané v súvislosti s výučbovým materiálom. T. Jones sa snaží odpovedať na otázky ako, kedy a prečo používať hypermédiá.

Ďalšie tri príspevky zaradené do skupiny General CAL sa zaoberajú interaktívnym programom pre stroje s operačným systémom UNIX, tvorbou inteligentného software-u na báze umelej inteligencie a hodnotením systémov CAI.

Medzi implementované inteligentné výučbové systémy boli zaradené WOMBAT (rozhodovacie procesy), WordTutor a PrologTutor.

V závere zborníka sa hovorí o databázových systémoch vo vyučovaní, o výučbových systémoch v Číne a o systémoch CAL ako prostriedkoch na učenie hudby.

Zborník prezentuje veľký počet konkrétnych implementovaných systémov na podporu vyučovania, z ktorých väčšina má grafické vstupy a výstupy. Hoci sa realizovateľné systémy pridržiavajú základných princípov tvorby CAL, málo príspevkov prináša teoretický pohľad na tvorbu týchto systémov.

Jana Parížková

KAROL HODINÁR

Štandardné aplikačné programy osobných počítačov

Alfa — Vydavateľstvo technickej a ekonomickej literatury, Bratislava 1989.
Stran 269; 132 obrázků, 27 tabulek; cena 30,— Kčs.

Kniha vyšla v listopadu 1989 a je určená široké obci užívateľů osobných počítačů. Klade si za cíl seznámit nové uživatele s nejtýpčtějšími aplikačními oblastmi — databázové systémy, tabulkové programy ("spreadsheets") a textové editory.

V první části se autor zabývá technickými a programovými prostředky osobních počítačů.

Pro začínající uživatele přináší řadu užitečných informací, souhrnně a srozumitelně vysvětlených, včetně základní informace o operačních systémech CP/M a MS-DOS.

V dalších kapitolách se autor věnuje jednotlivým aplikačním oblastem. Z výběru standardního programového vybavení, které autor popisuje, je však názorně vidět, jak se v této oblasti situace velmi rychle mění a informace platné snad v době psaní rukopisu jsou již dosti zastaralé v okamžiku vydání knihy (zvláště při výrobních lhůtách knih). Autor se totiž zaměřuje převážně na aplikační vybavení pro 8-bitové počítače, které jsou v dnešní době poměrně levných 16-bitových IBM-PC kompatibilních počítačů již anachronismem.

Z databázových systémů je věnována největší pozornost systému dBASE II, který se na 16-bitových počítačích vůbec nepoužívá. Již v době vydání knihy byl "standardem" systém dBASE III+, kterému je věnováno v publikaci bohužel daleko méně prostoru. Naštěstí je většina informací, týkající se např. programování v dBASE II, použitelná i pro programování v dBASE III+. O poslední verzi dBASE IV je v podstatě pouze zmínka. Škoda, že se autor alespoň nezmínil o dalších programových systémech z této oblasti, které byly u nás populární již v okamžiku vydání knihy, jako FoxBase. Kromě toho již v roce 1985 byl uveden na trh databázový systém PARADOX, který jako první zavedl vyhledávání prostřednictvím "dotazů dle příkladů" (metoda QbE — Query by Example), a který byl v roce 1989 vyhodnocen jako softwarový produkt roku a v dalších odborných hodnoceních je hodnocen nejvýše za všech databázových systémů.

Přes tuto závažnou připomínku je třeba ohodnotit kladně uvedené příklady evidence zájezdů fiktivní cestovní kanceláře a zejména systém programů pro knihovni služby, uvedený v příloze. Tyto příklady mohou i zkušenějšímu uživateli dBASE přinést řadu podnětů, jak si napsat sám určité programy.

V další části se autor věnuje známým programům pro tabulkové výpočty SuperCalc, Multiplan a zejména populární Lotus 1—2—3. Kapitola je zpracována dobře.

Poslední část publikace se věnuje textovým editorům, bohužel se však omezuje pouze na editor WordStar, který sice dosáhl ve světě kdysi značné popularity, ale přesto není rozhodně u nás dnes nejpoužívanější. Chybí alespoň zmínka o editorech typu WYSIWYG (What You See Is What You Get), nebo systémech pro tvorbu publikací (různé "desk top publishing" systémy). Uživatelé by se měli alespoň dozvědět o existenci dalších u nás velmi rozšířených editorů: WordPerfect, CiiWriter (multifontový editor pro vědecké texty) nebo dokonalý systém Latex, který je ovšem vhodný v kombinaci s laserovou tiskárnou. Zde ovšem opět platí, že autor vycházel ze situace platné v době psaní knihy.

Publikaci je možno doporučit začínajícím uživatelům systémů dBASE, uživatelům popsaných tabulkových programů a uživatelům textového editoru WordStar.

Pavel Pudil

PAUL A. FISHWICK, RICHARD B. MODJESKI, Eds.

Knowledge-Based Simulation — Methodology and Application

Advances in Simulation 4.

Springer-Verlag, New York—Berlin—Heidelberg—London—Paris—Tokyo—Hong Kong—Barcelona 1991.

Stran XVI + 294; 78 obrázků; cena neuvedena.

Knihy má podtitul Methodology and Application a dle něho je dělena na dvě části, metodologii a aplikace. První část odpovídá zcela skutečnosti, která dnes ve vztahu simulace a modelování je: obě strany vytvořily řadu metod a technických prostředků, které jsou nepochopitelným způsobem takřka nepřevoditelné z umělé inteligence na simulaci či naopak. Zaměření knihy, jmenovitě na znalostní přístup, omezuje poněkud výběr prostředků vzniklých v rámci umělé inteligence, takže první část knihy informuje mnohem konkrétněji než dřívější publikace o vztahu umělé

intelligence a simulace: zatímco dřívější publikace bychom mohli přirovnat k návodům, jak cestovat ve zcela neznámé zemi, sestaveným autory, kteří takto nikdy necestovali, knihu, kterou zde popisujeme, lze přirovnat k reportáži cestovatelů, kteří počítají s tím, že v zemi, kterou jako první navštívili, budou založena města a že tato země bude civilizována, avšak sami zatím jen na příhodných místech založili tábory či tvrze.

Všechny příspěvky — a to obou částí — totiž přináší řadu konkrétních programových produktů a aplikací, která je podnětná, avšak netvoří dosud nějaký ucelený systém. Pokusy o formulaci takového systému jsou sice v mnoha příspěvcích, avšak zdá se, že se mnoho neliší od dřívějších pokusů, které byly vlastně jen výčty tematických okruhů umělé inteligence. Za zmínku však stojí jistý pokrok v chápání synthesy simulace a umělé inteligence: hned v prvním článku po předmluvách píše jeho autor N. R. Nielsen, že objektivě orientované programování vzniklo před 20 léty v oblasti simulace, avšak bylo odborníky v simulaci ignorováno, takže se rozvinulo v oblasti umělé inteligence. Toto sdělení ze strany amerického odborníka, tedy odborníka ze světadílu, kde se až dosud tento vztah neznal či záměrně potlačoval, snad bude stimulovat to, že se intenzivněji naváže na přehlížené bohaté a dvacet let vznikající základní principy vztahů, které mezi znalostním přístupem a simulací nejen existují, ale byly už bohatě doloženy aplikacemi.

Až donedávna se vydávaly hodnotné knihy o simulaci, v nichž byla sama simulace vymezena tak, že si knihy vzájemně odporovaly. To odpovídá velmi bohatému spektru metod i aplikací simulace, které bylo možno velmi obtížně zvládnout celé a při tom přesně. Tento fakt se projevuje i na aplikacích simulace vycházející ze znalostního přístupu: je velkým přínosem pořadatelů knihy, že nějaká sporná pojetí simulace eliminovali. Spektrum aplikací je ovšem široké a dnes těžko uspořádatelné — od spojitě simulace, v níž má znalostní přístup specifickou funkci — přes simulaci diskrétní, až po vztahy k animaci, kognitivnímu modelování a dalším.

Kniha je čtvrtým svazkem série *Advances in Simulation* a zapadá do ní nejen svou vysokou kvalitou, ale i tím, pro které čtenáře je určena: totiž pro čtenáře, kteří už za sebou cosi z námětu knihy mají — zde ze simulace i ze snahy aplikovat znalostní přístup — takže není učebnici, nýbrž nabízí už zaběhnutým profesionálům, že v ní najdou bližší i vzdálenější cenné podněty pro budoucí práci.

Evžen Kindler

DAVID ANDERSON

Artificial Intelligence and Intelligent Systems

Ellis Horwood Ltd., Chichester and Halsted Press: John Wiley & Sons, New York—Chichester—Brisbane—Toronto 1990.

178 pages.

The modern society lives with computers and its members, willynilly, deal with them. The contact between man and machine became closer and for the special features of the "artificial brains" also more personal.

The consequences of the computerization for the human society, relations between people and computers, and the philosophical aspect of artificial intelligence became topical for relatively wide group of people. The referred book was written exactly for them.

Except a few formulas of elementary logic used in Chapter 5, no mathematical symbols appear in the book. Its style is pleasantly essayistic, complex problem of the philosophy of man-machine co-existence are presented clearly and vividly.

Even the titles of chapters, namely "What computers have to do", "What computers seem to do", "What computers can't do", "What some computers can't do", "A classical problem" and "Living with computers" illustrate the way chosen for the explanation of the author's ideas.

The main question dealt with the book is the problem of accessibility of the *artificial intelligence* as such. The author explains the idea of the classical Turing criterion and also examples of the computer programmes which seem to fulfil this criterion not being intelligent in the common sense. Proportional attention is paid to the arguments of the opponents of the artificial intelligence idea. Their objections against the principal possibility of the creation of artificial thinking are widely specified and discussed. The same concerns the natural limits of the logical formalization of normal human thinking. On the other hand the author also carefully analyzes the essential features of life and describes their analogies in the machine existence and activity.

It should be said that the author sides the idea of artificial intelligence and the border between life and non-life is shown as being very indefinite. In principle he prefers the idea of the potential co-existence of human and machine "life" in all its fundamental aspects.

The referred book is not a mathematical one. But every specialist in computer and information sciences interested in the wider social aspects of his domain should read it. It is not only useful but also very pleasant.

Milan Mareš