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# EIGHTY YEARS OF PROFESSOR JÁN JAKUBÍK

Professor Ján Jakubík, a prominent Slovak mathematician, reached eighty years of age on 8 October, 2003.

Ján Jakubík was born in Dudince (Slovakia). After having completed his secondary school education at Banská Štiavnica, he studied Mathematics and Physics at the Comenius University in Bratislava. Then he worked at the Slovak Technical University in Bratislava (1948–1952) and at the Technical University in Košice (1952–1985). Since 1985, he works at the Košice branch of the Mathematical Institute of the Slovak Academy of Sciences. He was appointed Associate Professor (1956) and Full Professor (1963). He was elected a corresponding member of the Slovak Academy of Sciences (1964) and of the Czechoslovak Academy of Sciences (1965). In 1977 he was elected an ordinary member both of the Slovak Academy of Sciences and the Czechoslovak Academy of Sciences.

His work was already appraised in [g] and [m] twenty years ago (with the list of his first 104 papers) and in [f] ten years ago (with the list of his papers [105]–[156]). In this article we will pay our attention only to the period 1994-2003. Scientific research of J. Jakubík in the last ten years can be divided into three domains:

(a) ordered sets, lattices;
(b) ordered groups, vector lattices;
(c) MV-algebras, pseudo MV-algebras.

The first two structures were studied by J. Jakubík also during the previous years. Theory of MV-algebras and pseudo MV-algebras is a new direction in his scientific research.

Let us present some typical results in the mentioned domains.

**The domain (a):**

F. Papangelou [r] investigated some types of sequential convergences on Boolean algebras. Sequential convergences on Boolean algebras and on distributive lattices were dealt with in Jakubík's papers [163], [190] and [223]. For a distributive lattice $L$ let $\operatorname{Conv} L$ be the system of all sequential convergences on $L$; this system is partially ordered in a natural way. If $B$ is a Boolean algebra, then the symbol $\operatorname{Conv} B$ has an analogous meaning, and similarly for a lattice ordered group $G$. In [163] there were established necessary and sufficient conditions for $L$ under which the partially ordered set $\operatorname{Conv} L$ is a complete lattice. In general, the partially ordered set $\operatorname{Conv} B$ need not be a lattice; namely, for $\alpha$ and $\beta$ from $\operatorname{Conv} B$, the join $\alpha \vee \beta$ need not exist in $\operatorname{Conv} B$. If $\alpha$ is a sequential convergence on a Boolean algebra $B$ which is generated by a set of disjoint sequences and if $\beta$ is any element of $\operatorname{Conv} B$, then the join $\alpha \vee \beta$ exists in $\operatorname{Conv} B$. Further it is shown that each interval of $\operatorname{Conv} B$ is a Brouwerian lattice ([190]). In [223] it is proved that for each generalized Boolean algebra $B$ there exists an abelian lattice ordered group $G$ such that the partially ordered set $\operatorname{Conv} B$ is isomorphic to a convex subset of the partially ordered set $\operatorname{Conv} G$.

J. Jakubík [l] introduced and studied the notion of the radical class of lattice ordered groups. This class is wider than the torsion class of lattice ordered groups that was defined and intensively studied by J. Martinez [n]. In [229] there is defined the concept of radical class of distributive lattices. Let $D$ be the class of all distributive lattices; further, let $D_0$ be the class of all distributive lattices having the least element. It is shown that there exists exactly one radical class $D$ (namely, $D$ itself) and that the collection of all radical classes in $D_0$ is a proper class.

Basic results on direct product decompositions of partially ordered sets were proved by J. Hashimoto [k]. The relations between direct product decompositions of a directed set $L$ and direct product decompositions of intervals of $L$ were investigated in [183]. Sufficient conditions for the Boolean algebra of all directed factors of $L$ to be atomic were found. Certain forms of the cancellation rule for direct and subdirect product decompositions of some types of partially ordered sets are contained in [230]. The following result is derived:

*Let $L$ be a directed set of finite length such that $L \simeq A \times B$, $L \simeq C \times D$ and $A \simeq C$. Then $B \simeq D$.*

Let $S$ be the class of all partially ordered sets $P$ such that the system of all nonempty intervals of $P$ is selfdual. In [184] it is proved that:

*For each infinite cardinal $\alpha$ there exists a connected partially ordered set $P_\alpha$ such that*

(i) *$P_\alpha$ belongs to $S$;*
(ii) card $P_\alpha = d$;
(iii) *$P_\alpha$ is homogeneous.*

G. Birkhoff [c] proposed the following problem: To find all finite lattices $L$ such that each automorphism of the unoriented graph corresponding to $L$ turns out to be a lattice automorphism. Let us denote by $C$ the class of all lattices which satisfy the mentioned condition. A partial solution of this problem concerning modular lattices is obtained in [194].

*Let $L$ be a finite modular lattice. Then the following conditions are equivalent:*

(i) *$L$ belongs to $C$;*
(ii) *no direct factor of $L$ having more than one element is selfdual.*

The assumption of modularity cannot be replaced by the assumption that $L$ is semimodular ([206]).

**The domain (b):**

In [168] it is shown that if $G$ is an abelian lattice ordered group which can be expressed as a direct product $G = A \times B$ with $A \neq \{0\} \neq B$, then $G$ is not affine complete. By means of this result the following theorem is obtained:

*Let $G$ be a complete lattice ordered group. Then the following conditions are equivalent:*

(i) *$G$ is affine complete;*
(ii) $G = \{0\}$.

The question, whether the conditions (i) and (ii) are equivalent for each lattice ordered group, remains open.

For a lattice ordered group $G$ denote by $G^L$ and $G^D$ the lateral completion or the Dedekind completion of $G$, respectively. The main result of S. J. Bernau [a] is the following theorem:

*Let $G$ be an archimedean lattice ordered group. Then the relation $G^{DL} = G^{LD}$ is valid.*

J. Jakubík [179] has proved the validity of this relation for strongly projectable lattice ordered groups.

Let $G$ be a lattice ordered group, $G^C$ the cut completion of $G$, $G^\wedge$ the Dedekind completion of $G$ and $F_\alpha$ the class of all abelian lattice ordered groups having only a finite number of disjoint elements. The following result is derived in [204]:

*Let $G \in F_\alpha$. Then $G^C \in F_\alpha$ and $G^C = G^\wedge$.*

S. J. Bernau [b] proved that each lattice ordered group $G$ has a uniquely determined lateral completion $G^L$. Bernau's method consists in applying a transfinite process to construct $G^L$. In each step of this construction, new elements are added to those already given by the preceding step. J. Jakubík [202] found out that for a projectable lattice ordered group $G$ it suffices to apply only one step in the process of adding new elements of $G$.

Convexities of lattices were defined by E. Fried [o; p. 225].

In [171] the collection $C(\mathcal{L})$ of all convexities of lattice ordered groups is investigated and it is shown that $C(\mathcal{L})$ is a proper class. A radical class of lattice ordered groups need not be a convexity. A torsion class is a convexity if and only if it is closed under direct products.

The notion of a half lattice ordered group (especially, of a half linearly ordered group) was introduced and studied by M. Giraudet and F. Lucas [j]. J. Jakubík [175] defined the *small direct product of half lattice ordered groups*; the relations between small direct product decompositions of a half lattice ordered group $G$ and direct product decompositions of its increasing part $G\uparrow$ are dealt with in this paper. It is shown that any two small direct product decompositions of $G$ have isomorphic refinements.

Basic results on cyclically ordered groups are due to L. Rieger [s]. In [161] there are investigated the properties of the partially ordered collection of all nonempty classes of cyclically ordered groups which are closed with respect to direct limits. A particular type of cyclically ordered groups, denoted as *dc-groups*, has been defined by J. Jakubík and in [185] it was proved that any two lexicographic product decompositions of a dc-group have isomorphic refinements. In [226] there is introduced the notion of a *half cyclically ordered group $G$* generalizing the notion of a half partially ordered group. Relations between lexicographic product decompositions of $G$ and lexicographic product decompositions of the increasing part $G\uparrow$ are investigated.

The following results were established in [181]:

*The system* $\operatorname{Conv} L$ *of all sequential converges in a vector lattice $L$ is nonempty if and only if $L$ is archimedean. Let $L$ be archimedean. Then* $\operatorname{Conv} L$ *has the least element (it need not have, in general, a greatest element). Each interval of* $\operatorname{Conv} L$ *is a Brouwerian lattice.*

**The domain (c):**

The notion of MV-algebra $\mathcal{A}$ was introduced by C. C. Chang [d]. The basic binary operation $\oplus$ on $\mathcal{A}$ is assumed to be commutative. The notion of a pseudo MV-algebra is a generalization of the notion of MV-algebra in such a way that the assumption of the commutativity of the operation $\oplus$ is omitted. Each MV-algebra (pseudo MV-algebra) can be constructed by means of an appropriately chosen abelian lattice ordered group (lattice ordered group) $G$ with a strong unit $u$. In this situation the expression $\mathcal{A} = \Gamma(G, u)$ is used. In this construction, the underlying set $A$ of $\mathcal{A}$ is the interval $[0, u]$ in $G$ (cf. D. Mundici [p] and A. Dvurečenskij [i]).

Let $\mathcal{A}$ be an MV-algebra, $\mathcal{A} = \Gamma(G, u)$. To each direct product decomposition of $G$ there corresponds a direct product decomposition of $\mathcal{A}$ (cf. [165]). Each direct product decomposition of $G$ has only a finite number of nonzero direct factors. On the other hand, $\mathcal{A}$ can have direct product decompositions with an infinite number of nonzero direct factors. Further, it is proved that any two direct decompositions of an MV-algebra have a common refinements.

There exist exactly three nonisomorphic types of lattice ordered groups $G$ with one generator. In each of these cases $G$ is complete. The situation concerning MV-algebras with one generator is essentially different (see [189]): An MV-algebra with one generator need not be complete; moreover, it need not be archimedean. There exist infinitely many nonisomorphic complete MV-algebras with one complete generator. Further, it is shown that each MV-algebra possesses a unique maximal completion.

In [188] some results of R. Cignoli [e] were generalized; further, there is proved a result on the relations between generalized atoms and direct product decompositions of an MV-algebra.

It is well known that if a Boolean algebra is orthogonally complete, then it is Dedekind complete. An orthogonally complete MV-algebra need not be Dedekind complete.

*For each MV-algebra $\mathcal{A}$ the following conditions are equivalent* ([207])*:*

(i) *$\mathcal{A}$ is Dedekind complete;*
(ii) *$\mathcal{A}$ is Dedekind $\sigma$-complete and orthogonally complete.*

Let $\mathcal{A}$ be a pseudo MV-algebra, $\mathcal{A} = \Gamma(G, u)$ and let $\mathcal{L}(\mathcal{A})$ be the corresponding lattice. Assume that $\alpha$ is an infinite cardinal. In [233] it is proved that:

*If the lattice $\mathcal{L}(\mathcal{A})$ is $\alpha$-complete, then $\mathcal{A}$ is an MV-algebra. The collection of all $\alpha$-complete pseudo MV-algebras is a radical class.*

A Cantor-Bernstein theorem for $\sigma$-complete MV-algebras was proved by A. De Simone, D. Mundici and M. Navara [h]. This result is generalized in [222] in two directions. Firstly, it is shown that instead of $\sigma$-completeness it suffices to apply the weaker assumption of orthogonal $\sigma$-completeness. Secondly, instead of an MV-algebra, pseudo MV-algebra can be taken into account.

Prof. Jakubík is author of 241 papers published in scientific journals. His papers were quoted in more than 750 articles. All monographs on the ordered algebraic structures have quoted his papers, for example FUCHS, L.: *Partially Ordered Algebraic Systems* (1963) quotes 12 papers, KOPYTOV, V. M.: *Lattice Ordered Groups* (1984) (Russian) quotes 39 papers, GLASS, A. M. W.: *Partially Ordered Groups* (1999) quotes 35 papers, DARNEL, M. R.: *Theory of Lattice Ordered Groups* (1995) quotes 42 papers.

For his scientific activity Prof. Jakubík was awarded several acknowledgements, out of which these are following: The National Price of the Slovak Republic (1969), the State Price of K. Gottwald (1979), the Price of J. Hronec awarded by Matica Slovenská (1995), the Price of the Ministry of Education (2002). For his scientific and pedagogical activity he was awarded the title "doctor honoris causa" at the Technical University in Košice (2002).

The scientific contribution of Prof. Jakubík has not been complete yet. He has been still working intensively and publishing obtained results in scientific journals.

His lot in life has become much harder after the death of his wife who had created a harmonic family background, and who had also worked as Associated Professor in mathematics at the Technical University in Košice. At present Professor Jakubík lives together with his daughter Ľudmila. His second daughter Danica Jakubíková-Studenovská is an Associated Professor in mathematics at the Faculty of Natural Sciences in Košice and she has achieved several results in the field of monounary algebras.

Prof. Jakubík has a true and sincere relations towards his birthplace, towards Slovakia, Slovak literature, history and folklore. Even now, from time to time, he plays our beautiful

Slovak folk songs using a pipe which he received as a present from his trusted friend, Professor Kolibiar.

We wish Professor Jakubík, together with all mathematical community, a very good health, a lot of achievements in his research, and many, many happy years ahead.

## REFERENCES


[a] BERNAU, S. J.: *Lateral and Dedekind completion of archimedean lattice groups*, J. London Math. Soc. **1** (1969), 358–362.

[b] BERNAU, S. J.: *Lateral completion of an arbitrary lattice group*, J. Austral. Math. Soc. **19** (1975), 263–289.

[c] BIRKHOFF, G.: *Lattice Theory* (3rd ed), Amer. Math. Soc., Providence, RI, 1967.

[d] CHANG, C. C.: *Algebraic analysis of many-valued logics*, Trans. Amer. Math. Soc. **88** (1958), 467–490.

[e] CINGOLI, R.: *Complete and atomic algebras of the infinite valued Lukasievicz logic*, Studia Logica **50** (1991), 375–384.

[f] CSONTÓOVÁ, M.—ČERNÁK, Š.—PLOŠČICA, M.: *Seventy years of Professor Ján Jakubík*, Math. Slovaca **44** (1994), 483–487.

[g] ČERNÁK, Š.—KOLIBIAR, M.: *Life jubilee of Academician Ján Jakubík*, Math. Slovaca **33** (1983), 321–326. (Slovak)

[h] DE SIMONE, A.—MUNDICI, D.—NAVARA, M.: *A Cantor-Bernstein theorem for $\sigma$-complete MV-algebras*, Czechoslovak Math. J. **53** (2003), 437–447.

[i] DVUREČENSKIJ, A.: *Pseudo MV-algebras are intervals in l-groups*, J. Austral. Math. Soc. **72** (2002), 427–445.

[j] GIRAUDET, M.—LUKAS, F.: *Groupes ā moitié ordonés*, Fundamenta Math. **139** (1991), 75–89.

[k] HASHIMOTO, J.: *On direct product decompositions of partially ordered sets*, Ann. of Math. **54** (1951), 315–318.

[l] JAKUBÍK, J.: *Radical mappings and radical classes of lattice ordered groups*. In: Sympos. Math. 21, Academic Press, New York-London, 1977, pp. 451–477.

[m] KOLIBIAR, M.: *Professor Ján Jakubík sexagenarian*, Czechoslovak Math. J. **33** (1983), 657–664.

[n] MARTINEZ, J.: *Torsion theory for lattice ordered groups*, Czechoslovak Math. J. **25** (1975), 284–299.

[o] *General Algebra 1988* (R. Mlitz, ed.), Proc. of the internat. conference held in memory of Wilfried Nöbauer, Krems, Austria, August 21–27, 1988, North-Holland, Amsterdam-New York-Tokyo-Oxford, 1990.

[p] MUNDICI, D.: *Interpretation of $AFC^*$-algebras in Lukasiewicz sentential calculus*, J. Funct. Anal. **65** (1986), 15–63.

[r] PAPANGELON, F.: *Order convergence and topological completion of commutative lattice-groups*, Math. Ann. **155** (1964), 81–107.

[s] RIEGER, L.: *On ordered and cyclically ordered groups I; II; III*, Věstník Král. čes. spol. nauk (1946; 1947; 1948), 1–31; 1–33; 1–26. (Czech)


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## SUPPLEMENT TO THE LIST OF SCIENTIFIC PAPERS OF J. JAKUBÍK


[157] *On systems of sequences of reals*, Tatra Mt. Math. Publ. **2** (1993), 19–23.

[158] *On filters of ordered semigroups*, Czechoslovak Math. J. **43** (1993), 519–522.

[159] *Convex isomorphisms of directed multilattices*, Math. Bohem. **118** (1993), 359–379 (with Csontóová, M.).

[160] *On strong superlattices*, Math. Slovaca **44** (1994), 131–138.

[161] *Direct limits of cyclically ordered groups*, Czechoslovak Math. J. **44** (1994), 231–250 (with G. Pringerová).

[162] *On convexities of d-groups*, Czechoslovak Math. J. **44** (1994), 305–314.

[163] *Sequential convergences in distributive lattices*, Math. Bohem. **119** (1994), 245–254.

[164] *On extended cyclic orders*, Czechoslovak Math. J. **44** (1994), 661–675.

[165] *Direct product decomposition of MV-algebras*, Czechoslovak Math. J. **44** (1994), 725–739.

[166] *On some completeness properties for lattice ordered groups*, Czechoslovak Math. J. **45** (1995), 253–266.

[167] *On complete MV-algebras*, Czechoslovak Math. J. **45** (1995), 473–480.

[168] *Affine completeness of complete lattice ordered groups*, Czechoslovak Math. J. **3** (1995), 571–576.

[169] *Sequential convergences on MV-algebras*, Czechoslovak Math. J. **45** (1995), 709–726.

[170] *On sequences in vector lattices*, Math. Bohem. **120** (1995), 379–386.

[171] *Convexities of lattice ordered groups*, Math. Bohem. **121** (1996), 59–67.

[172] *On complete lattice ordered groups with strong units*, Czechoslovak Math. J. **46** (1996), 221–230.

[173] *Directly indecomposable direct factors of a lattice*, Math. Bohem. **121** (1996), 281–292.

[174] *Principal convergences on lattice ordered groups*, Czechoslovak Math. J. **46** (1996), 721–732.

[175] *On half lattice ordered groups*, Czechoslovak Math. J. **46** (1996), 745–767.

[176] *Systems of intervals of partially ordered sets*, Math. Slovaca **46** (1996), 355–361 (with J. Lihová).

[177] *Convergence $\ell$-groups with zero radical*, Math. Bohem. **122** (1997), 63–73.

[178] *Unions of uniquely complemented lattices*, Math. Bohem. **122** (1997), 147–152.

[179] *Lateral and Dedekind completions of strongly projectable lattice ordered groups*, Czechoslovak Math. J. **47** (1997), 511–523.

[180] *Closed convex $\ell$-subgroups and radical classes of convergence $\ell$-groups*, Math. Bohem. **122** (1997), 301–315.

[181] *Sequential convergences in a vector lattice*, Math. Bohem. **123** (1998), 33–48.

[182] *Convex isomorphisms of archimedean lattice ordered groups*, Mathware Soft Comput. **5** (1998), 49–56.

[183] *Atomicity of the Boolean algebra of direct factors of a directed set*, Math. Bohem. **123** (1998), 145–161.

[184] *Partially ordered sets having selfdual system of intervals*, Math. Bohem. **123** (1998), 271–278.

[185] *Lexicographic product decompositions of cyclically ordered groups*, Czechoslovak Math. J. **48** (1998), 229–241.

[186] *Radical classes of generalized Boolean algebras*, Czechoslovak Math. J. **48** (1998), 253–268.

[187] *Affine completeness of projectable lattice ordered groups*, Czechoslovak Math. J. **48** (1998), 359–363 (with M. Csontóová).

[188] *On archimedean MV-algebras*, Czechoslovak Math. J. **48** (1998), 575–582.

[189] *Complete generators and maximal completions of MV-algebras*, Czechoslovak Math. J. **48** (1998), 597–608.

[190] *Disjoint sequences in Boolean algebras*, Math. Bohem. **123** (1998), 411–418.

[191] *On $\vee$-irreducible elements in the positive cone of an $\ell$-group*, Acta Univ. Mathaei Belii Nat. Sci. Ser. Ser. Math. **6** (1998), 21–29 (with G. Pringerová).

[192] *Subdirect product decompositions of MV-algebras*, Czechoslovak Math. J. **49** (1999), 163–173.

[193] *Radical classes of MV-algebras*, Czechoslovak Math. J. **49** (1999), 191–211.

[194] *Graph automorphisms of a finite modular lattice*, Czechoslovak Math. J. **49** (1999), 443–447.

[195] *Cantor-Bernstein theorem for MV-algebras*, Czechoslovak Math. J. **49** (1999), 517–526.

[196] *Radical classes of complete lattice ordered groups*, Math. Slovaca **49** (1999), 417–424.

[197] *Distinguished extensions of an MV-algebra*, Czechoslovak Math. J. **49** (1999), 867–876.

[198] *Cancellation rule for internal direct product decompositions of a connected partially ordered set*, Math. Bohem. **125** (2000), 115–122 (with M. Csontóová).

[199] *On convex linearly ordered subgroups of an $h\ell$-group*, Math. Slovaca **50** (2000), 127–133, (with Š. Černák).

[200] *Nearly disjoint sequences in convergence $\ell$-groups*, Math. Bohem. **125** (2000), 139–144.

[201] *Retract mappings in projectable MV-algebras*, Soft Comput. **4** (2000), 27–32.

[202] *Lateral completion of a projectable lattice ordered group*, Czechoslovak Math. J. **50** (2000), 431–444.

[203] *Direct product decompositions of infinitely distributive lattices*, Math. Bohem. **125** (2000), 341–354.

[204] *On cut completions of abelian lattice ordered groups*, Czechoslovak Math. J. **50** (2000), 587–602.

[205] *Convexities of normal valued lattice ordered groups*, Czechoslovak Math. J. **50** (2000), 641–649.

[206] *Graph automorphisms of semimodular lattices*, Math. Bohem. **125** (2000), 459–464.

[207] *Completeness properties for MV-algebras*, Mult.-Valued Log. **6** (2001), 157–169.

[208] *Lexicographic products of half linearly ordered groups*, Czechoslovak Math. J. **51** (2001), 127–138.

[209] *On iterated limits of subsets of a convergence $\ell$-groups*, Math. Bohem. **126** (2001), 53–61.

[210] *Weak $\sigma$-distributivity of lattice ordered groups*, Math. Bohem. **126** (2001), 151–159.

[211] *On chains in MV-algebras*, Math. Slovaca **51** (2001), 151–166.

[212] *Regular representations of semisimple MV-algebras by continuous real functions*, Math. Slovaca **51** (2001), 269–274.

[213] *Sequential convergences on Boolean algebras defined by systems of maximal filters*, Czechoslovak Math. J. **51** (2001), 261–274 (with R. Frič).

[214] *Direct product decompositions of pseudo MV-algebras*, Arch. Math. (Brno) **37** (2001), 131–142.

[215] *State homomorphisms of MV-algebras*, Czechoslovak Math. J. **51** (2001), 609–616.

[216] *Distinguished completion of a direct product of lattice ordered groups*, Czechoslovak Math. J. **51** (2001), 661–671.

[217] *On the congruence lattice of an abelian lattice ordered group*, Math. Slovaca **126** (2001), 269–274.

[218] *Basic elements in a pseudo MV-algebra*, Soft Comput. **5** (2001), 372–375.

[219] *Convex mappings of archimedean MV-algebras*, Math. Slovaca **51** (2001), 383–391.

[220] *Complete distributivity of lattice ordered groups and vector lattices*, Czechoslovak Math. J. **51** (2001), 889–896.

[221] *Strong subdirect products of MV-algebras*, Math. Slovaca **51** (2001), 507–520.

[222] *A theorem of Cantor-Bernstein type for orthogonally σ-complete pseudo MV-algebras*, Tatra Mt. Math. Publ. **22** (2001), 91–103.

[223] *Sequential convergences on generalized Boolean algebras*, Math. Bohem. **127** (2002), 1–14.

[224] *Completely subdirect products of directed sets*, Math. Bohem. **127** (2002), 71–81.

[225] *General comparability of pseudo MV-algebras*, Math. Slovaca **52** (2002), 13–17.

[226] *On half cyclically ordered groups*, Czechoslovak Math. J. **52** (2002), 275–294.

[227] *On the lattice of additive hereditary properties of finite graphs*, Discuss. Math. General Algebra Appl. **22** (2002), 73–86.

[228] *Cantor-Bernstein theorem for lattices*, Math. Bohem. **127** (2002), 463–471.

[229] *Radical classes of distributive lattices having the least element*, Math. Bohem. **127** (2002), 409–425.

[230] *On direct and subdirect product decompositions of partially ordered sets*, Math. Slovaca **52** (2002), 377–395.

[231] *Torsion classes of Specker lattice ordered groups*, Czechoslovak Math. J. **52** (2002), 469–482.

[232] *On intervals and isometries of MV-algebras*, Czechoslovak Math. J. **52** (2002), 651–663.

[233] *On the α-completeness of pseudo MV-algebras*, Math. Slovaca **52** (2002), 511–516.

[234] *On product MV-algebras*, Czechoslovak Math. J. **52** (2002), 797–810.

[235] *On orthogonally σ-complete lattice ordered groups*, Czechoslovak Math. J. **52** (2002), 881–888.

[236] *Graph automorphisms and cells of lattices*, Czechoslovak Math. J. **53** (2003), 103–111.

[237] *Convex chains in a pseudo MV-algebra*, Czechoslovak Math. J. **53** (2003), 113–125.

[238] *Torsion classes of MV-algebras*, Soft Comput. **7** (2003), 468–471.

[239] *Maximal completion of a pseudo MV-algebra*, Arch. Math. (Brno) **39** (2003), 141–161.

[240] *On free MV-algebras*, Czechoslovak Math. J. **53** (2003), 311–317.

[241] *On absolute retracts and absolute convex retracts in some classes of l-groups*, Discuss. Math. General Algebra Appl. **23** (2003), 19–30.