

## *Theory Of Semirings With Applications In Mathematics And Theoretical Computer Science*

Semirings and their Applications Fuzzy Semirings with Applications to Automata Theory Semirings: Algebraic Theory And Applications In Computer Science The Theory of Semirings with Applications in Mathematics and Theoretical Computer Science A Guide to the Literature on Semirings and their Applications in Mathematics and Information Sciences Power Algebras over Semirings A Guide to the Literature on Semirings and their Applications in Mathematics and Information Sciences Semirings and Affine Equations over Them Semirings as Building Blocks in Cryptography Revue Roumaine de Mathématiques Pures Et Appliquées A short guide to the literature on semirings and their applications in mathematics and computer science Revue roumaine de mathématiques pures et appliquées Mathematical Reviews Pure Mathematics and Applications Applications of Smarandache fuzzy minimal open semirings Bulletin of the Korean Mathematical Society A Short Guide Through the Literature on Semirings Kyungpook Mathematical Journal Demonstratio mathematica Sarajevo Journal of Mathematics Jonathan S. Golan Javed Ahsan Hanns Joachim Weinert Jonathan S. Golan K. Glazek Jonathan S. Golan K. Glazek Jonathan S. Golan Mariana Durcheva Kazimierz Górecki J. Mahalakshmi Taehan Suhakhoe Kazimierz Górecki

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there is no branch of mathematics however abstract which may not some day be applied to phenomena of the real world nikolai ivanovich lobachevsky this book is an extensively revised and expanded version of the theory of semirings with applications in mathematics and theoretical computer science golan 1992 first published by longman when that book went out of print it became clear in light of the significant advances in semiring theory over the past years and its new important applications in such areas as idempotent analysis and the theory of discrete event dynamical systems that a second edition incorporating minor changes would not be sufficient and that a major revision of the book was in order therefore though the structure of the first dition was preserved the text was extensively rewritten and substantially expanded in particular references to many interesting and applications of semiring theory developed in the past few years had to be added unfortunately i find that it is best not to go into these applications in detail for that would entail long digressions into various domains of pure and applied mathematics which would only detract from the unity of the volume and increase its length considerably however i have tried to provide an extensive collection of examples to arouse the reader s interest in applications as well as sufficient citations to allow the interested reader to locate them for the reader s convenience an index to these citations is given at the end of the book

the purpose of this book is to present an up to date account of fuzzy ideals of a semiring the book concentrates on theoretical aspects and consists of eleven chapters including three invited chapters among the invited chapters two are devoted to applications of semirings to automata theory and one deals with some generalizations of semirings this volume may serve as a useful hand book for graduate students and researchers in the areas of mathematics and theoretical computer science

this book provides an introduction to the algebraic theory of semirings and in this context to basic algebraic concepts as e g semigroups lattices and rings it includes an algebraic theory of infinite sums as well as a detailed treatment of several

applications in theoretical computer science complete proofs various examples and exercises some of them with solutions make the book suitable for self study on the other hand a more experienced reader who looks for information about the most common concepts and results on semirings will find cross references throughout the book a comprehensive bibliography and various hints to it

this volume presents a short guide to the extensive literature concerning semirings along with a complete bibliography the literature has been created over many years in variety of languages by authors representing different schools of mathematics and working in various related fields in many instances the terminology used is not universal which further compounds the difficulty of locating pertinent sources even in this age of the internet and electronic dissemination of research results so far there has been no single reference that could guide the interested scholar or student to the relevant publications this book is an attempt to fill this gap my interest in the theory of semirings began in the early sixties when together with bogdan w glori i tried to investigate some algebraic aspects of compactifications of topological spaces semirings of semicontinuous functions and the general ideal theory for special semirings unfortunately local algebraists in poland told me at that time that there was nothing interesting in investigating semiring theory because ring theory was still being developed however some time later we became aware of some similar investigations having already been done the theory of semirings has remained my first love ever since and i have been interested in the results in this field that have been appearing in literature even though i have not been active in this area myself

this monograph is a continuation of several themes presented in my previous books 146 149 in those volumes i was concerned primarily with the properties of semirings here the objects of investigation are sets of the form  $ra$  where  $r$  is a semiring and  $a$  is a set having a certain structure the problem is one of translating that structure to  $ra$  in some natural way as such it tries to find a unified way of dealing with diverse topics in mathematics and theoretical computer science as formal language theory the theory of fuzzy algebraic structures models of optimal control and many others another special case is the creation of idempotent analysis and similar work in optimization theory unlike the case of the previous work which rested on a fairly established mathematical foundation the approach here is much more tentative and docimastic this is an introduction to not a definitive presentation of an area of mathematics still very much in the making the basic philosophical problem lurking in the background is one stated succinctly by hable and sostak 185 to what extent basic fields of mathematics like algebra and topology are dependent on the underlying set theory the conflicting definitions proposed by various researchers in search of a resolution to this conundrum show just how difficult this problem is to see in a proper light

this book presents a guide to the extensive literature on the topic of semirings and includes a complete bibliography it serves as a complement to the existing monographs and a point of reference to researchers and students on this topic the literature on semirings has evolved over many years in a variety of languages by authors representing different schools of mathematics and working in various related fields recently semiring theory has experienced rapid development although publications are widely scattered this survey also covers those newly emerged areas of semiring applications that have not received sufficient treatment in widely accessible monographs as well as many lesser known or forgotten works the author has been collecting the bibliographic data for this book since 1985 over the years it has proved very useful for specialists for example j s golan wrote he owed a special debt to kazimierz glazek whose bibliography proved to be an invaluable guide to the bewildering maze of literature on semirings u hebisch and h j weinert also mentioned his collection of literature had been of great assistance to them now updated to include publications up to the beginning of 2002 this work is available to a wide readership audience this volume is the first single reference that can guide the interested scholar or student to the relevant publications in semirings semifields algebraic theory of languages and automata positive matrices and other generalisations and ordered semigroups and groups

semiring theory stands with a foot in each of two mathematical domains the first being abstract algebra and the other the fields of applied mathematics such as optimization theory the theory of discrete event dynamical systems automata theory and formal language theory as well as from the allied areas of theoretical computer science and theoretical physics most important applications of semiring theory in these areas turn out to revolve around the problem of finding the equalizer of a pair of affine maps between two semimodules in this volume we chart the state of the art on solving this problem and present many specific cases of applications this book is essentially the third part of a trilogy along with semirings and their applications and power algebras over semirings both written by the same author and published by kluwer academic publishers in 1999 while each book can be read independently of the others to get the full force of the theory and applications one should have access to all three this work will be of interest to academic and industrial researchers and graduate students the intent of the book is to bring the applications to the attention of the abstract mathematicians and to make the abstract mathematics available to those who are using these tools in an ad hoc manner without realizing the full force of the theory

semirings as an algebraic structure have been known since 1934 but remained unapplied for mathematical purposes for a long time it has only been in the past decade that they have been used in cryptography the advantage of additively idempotent semirings is that the additive operation does not have an inverse which can help in preventing the breakage of a cryptosystem this book describes a number of cryptographic protocols as well as the hard mathematical problems on which their security is based it will appeal to cryptographers and specialists in applied algebra

in this disquisition the concepts of  $s$  fuzzy minimal open  $s$  fuzzy minimal closed  $s$  fuzzy maximal open  $s$  fuzzy maximal closed semirings are instigated moreover the ideas of  $s$  fuzzy semiring minimal regular  $s$  fuzzy semiring minimal o regular  $s$  fuzzy semiring minimal normal spaces and  $s$  fuzzy semiring minimal  $c$  normal spaces are introduced and examined

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