COST 274 TARSKI

Theory and Applications of Relational Structures as Knowledge Instruments

Books, Theses, and Publications

August 2004

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Preface

COST 274 TARSKI has a structure quite different from other COST actions — a fact deserving explanation.

The original proposers of the action found out that rather similar relational mechanisms were being reinvented all over again in a variety of application fields. In the examples of fields given here, one would not easily detect any interrelation — the proposers, however, did.

1 The administration of health services in different countries has collected a huge amount of data on patients with regard to illnesses, e.g. The classical approach is to analyse this data using statistical methods. It has, however, been shown that statistics used indiscriminately (i.e., without relational care) may deliver structurally erroneous results. This applies *mutatis mutandis* to applications found in *traffic prediction*, *analysis of forest damage*, or *data mining/warehousing* in general.

2 In social choice theory, one studies procedures to aggregate individual preferences with respect to candidates or political parties to a common or social preference. It turns out that the outcome is determined rather by the procedure than by the individual preferences and that for practically all procedures there are many counterintuitive results. The question is, under which conditions one can design "good" procedures. If the procedure is one of proportional representation, in general coalitions are needed in order to form a government. Can one construct stable governments, given the preferences of the different parties?

3 Banks have collected considerable amounts of data concerning transactions and their results, and they would very much like to deduce rules to improve future performance. When a multitude of (qualitative) criteria is present and not just one, it is a challenging task to aggregate these data, a procedure for which discrete Sugeno or Choquet integrals have been invented. Aggregation for data given in the form of real numbers is comparatively simple: often just a linear form with some coefficients is applied. It is evident that one then loses all information on which items really contribute to he final sum. This is undesirable for decision making.

4 Fuzzy control is by now considered an indication for a high quality washing machine, e.g. Engineers have learned to handle qualitative data *too high in temperature*, *water below intended level* and to reason on how the device should react. Fuzzy logic represents facts such as $a \in A$ by a (real-valued) membership function for a, specifying the degree of membership of a in A. Relational theories allow the possibility of tracing the reasons for such degrees of membership.

5 While we have analytic geometry and linear algebra available to handle 2D-information from video input, we quickly become aware of the restricted resolution of such devices. The concepts of *point* and *line* are then often inadequate as they give results not properly represented by pixels. So the roughness of resolution of the input device has to be related to the incomplete possibility to express the result precisely on the screen output. This brought to existence schools for spatial reasoning using relations, partly based on early Polish investigations on mereology by Stanisław Leśniewski from about 1930.

6 Given the widespread applicability of relations, it is not surprising that investigations have also been started to reconsider relativity theory from the point of view of relations. While not a focus of our action, it has to be reported when collecting existing relational approaches. We note in this context that quantum effects are also concerned with uncertainty.

7 Closely related to such work is that of the community of logicians. While often working on self-posed problems — and thus drilling holes of breadth ε and depth ∞ — they found their breakthrough to practical applications, be it in multivalued logics, in the respective proof systems, etc. These mostly converge to relational and modal logics, these being typically formulated in a relational way at the semantic level.

8 Yet another task occurs when a rectangular table of values is given with single items missing (as often occurs in business administration). How can one, under reasonable assumptions, reconstruct a missing entry (an imputation as opposed to amputation). It has been discovered that such assumptions are naturally formulated using relational algebra.

9 While there is some tradition in using relations in semantics of programming languages, now related formalisms like Kleene algebras and fixpoint calculi have been developed; lots of other applications around software have been identified: The tabular method for high security software put forward by David Parnas in Canada, the analysis and development of software systems and efficient algorithms, foundations of specification, transformation and refinement, techniques for compiler optimization and concurrency control, etc. Popular formal methods like B, Z or Alloy are based on relational reasoning.

10 Many will know the spectacular result of John von Neumann that every real-valued rectangular matrix $A = (a_{ij})$ has a uniquely determined game value v. This number has the property that for all column vectors $c = (c_j)$ and row vectors $r = (r_i)$ with nonnegative coefficients in both cases summing up to 1, i.e., for all mixed strategies, we have $\sum_j a_{ij}c_j \geq v$ as well as $\sum_i a_{ij}r_i \leq v$. In many cases this leads to uniquely determined strategy vectors c, r, while in others a diversity of strategy vectors will exist, where it is rather difficult to keep track of — if not using relational means.

COST 274 TARSKI is not intended to divert the course of individual researchers from their present missions. Rather, the purpose of COST 274 TARSKI is intended to inform them on what is going on in all the areas they are increasingly considering to be very close to their own.

- The person or group having developed a sophisticated computer program and lacks real-life problems to apply it to may be brought in contact with the application fields.

- The person or group having developed sophisticated deduction or proof systems may be informed on application specific issues such as rules for transitions under vagueness.

- A major cross-fertilization occurs when persons or groups are suggested to slightly adjust their basic definitions so as to subsume their field under the general framework.
- Should a commonly accepted notation evolve together with a set of computer programs, it might be a great help for teaching students in a way oriented towards future developments.

Even for the chair and the work area chairpersons it is not a simple task to oversee all these activities. While we are confident that the activities reported below are all more or less directly related to our common topic, we are certainly not familiar with every detail reported.

All the more are we devoted to focus the diversity of fruitful developments and make them a strong, new, and commonly understood technology, not least teachable to students.

August 2004

Gunther Schmidt
Chairman of COST 274

Books

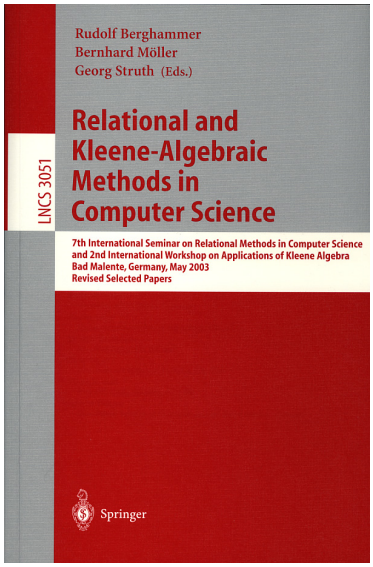
Rudolf Berghammer,
Bernhard Möller, and Georg Struth (Eds.)

Relational and Kleene-Algebraic Methods in Computer Science

7th Internat. Seminar on Relational Methods in Comput. Sci.
2nd Internat. Workshop on Applications of Kleene Algebra
Bad Malente, Germany, May 2003, Revised Selected Papers

Lecture Notes in Comput. Sci. 3051, Springer 2004

ISBN 3-540-22145-X, 279 pages



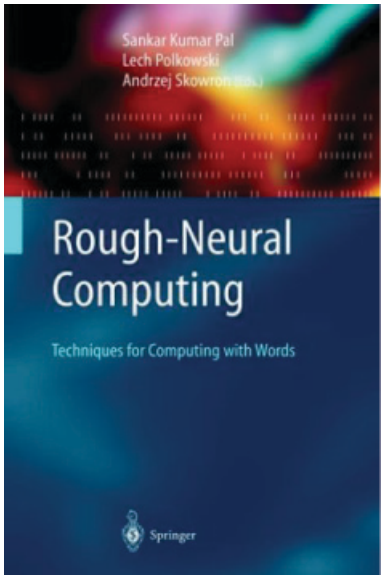
Sankar Kumar Pal, Lech Polkowski,
and Andrzej Skowron (Eds.)

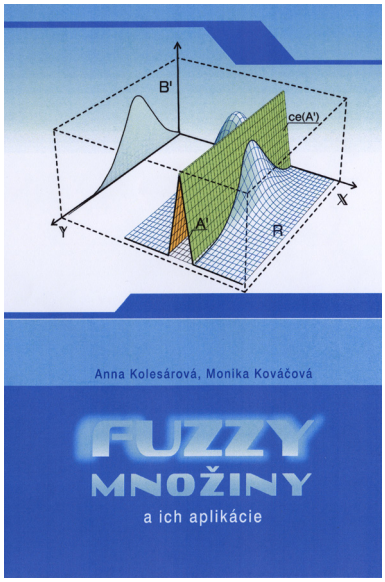
Rough-Neural Computing Techniques for Computing with Words

Cognitive Technologies

Springer, 2004

ISBN 3-540-43059-8, 734 pages





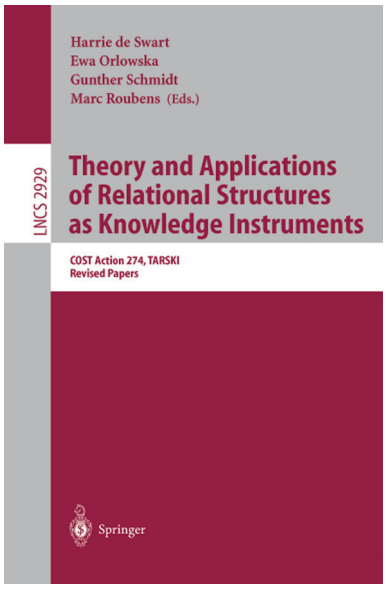
Anna Kolesárová and Monika Kováčová

Fuzzy Množiny
— a ich aplikácie

Slovenská technická univerzita v Bratislave,
Vydavateľstvo STU, 160 pages

2004

ISBN 80-227-2036-4



Harrie de Swart, Ewa Orłowska,
Gunther Schmidt, Marc Roubens (Eds.)

Theory and Applications of Relational Structures as Knowledge Instruments

Springer 2003

Lecture Notes in Computer Science 2929
COST Action 274 TARSKI

ISBN 3-540-20780-5, 273 pages

Rudolf Berghammer and Bernhard Möller (Eds.)

7th Seminar RelMiCS in combination with 2nd Workshop Kleene Algebra

Institut für Informatik und Praktische Mathematik,
Christian-Albrechts-Universität zu Kiel, 2003

Participants Proceedings, 297 pages

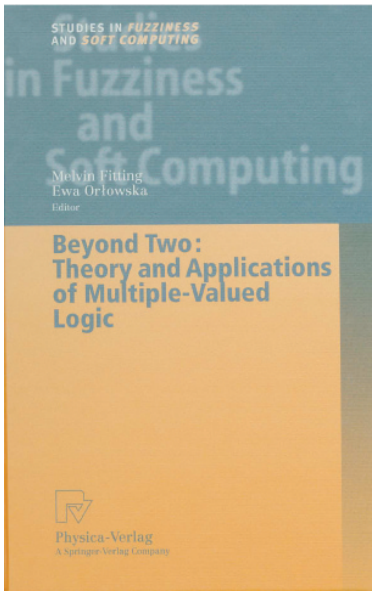
Melvin Fitting and Ewa S. Orłowska (Eds.)

Beyond Two:
Theory and Applications of Multiple-Valued Logic

Studies in Fuzziness and Soft Computing 114

Physica-Verlag, 2003

ISSN 1-434-9922, ISBN 3-7908-1541-1, 374 pages



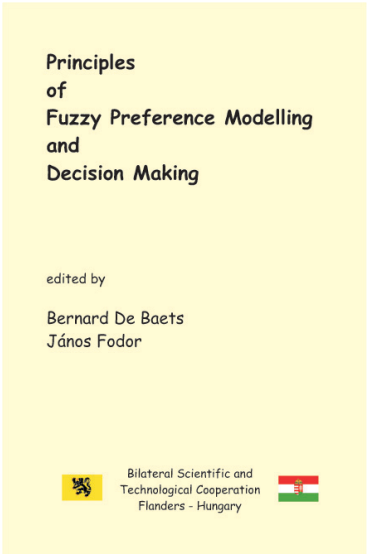
Bernard De Baets and János Fodor (Eds.)

Principles of Fuzzy Preference Modelling and Decision Making

Bilateral Scientific and Technological Co-operation Flanders-Hungary

Academia Press 2003

ISBN 90-382-0567-8



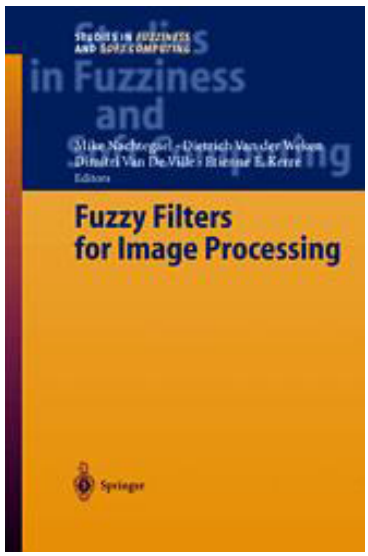
Mike Nachtegael, Dietrich Van der Weken, Dimitri Van De Ville, and Etienne E. Kerre (Eds.)

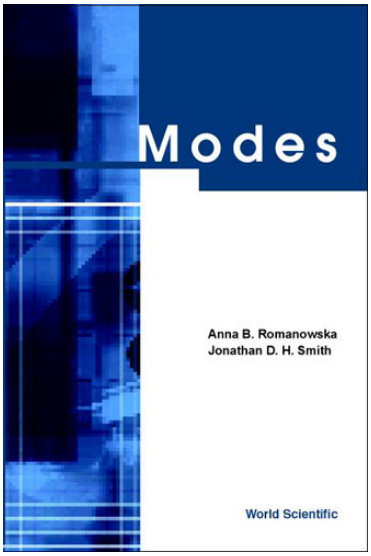
Fuzzy Filters for Image Processing

Studies in Fuzziness and Soft Computing

Springer 2003, 386 pages

ISBN 3-5400-0465-3



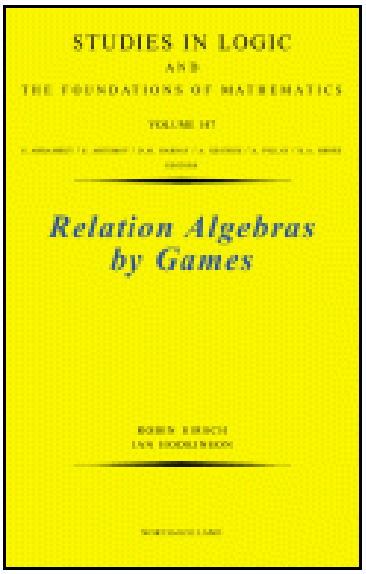


Anna B. Romanowska, Jonathan D. H. Smith

Modes

World Scientific, Singapore, 2002

ISBN 9-810-24942-X, xi + 623 pages



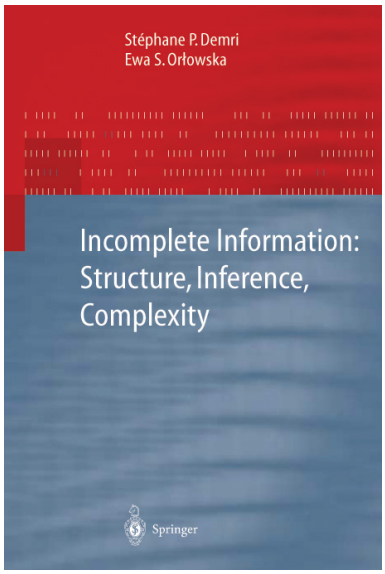
Robin Hirsch and Ian Hodkinson

Relation Algebras by Games

Studies in Logic and the Foundations of Mathematics, 147

North-Holland 2002

ISBN 0-444-50932-1, 712 pages



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Incomplete Information: Structure, Inference, Complexity

Springer 2002

Monographs in Theoretical Computer Science

ISSN 0020-0255, 405 pages

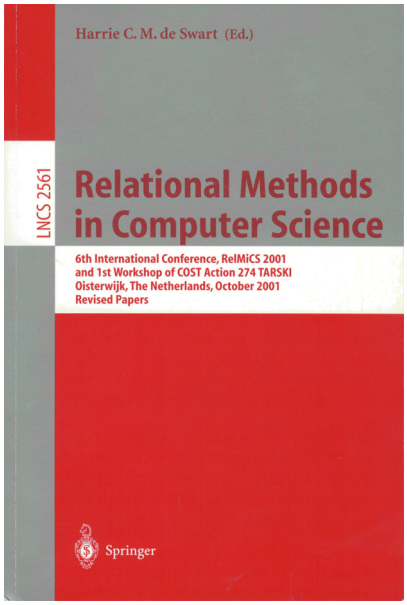
Harrie de Swart (Ed.)

Relational Methods in Computer Science

Springer 2001

Lecture Notes in Computer Science 2561
Proc. of the 6th International Conf. RelMiCS 6
and 1st Workshop of COST Action 274: TARSKI
Oisterwijk, The Netherlands

ISSN 0065-9266, 313 pages



Ph. D. and Habilitation Theses

Ulf Milanese

On the implementation of a ROBDD-based tool for the manipulation and visualization of relations

(in German)

λογος 2003

Christian-Albrechts-Universität zu Kiel

Eric Offermann

On the Construction of Relational Categories

Fakultät für Informatik
Universität der Bundeswehr München 2003

ISBN 3-89959-078-3, 230 pages

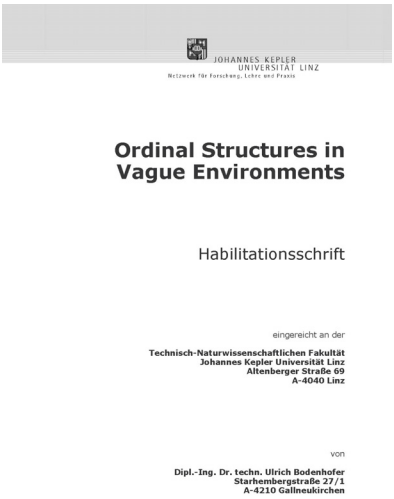
Der Andere Verlag, Osnabrück

Ulrich Bodenhofer

Ordinal Structures in Vague Environments

Habilitation Thesis

Johannes Kepler Universität Linz, Austria 2003


JOHANNES KEPLER UNIVERSITÄT LINZ
Netzwerk für Forschung, Lehre und Praxis

Ordinal Structures in Vague Environments

Habilitationsschrift

eingereicht an der
Technisch-Naturwissenschaftlichen Fakultät
Johannes Kepler Universität Linz
Altenberger Straße 69
A-4040 Linz

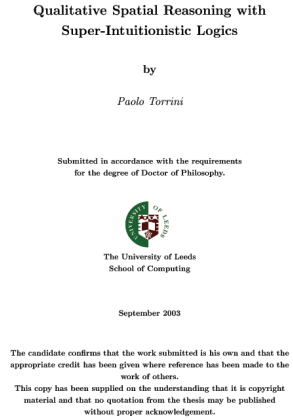
von
Dipl.-Ing. Dr. techn. Ulrich Bodenhofer
Starhembergstraße 27/1
A-4210 Gallneukirchen

Paolo Torrini

Qualitative Spatial Reasoning with Super-Intuitionistic Logics

School of Computing
University of Leeds, 2003

154 pages


Qualitative Spatial Reasoning with Super-Intuitionistic Logics

by

Paolo Torrini

Submitted in accordance with the requirements for the degree of Doctor of Philosophy.

The University of Leeds
School of Computing

September 2003

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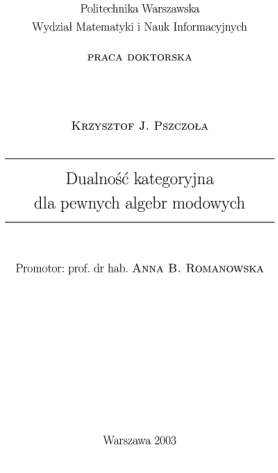
Krzysztof J. Pszczola

Dualność kategoryjna dla pewnych algebr modowych (Categorical duality for some modes)

Warsaw University of Technology
Faculty of Mathematics and Information Science 2003

100 pages


Politechnika Warszawska
Wydział Matematyki i Nauk Informacyjnych

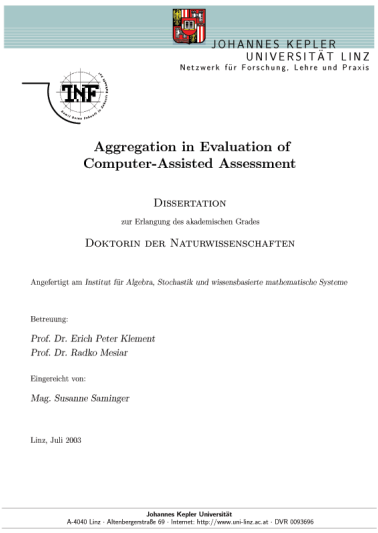
praca doktorska

Krzysztof J. Pszczoła

Dualność kategoryjna
dla pewnych algebr modowych

Promotor: prof. dr hab. Anna B. Romanowska

Warszawa 2003


JOHANNES KEPLER
UNIVERSITÄT LINZ
Netzwerk für Forschung, Lehre und Praxis

Aggregation in Evaluation of Computer-Assisted Assessment

Dissertation

zur Erlangung des akademischen Grades

Doktorin der Naturwissenschaften

Angefertigt am *Institut für Algebra, Stochastik und wissensbasierte mathematische Systeme*

Betreuung:

Prof. Dr. Erich Peter Klement
Prof. Dr. Radko Mesiar

Eingereicht von:

Mag. Susanne Saminger

Linz, Juli 2003

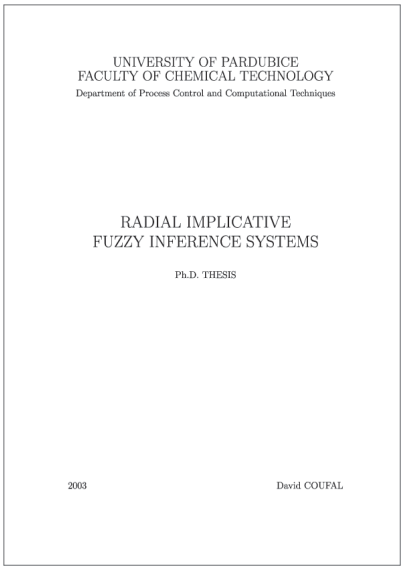
Johannes Kepler Universität
A-4040 Linz · Altenbergerstraße 69 · Internet: http://www.uni-linz.ac.at · DVR 0093696

Susanne Saminger

Aggregation in Evaluation of Computer-Assisted Assessment

Johannes Kepler Universität Linz, Austria 2003

100 pages


UNIVERSITY OF PARDUBICE
FACULTY OF CHEMICAL TECHNOLOGY
Department of Process Control and Computational Techniques

RADIAL IMPLICATIVE
FUZZY INFERENCE SYSTEMS

Ph.D. THESIS

2003 David COUFAL

David Coufal

Radial Implicative Fuzzy Inference Systems

Department of Process Control and Computational Techniques
Faculty of Chemical Technology
University of Pardubice, CR, 2003

198 pages


The Kleene Algebra of Nested
Pointer Structures:
Theory and Applications

Dissertation
zur Erlangung des Doktorgrades der Naturwissenschaften
der Fakultät für Angewandte Informatik
der Universität Augsburg

vorgelegt von
Dipl.-Inf. Thorsten Ehm

Augsburg
Oktober 2003

Thorsten Ehm

The Kleene Algebra of Nested Pointer Structures: Theory and Applications

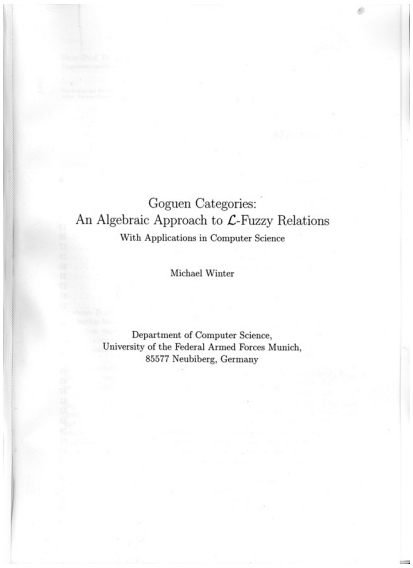
Fakultät für Angewandte Informatik
Universität Augsburg, Germany, 2003

Michael Winter

Goguen Categories:
An Algebraic Approach to $\mathcal{L}$-Fuzzy Relations
— With Applications in Computer Science

Fakultät für Informatik
Universität der Bundeswehr München 2002

Habilitation Thesis, 158 pages


Goguen Categories:
An Algebraic Approach to $\mathcal{L}$-Fuzzy Relations
With Applications in Computer Science

Michael Winter

Department of Computer Science,
University of the Federal Armed Forces Munich,
85577 Neubiberg, Germany

Thorsten Hoffmann

Fallstudien relationaler Programmentwicklung
am Beispiel ausgewählter Graphdurchlaufstrategien

Christian-Albrechts-Universität Kiel 2002

ISBN 3-89722-967-6, 150 pages

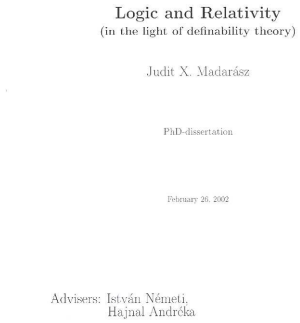
$\lambda o \gamma o \zeta$ 2002

Judit X. Madarász

Logic and relativity
(in the light of definability theory)

Eötvös Lóránd University Budapest, 2002

xviii+365 pages

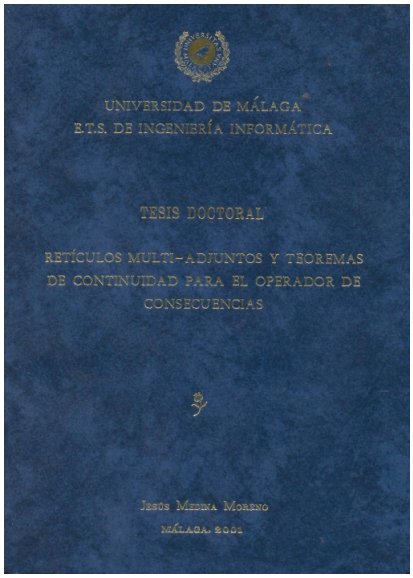

Logic and Relativity
(in the light of definability theory)

Judit X. Madarász

PhD-dissertation

February 26, 2002

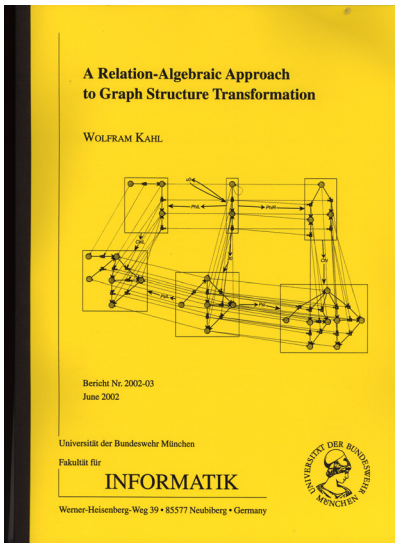
Advisers: István Németi,
Hajnal Andréka



JESÚS MEDINA MORENO

Retículos multi-adjuntos y teoremas de continuidad para el operador de consecuencias

Universidad de Málaga, 2001



WOLFRAM KAHL

A Relation-Algebraic Approach to Graph Structure Transformation

Fakultät für Informatik
Universität der Bundeswehr München 2001

Habilitation Thesis, 204 pages

Special Journal Issues

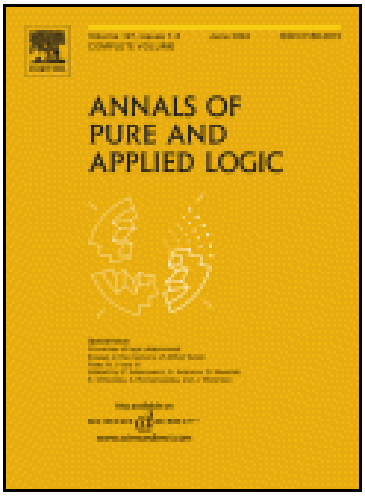
Z. Adamowicz, S. Artemov, D. Niwiński,
E. Orłowska, A. Romanowska and J. Woleński (Eds.)

Provinces of logic determined. Essays in the memory of Alfred Tarski. Parts IV, V and VI

Special Issue of Annals of Pure and Applied Logic

Elsevier, 2004

ISSN 0168-0072



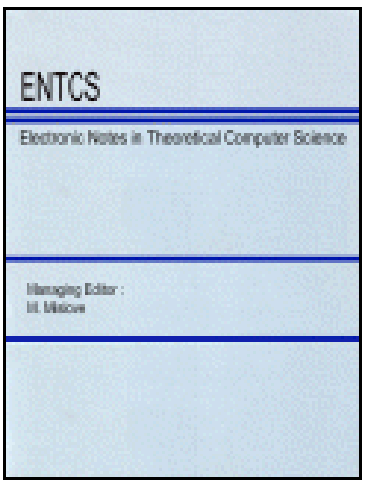
Wolfram Kahl, David L. Parnas,
and Gunther Schmidt (Guest Eds.)

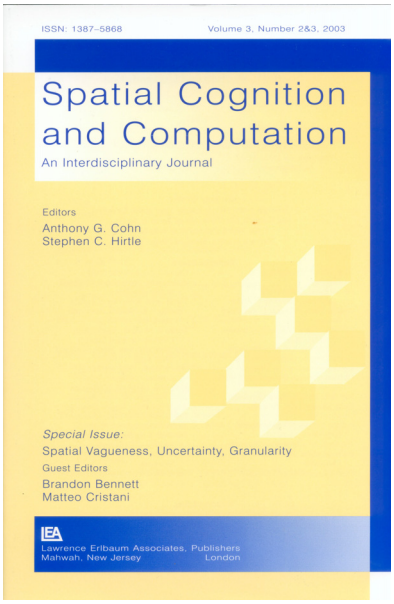
Relational Methods in Software — RelMiS 2001
A satellite event of ETAPS, April 2001, Genova

Electronic Notes in Theoretical Computer Science, vol. 44 (3)

M. Mislove, Ed., Elsevier, 2003

ISSN: 1571-0661





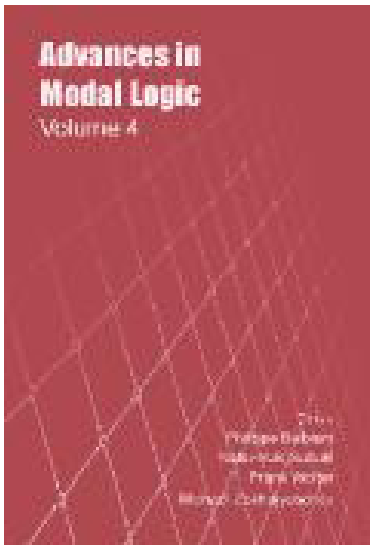
Brandon Bennett, Matteo Cristiani (Guest Eds.)

Spatial Vagueness, Uncertainty, Granularity

Spatial Cognition and Computation
An Interdisciplinary Journal
Edited by Anthony G. Cohn and Stephen C. Hirtle

Lawrence Erlbaum Associates, Publishers, 2003

ISSN 1387-5868, volume 3, number 2&3

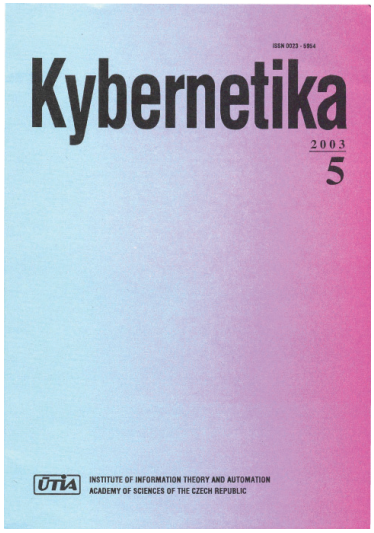


Philippe Balbiani, Nobu-Yuki Suzuki, Frank Wolter, Michael Zakharyaschev (Guest Editors)

Proceedings Advances in Modal Logic Conference

King's College London Publications 2003

Advances in Modal Logic — Vol. 4



Manuel Ojeda-Aciego
Peter Vojtáš
Slawomir Zadrożny (Guest Editors)
Selected Papers from CMMSE, Computational and Mathematical Methods in Science and Engineering, FSTA, Fuzzy Sets Theory and Applications, and AGOP, Aggregation Operators
Kybernetika, vol. 39 (5)
Kluwer Academic Publishers, 2003
ISSN: 0023-5954

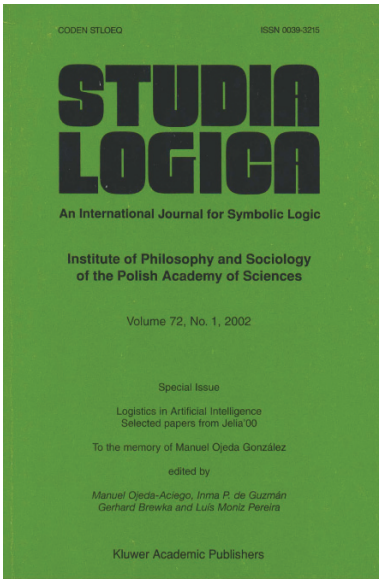
Manuel Ojeda-Aciego
Inma P. de Guzmán
Gerhard Brewka
Luíz Moniz Pereira (Guest Editors)

Logics in Artificial Intelligence
Selected Papers from Jelia'00

Studia Logica, vol. 72 (1)

Kluwer Academic Publishers, 2002

ISSN: 1571-0661



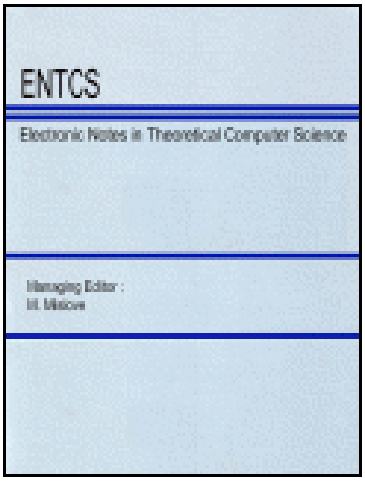
Patrik Eklund and Manuel Ojeda-Aciego (Guest Editors)

Unification in non-classical logics — UNCL'2002
A satellite workshop of ICALP '2002, Málaga

Electronic Notes in Theoretical Computer Science, vol. 66 (5)

M. Mislove, Ed., Elsevier, 2002

ISSN: 0-444-51338-8



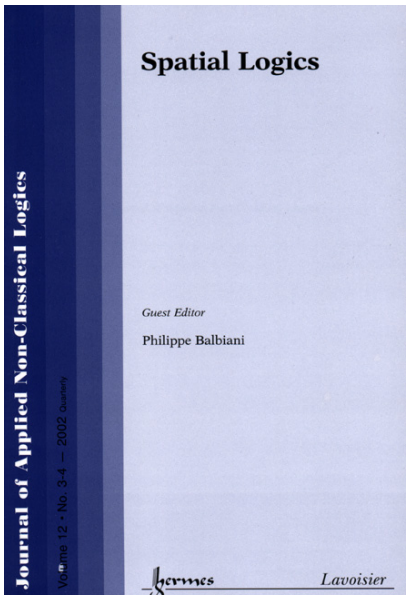
Philippe Balbiani (Guest Editor)

Spatial Logics

Lavoisier 2002

J. Appl. Non-Class. Logics — Vol. 12, 3/4, 2002

ISBN 2-7462-0636-6, ISSN 1166-3081, 243 pages



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