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# $L$-Ordered and $L$-Lattice Ordered Groups

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**Abstract**

This paper pursues an investigation on groups equipped with an $L$-ordered relation, where $L$ is a fixed complete complete Heyting algebra. First, by the concept of join and meet on an $L$-ordered set, the notion of an $L$-lattice is introduced and some related results are obtained. Then we applied them to define an $L$-lattice ordered group. We also introduce convex $L$-subgroups to construct a quotient $L$-ordered group. At last, a relation between the positive cone of an $L$-ordered group and special type of elements of $L^G$ is found, where $G$ is a group.

Mathematics Subject Classification: 06A15, 03E72, 06D72, 06D20.

Keywords: Fuzzy order; $L$-frame; $L$-lattice ordered group.

## 1 Introduction

Fuzzy orders can be divided into two groups. The first group follows Zadeh's paper [24] and uses an antisymmetry condition based on a crisp relation of equality (see e.g. [6, 13, 15, 16]), the second one (see e.g. [2, 3, 4, 7, 8]) involves a fuzzy relation of equivalence or its specific case of fuzzy equality. The former is more frequent, the latter is younger (it was initiated by Höhle in [11]). Mutual transformations of some representatives of both groups were described e.g. in [17, 21].

In [26], Zhang and Liu defined a kind of an $L$-frame by a pair $(A, i_A)$, where A is a classical frame and $i_A : L \to A$ is a frame morphism. For a stratified $L$-topological space $(X, \delta)$, the pair $(\delta, i_X)$ is one of this kind of $L$-frames, where $i_X : L \to \delta$, is a map which sends $a \in L$ to the constant maps with the value $a$. Conversely, a point of an $L$-frame $(A, i_A)$ is a frame morphism $p : (A, i_A) \to (L, id_L)$ satisfying $p \circ i_A = id_L$ and $\mathcal{L}pt(A)$ denotes the set of all points of $(A, i_A)$. Then $\{\Phi_x : \mathcal{L}pt(A) \to L | \ \forall p \in \mathcal{L}pt(A),\ \Phi_x(p) = p(x)\}$ is a stratified $L$-topology on $\mathcal{L}pt(A)$. By these two assignments, Zhang and Liu constructed an adjunction between $SL - Top$ and $L - Loc$ and consequently they established the Stone representation theorem for distributive lattices by means of this adjunction. They pointed out that, from the viewpoint of lattice theory, Rodabaugh's fuzzy version of the Stone representation theory is just one and it has nothing different from the classical one. While in our opinion, Zhang-Liu's $L$-frames preserve many features and also seem to have no strong difference from a crisp one.

Recently, based on complete Heyting algebras, Fan and Zhang [9, 25], studied quantitative domains through fuzzy set theory. Their approach first defines a fuzzy partial order, specifically a degree function, on a non-empty set. Then they define and study fuzzy directed subsets and (continuous) fuzzy directed complete posets (dcpos for short). Moreover, Yao [22] and Yao and Shi [23] pursued an investigation on quantitative domains via fuzzy sets. They defined the notions of fuzzy Scott topology on fuzzy dcpos, Scott convergence and topological convergence for stratified $L$-filters and study them. They also, showen that the category of fuzzy dcpos with fuzzy Scott continuous maps are Cartesian-closed.

In [20], Yao introduced an $L$-frame by an $L$-ordered set equipped with some further conditions. It is a complete $L$-ordered set with the meet operation having a right fuzzy adjoint. They established

# Lattice Ordered Groups Advances And Techniques

Michiel Hazewinkel

**Lattice Ordered Groups Advances And Techniques:**

Lattice-Ordered Groups A.M. Glass,W.C. Holland,2011-10-02 *Lattice Ordered Groups: Advances and Techniques* Andrew Martin William Glass,Holland W Charles,1989 **Theory of Lattice-Ordered Groups** Michael Darnel,2021-12-16 Provides a thorough discussion of the orderability of a group The book details the major developments in the theory of lattice ordered groups delineating standard approaches to structural and permutation representations A radically new presentation of the theory of varieties of lattice ordered groups is offered This work is intended for pure and applied mathematicians and algebraists interested in topics such as group order number and lattice theory universal algebra and representation theory and upper level undergraduate and graduate students in these disciplines College or university bookstores may order five or more copies at a special student price which is available from Marcel Dekker Inc upon request *Lattice-Ordered Groups* A.M. Glass,W.C. Holland,2012-12-06 A lattice ordered group is a mathematical structure combining a partial order lattice structure and a group structure on a set in a compatible way Thus it is a composite structure or a set carrying two or more simple structures in a compatible way The field of lattice ordered groups turn up on a wide range of mathematical fields ranging from functional analysis to universal algebra These papers address various aspects of the field with wide applicability for interested researchers **Ordered Groups and Infinite Permutation Groups** W.C. Holland,2013-12-01 The subjects of ordered groups and of infinite permutation groups have long en joyed a symbiotic relationship Although the two subjects come from very different sources they have in certain ways come together and each has derived considerable benefit from the other My own personal contact with this interaction began in 1961 I had done Ph D work on sequence convergence in totally ordered groups under the direction of Paul Conrad In the process I had encountered pseudo convergent sequences in an ordered group G which are like Cauchy sequences except that the differences be tween terms of large index approach not 0 but a convex subgroup G of G If G is normal then such sequences are conveniently described as Cauchy sequences in the quotient ordered group GIG If G is not normal of course GIG has no group structure though it is still a totally ordered set The best that can be said is that the elements of G permute GIG in an order preserving fashion In independent investigations around that time both P Conrad and P Cohn had showed that a group admits a total right ordering if and only if the group is a group of automor phisms of a totally ordered set In a right ordered group the order is required to be preserved by all right translations unlike a two sided ordered group where both right and left translations must preserve the order *Lattices and Ordered Algebraic Structures* T.S. Blyth,2005-04-18 The text can serve as an introduction to fundamentals in the respective areas from a residuated maps perspective and with an eye on coordinatization The historical notes that are interspersed are also worth mentioning The exposition is thorough and all proofs that the reviewer checked were highly polished Overall the book is a well done introduction from a distinct point of view and with exposure to the author s research expertise MATHEMATICAL REVIEWS **Combinatorics, Computability and Logic** C.S. Calude,M.J. Dinneen,S.

Sburlan,2012-12-06 This volume contains the papers presented at the Third Discrete Mathematics and Theoretical Computer Science Conference DMTCS1 which was held at Ovidius University Constantza Romania in July 2001 The conference was open to all areas of discrete mathematics and theoretical computer science and the papers contained within this volume cover topics such as abstract data types and specifications algorithms and data structures automata and formal languages computability complexity and constructive mathematics discrete mathematics combinatorial computing and category theory logic nonmonotonic logic and hybrid systems molecular computing **Encyclopaedia of Mathematics** Michiel Hazewinkel,2012-12-06 This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathe matics It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by Soviet Encyclopaedia Publishing House in five volumes in 1977 1985 The annotated translation consists of ten volumes including a special index volume There are three kinds of articles in this ENCYCLOPAEDIA First of all there are survey type articles dealing with the various main directions in mathematics where a rather fine subdivi sion has been used The main requirement for these articles has been that they should give a reasonably complete up to date account of the current state of affairs in these areas and that they should be maximally accessible On the whole these articles should be understandable to mathematics students in their first specialization years to graduates from other mathematical areas and depending on the specific subject to specialists in other domains of science en gineers and teachers of mathematics These articles treat their material at a fairly general level and aim to give an idea of the kind of problems techniques and concepts involved in the area in question They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details on how to carry out proofs and constructions The second kind of article of medium length contains more detailed concrete problems results and techniques Partially Ordered Groups A M W Glass,1999-07-22 Recently the theory of partially ordered groups has been used by analysts algebraists topologists and model theorists This book presents the most important results and topics in the theory with proofs that rely on and interplay with other areas of mathematics It concludes with a list of some unsolved problems for the reader to tackle In stressing both the special techniques of the discipline and the overlap with other areas of pure mathematics the book should be of interest to a wide audience in diverse areas of mathematics Ordered Algebraic Structures Jorge Martínez,W.C. Holland,2012-12-06 This volume contains a selection of papers presented at the 1991 Conrad Conference held in Gainesville Florida USA in December 1991 Together these give an overview of some recent advances in the area of ordered algebraic structures The first part of the book is devoted to ordered permutation groups and universal as well as model theoretic aspects The second part deals with material variously connected to general topology and functional analysis Collectively the contents of the book demonstrate the wide applicability of order theoretic methods and how ordered algebraic structures have connections with many research disciplines For researchers and graduate students whose work involves ordered algebraic structures **A**

**Guide to the Literature on Semirings and their Applications in Mathematics and Information Sciences** K. Glazek,2013-06-29 This volume presents a short guide to the extensive literature concerning semir ings 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 dis semination 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 to gether with Bogdan W glorz 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 alge braists 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 hav ing 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 **Encyclopaedia of Mathematics** M. Hazewinkel,2013-12-01 **New Trends In Fuzzy Logic - Proceedings Of The Wilf'95-italian Workshop On Fuzzy Logic 1995** Francesco Masulli,Dario Mancini,Alfredo Petrosino,Andrea Bonarini,1996-08-30 This book reports the recent results obtained by Italian researchers in fuzzy logic It collects some selected papers presented at the 1995 Italian Workshop on Fuzzy Logic WILF 95 and some invited contributions The book covers some of the most interesting topics in fuzzy logic theory evolutionary computing and gives an overview of applications in control image processing pattern recognition decisions support systems and high energy physics **Quaternions and Cayley Numbers** J.P. Ward,2012-12-06 In essence this text is written as a challenge to others to discover significant uses for Cayley number algebra in physics I freely admit that though the reading of some sections would benefit from previous experience of certain topics in physics particularly relativity and electromagnetism generally the mathematics is not sophisticated In fact the mathematically sophisticated reader may well find that in many places the rather deliberate progress too slow for their liking This text had its origin in a 90 minute lecture on complex numbers given by the author to prospective university students in 1994 In my attempt to develop a novel approach to the subject matter I looked at complex numbers from an entirely geometric perspective and no doubt in line with innumerable other mathematicians re traced steps first taken by Hamilton and others in the early years of the nineteenth century I even enquired into the possibility of using an alternative multiplication rule for complex numbers in which argzlz2 argzl argz2 other than the one which is normally accepted argzlz2 argzl argz2 Of course my alternative was rejected because it didn t lead to a product which had properties that we now accept as fundamental i e **Nonstandard Methods of Analysis** A.G. Kusraev,Semën Samsonovich

Kutateladze,2012-12-06 Nonstandard Methods of Analysis is concerned with the main trends in this field infinitesimal analysis and Boolean valued analysis The methods that have been developed in the last twenty five years are explained in detail and are collected in book form for the first time Special attention is paid to general principles and fundamentals of formalisms for infinitesimals as well as to the technique of descents and ascents in a Boolean valued universe The book also includes various novel applications of nonstandard methods to ordered algebraic systems vector lattices subdifferentials convex programming etc that have been developed in recent years For graduate students postgraduates and all researchers interested in applying nonstandard methods in their work **Clifford Algebras and Spinor Structures** Rafal Ablamowicz,P. Lounesto,2013-06-29 This volume is dedicated to the memory of Albert Crumeyrolle who died on June 17 1992 In organizing the volume we gave priority to articles summarizing Crumeyrolle s own work in differential geometry general relativity and spinors articles which give the reader an idea of the depth and breadth of Crumeyrolle s research interests and influence in the field articles of high scientific quality which would be of general interest In each of the areas to which Crumeyrolle made significant contribution Clifford and exterior algebras Weyl and pure spinors spin structures on manifolds principle of triality conformal geometry there has been substantial progress Our hope is that the volume conveys the originality of Crumeyrolle s own work the continuing vitality of the field he influenced and the enduring respect for and tribute to him and his accomplishments in the mathematical community It isour pleasure to thank Peter Morgan Artibano Micali Joseph Grifone Marie Crumeyrolle and Kluwer Academic Publishers for their help in preparingthis volume

*Noncommutative Algebraic Geometry and Representations of Quantized Algebras* A. Rosenberg,2013-03-09 This book is based on lectures delivered at Harvard in the Spring of 1991 and at the University of Utah during the academic year 1992 93 Formally the book assumes only general algebraic knowledge rings modules groups Lie algebras functors etc It is helpful however to know some basics of algebraic geometry and representation theory Each chapter begins with its own introduction and most sections even have a short overview The purpose of what follows is to explain the spirit of the book and how different parts are linked together without entering into details The point of departure is the notion of the left spectrum of an associative ring and the first natural steps of general theory of noncommutative affine quasi affine and projective schemes This material is presented in Chapter I Further developments originated from the requirements of several important examples I tried to understand to begin with the first Weyl algebra and the quantum plane The book reflects these developments as I worked them out in reallife and in my lectures In Chapter 11 we study the left spectrum and irreducible representations of a whole lot of rings which are of interest for modern mathematical physics The dasses of rings we consider indude as special cases quantum plane algebra of q differential operators quantum Heisenberg and Weyl algebras quantum enveloping algebra ofthe Lie algebra sl 2 coordinate algebra of the quantum group SL 2 the twisted SL 2 of Woronowicz so called dispin algebra and many others Nearrings, Nearfields and K-Loops Gerhard Saad,Momme Johs

Thomsen,2012-12-06 This present volume is the Proceedings of the 14th International Conference on Near rings and Nearfields held in Hamburg at the Universitiit der Bundeswehr Hamburg from July 30 to August 06 1995 This Conference was attended by 70 mathematicians and many accompanying persons who represented 22 different countries from all five continents Thus it was the largest conference devoted entirely to nearrings and nearfields The first of these conferences took place in 1968 at the Mathematische For schungsinstitut Oberwolfach Germany This was also the site of the conferences in 1972 1976 1980 and 1989 The other eight conferences held before the Hamburg Conference took place in eight different countries For details about this and more over for a general historical overview of the development of the subject we refer to the article On the beginnings and development of near ring theory by G Betsch 3 During the last forty years the theory of nearrings and related algebraic struc tures like nearfields nearmodules nearalgebras and seminearrings has developed into an extensive branch of algebra with its own features In its position between group theory and ring theory this relatively young branch of algebra has not only a close relationship to these two more well known areas of algebra but it also has just as these two theories very intensive connections to many further branches of mathematics *Image Representation and Processing* V.V. Alexandrov,Gorsky,2012-12-06 Recently much attention has been paid to image processing with multiresolution and hierarchical structures such as pyramids and trees This volume deals with recursive pyramids which combine the advantages of available multiresolution structures and which are convenient both for global and local image processing Recursive pyramids are based on regular hierarchical recursive structures containing data on image fragments of different sizes Such an image representation technique enables the effective manipulation of pictorial information as well as the development of special hardware or data structures The major aspects of this book are two original mathematical models of greyscale and binary images represented by recursive structures Image compression transmission and processing are discussed using these models A number of applications are presented including optical character recognition expert systems and special computer architecture for pictorial data processing The majority of results are presented as algorithms applicable to discrete information fields of arbitrary dimensions e g 2 D or 3 D images The book is divided into six chapters Chapter 1 provides a brief introduction Chapter 2 then deals with recursive structures and their properties Chapter 3 introduces pyramidal image models Image coding and the progressive transmission of images with gradual refinement are discussed in Chapter 4 Chapters 5 and 6 are devoted to image processing with pyramidal recursive structures and applications The volume concludes with a comprehensive bibliography For applied mathematicians and computer scientists whose work involves computer vision information theory and other aspects of image representation techniques

*Inconsistent Mathematics* C.E. Mortensen,2013-03-14 without a properly developed inconsistent calculus based on infinitesimals then in consistent claims from the history of the calculus might well simply be symptoms of confusion This is addressed in Chapter 5 It is further argued that mathematics has a certain primacy over logic in that paraconsistent or

relevant logics have to be based on inconsistent mathematics If the latter turns out to be reasonably rich then paraconsistentism is vindicated while if inconsistent mathematics has seri ous restriytions then the case for being interested in inconsistency tolerant logics is weakened On such restrictions see this chapter section 3 It must be conceded that fault tolerant computer programming e g Chapter 8 finds a substantial and important use for paraconsistent logics albeit with an epistemological motivation see this chapter section 3 But even here it should be noted that if inconsistent mathematics turned out to be functionally impoverished then so would inconsistent databases 2 Summary In Chapter 2 Meyer s results on relevant arithmetic are set out and his view that they have a bearing on G8del s incompleteness theorems is discussed Model theory for nonclassical logics is also set out so as to be able to show that the inconsistency of inconsistent theories can be controlled or limited but in this book model theory is kept in the background as much as possible This is then used to study the functional properties of various equational number theories

Reviewing **Lattice Ordered Groups Advances And Techniques**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is truly astonishing. Within the pages of "**Lattice Ordered Groups Advances And Techniques**," an enthralling opus penned by a highly acclaimed wordsmith, readers attempt an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve into the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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