

THE 70TH BIRTHDAY OF PROFESSOR JÁN JAKUBÍK

MIROSLAV PLOŠČICA

On October 8, 1993, Professor Ján Jakubík, one of the leading personalities of mathematical sciences in Slovakia, celebrated his seventieth birthday.

Ján Jakubík was born in Dudince (central Slovakia). After attending the secondary school in Banská Štiavnica he studied mathematics and physics at the Faculty of Natural Sciences of the Slovak University in Bratislava (now Comenius University). He graduated in 1949 and became Assistant Professor at the Slovak Technical University in Bratislava. In 1952 he joined the newly established Technical University in Košice. Here he became Associate Professor (1956) and Professor (1963). In 1963 he obtained the degree of Doctor of Sciences (DrSc.). He was elected corresponding member of the Slovak (1964) and Czechoslovak Academy of Sciences (1965) and ordinary member (Academician) in 1977. Since 1985 he has been working at the Mathematical Institute of the Slovak Academy of Sciences as the head of its Košice department.

The scientific work of J. Jakubík is very extensive, with many deep results. It belongs almost entirely to the area of universal algebra and ordered structures. The study of ordered sets, lattices and, especially, ordered groups is the main research interest of J. Jakubík. Let us mention some of his many results. Further information can be found in [a], [b] and [c].

One of the first (and still lasting) Jakubík's interests is the question, to what extent a lattice is determined by its (unoriented) covering graph. He solved this problem for some classes of lattices ([2], [3], [5], [70], [109], [110]), multilattices ([17]) and metric lattices ([12]). It turns out that this question is often connected with the direct decomposability of the considered lattice.

J. Jakubík was among the first who revealed the importance of the weak projectivity of intervals for the study of congruences in lattices ([8]). He also investigated the possibility of extending the Jordan-Dedekind condition to infinite chains.

J. Jakubík has extensively investigated various types of products of ordered structures. He is interested in problems like the existence of a common refinement of two direct decompositions, the conditions under which a given object is a direct product of directly irreducible factors, and similar questions for other

types of products. This was also a motivation for his papers about the center of a lattice ([19], [63], [72]). He found a sufficient condition for the center of a lattice to be closed under all existing suprema and infima; this is a generalization of several results of this kind (S. Maeda, J. v. Neumann, M. P. Janowitz and others).

The largest part of Jakubík's research work is devoted to ordered groups and ℓ -groups. He investigated natural fundamental questions as well as a whole range of special problems.

He proved that in some situations the behaviour of an ordered group depends on its ordering only; this is the case e. g. for direct decomposability of a directed ordered group ([28]). The papers [136] and [148] deal with the situation when the group operation is uniquely determined by the order relation of an ℓ -group. By [148], any such group must be archimedean. By [139], if the positive cone of an ℓ -group G has a unique addition, then G itself has a unique addition. (Both results answer questions of P. Conrad and M. Darnel.)

Paper [50] contains the proof that any two mixed product decompositions of an ordered group with directed factors have isomorphic refinements. This is a generalization of the results of A. I. Maltsev and L. Fuchs on lexicographic products. In a recent paper [127] he investigated the family of all lexicographic product decompositions of a linearly ordered group, quasiordered by the refinement property. Analogous questions for mixed product decompositions are studied in [147].

Several papers of J. Jakubík are devoted to the concept of orthogonality (or disjointness) in ordered groups. In [34] he proved that, in the lattice $F(G)$ of all fllets of a ℓ -group G , the descending chain condition does not imply the complementarity. This answers a question of P. Jaffard. The paper [35] shows the existence of the least orthogonal completion of an archimedean ℓ -group and its invariance with respect to the group operation. An analogous theorem for strongly projectable ℓ -groups is proved in [86]. The paper [69] contains the result that any σ -complete and conditionally orthogonally complete ℓ -group is complete.

J. Martinez introduced the concept of a torsion class of ℓ -groups as an alternative to the concept of a variety. J. Jakubík in [81] found a wider generalization: a radical class. He showed usefulness of this notion for classification and description of ℓ -groups. There are important classes of ℓ -groups that are radical classes, but not varieties (archimedean ℓ -groups, complete ℓ -groups, completely distributive ℓ -groups, etc.). In [91], [95], [96], [117], [139] and other papers he studied families of radical classes ordered by the set inclusion.

In the last decade J. Jakubík paid much attention to (sequential) convergence on lattices, Boolean algebras and, primarily, on ℓ -groups. In several papers he investigated the partially ordered set of all compatible convergences on a ℓ -group.

THE 70TH BIRTHDAY OF PROFESSOR JÁN JAKUBÍK

In [121] he proved that each archimedean completely distributive ℓ -group has the largest (coarsest) convergence. In [134] he showed that the existence of the largest convergence on a ℓ -group depends only on the lattice structure of the ℓ -group.

Along with the research, J. Jakubík did a great deal of pedagogical work at the Technical University Košice. He also significantly participated in organizing of the mathematical life in Czechoslovakia as a member of several editorial boards and committees for doctoral and post-doctoral dissertations.

On the occasion of his 70th birthday, the whole Slovak and Czech mathematical community wishes J. Jakubík good health and a further successful struggle with mathematical problems.

REFERENCES

- [a] ŠIK, F. : *Slovak state prize awarded*, Czechoslovak Math. J. **20** (1970), 349–351.
- [b] KOLIBIAR, M. : *K päťdesiatke profesora Jána Jakubíka*, Matematický časopis **23** (1973), 295–296.
- [c] ČERNÁK, Š.—KOLIBIAR, M. : *Životné jubileum akademika Jána Jakubíka*, Math. Slovaca **33** (1983), 321–326.

List of publications of Ján Jakubík

- [1] Jednoznačnosť rozkladu sväzu na direktný súčin. Matematicko-fyzikálny zborník SAV **1** (1951), 45–50.
- [2] O nekotorych svojstvach par struktur (with M. Kolibiar). Czechoslovak Math. J. **4** (1954), 1–27.
- [3] O graficheskom izomorfizme struktur. Czechoslovak Math. J. **4** (1954), 131–141.
- [4] O rovnomernej konvergencii spojitych funkcií. Matematicko-fyzikálny časopis **4** (1954), 154–161.
- [5] O grafovom izomorfizme semimodulárnych sväzov. Matematicko-fyzikálny časopis **4** (1954), 162–177.
- [6] Sistema otnoshenií kongruentnosti v strukturach. Czechoslovak Math. J. **4** (1954), 248–273.
- [7] O otnosheniyach kongruentnosti na abstraktnykh algebrach. Czechoslovak Math. J. **4** (1954), 314–317.
- [8] Relácie kongruentnosti a slabá projektívnosť na sväzoch. Časopis Pěst. Mat. **80** (1955), 206–216.
- [9] Poznámka o absolútne konvergentných radoch. Matematicko-fyzikálny časopis **5** (1955), 133–136.

- [10] Pryamye razlozheniya jedinicy v modulyarnykh strukturakh. Czechoslovak Math. J. **5** (1955), 399–411.
- [11] Pryamye razlozheniya vpolne distributivnykh struktur. Czechoslovak Math. J. **5** (1955), 488–491.
- [12] O metrických svázoch. Matematicko-fyzikálny časopis **5** (1955), 140–143.
- [13] On the Jordan-Dedekind chain condition. Acta Sci. Math. **16** (1955), 266–269.
- [14] O konvergencii v lineárnych priestoroch. Matematicko-fyzikálny časopis **6** (1956), 57–67.
- [15] O existenčných algebrách. Časopis Pěst. Mat. **81** (1956), 43–45.
- [16] Ob aksiomach teorii multistruktur. Czechoslovak Math. J. **6** (1956), 426–430.
- [17] Grafový izomorfizmus multizväzov. Acta Fac. Rer. Nat. Univ. Comen. Mathematica **1** (1956), 255–264.
- [18] Poznámka o Jordan-Dedekindovej podmienke v Booleových algebrách. Časopis Pěst. Mat. **82** (1957), 44–46.
- [19] Centrum nekonečne distributívnych svázov. Matematicko-fyzikálny časopis **7** (1957), 116–120.
- [20] Poznámka o endomorfizmoch na svázoch. Časopis Pěst. Mat. **83** (1958), 226–229.
- [21] O zameniteľných kongruenciách na svázoch. Matematicko-fyzikálny časopis **8** (1958), 155–162.
- [22] O reťazoch v Booleových algebrách. Matematicko-fyzikálny časopis **8** (1958), 193–202.
- [23] Konvexe Ketten in ℓ -Gruppen. Časopis Pěst. Mat. **83** (1958), 53–63.
- [24] Ob odnom klasse strukturno uporyadachennykh grupp. Časopis Pěst. Mat. **84** (1959), 150–161.
- [25] O glavnykh idealach v strukturno uporyadachennykh gruppach. Czechoslovak Math. J. **9** (1959), 528–543.
- [26] Konvexné reťazce v čiasotčne usporiadaných grupách. Matematicko-fyzikálny časopis **9** (1959), 236–242.
- [27] Ob odnom svoístve strukturno uporyadachennykh grupp. Časopis Pěst. Mat. **85** (1960), 51–59.
- [28] Pryamye razlozheniya chastichno uporyadachennykh grupp. Czechoslovak Math. J. **10** (1960), 231–243.
- [29] K teorii chastichno uporyadachennykh grupp. Časopis Pěst. Mat. **86** (1961), 318–330.
- [30] Pryamye razlozheniya chastichno uporyadachennykh grupp. II. Czechoslovak Math. J. **11** (1961), 490–515.
- [31] Über eine Klasse von ℓ -Gruppen. Acta Fac. Rer. Nat. Univ. Comen. Math. **6** (1961), 267–273.
- [32] The interval topology of an ℓ -group. Matematicko-fyzikálny časopis **12** (1962), 209–211.
- [33] Über Teilbünde der ℓ -Gruppen. Acta Scientiarum Mathematicarum **23** (1962), 249–254.
- [34] Über ein Problem von Paul Jaffard. Arch. Math. (Basel) **14** (1963), 16–21.
- [35] Predstavleniya i rasshireniya ℓ -grupp. Czechoslovak Math. J. **13** (1963), 267–283.
- [36] Die Jordan-Dedekindsche Bedingung im direkten Produkt von geordneten Mengen. Acta Scientiarum Mathematicarum **24**, 1963, 20–23.
- [37] Interval topology of an ℓ -group. Colloq. Math. **11** (1963), 65–72.
- [38] Leksikograficheskie proizvedeniya chastichno uporyadachennykh gruppoidov. Czechoslovak Math. J. **14** (1964), 281–305.
- [39] Über halbgeordnete Gruppen mit verallgemeinerter Jordanscher Zerlegung. Rev. Roumaine Math. Pures Appl. **9** (1964), 187–190.

THE 70TH BIRTHDAY OF PROFESSOR JÁN JAKUBÍK

- [40] Über Verbandsgruppen mit zwei Erzeugenden. *Czechoslovak Math. J.* **14** (1964), 444–454.
- [41] Kolibiar, M., Über euklidische Verbände. *Math. Ann.* **155** (1964), 334–342.
- [42] Kompakt erzeugte Verbandsgruppen. *Math. Nachr.* **30** (1965), 193–201.
- [43] Über die Intervalltopologie auf einer halbgeordneten Gruppe. *Matematicko-fyzikálny časopis* **15** (1965), 257–272.
- [44] Die Dedekindschen Schnitte im direkten Produkt von halbgeordneten Gruppen. *Matematicko-fyzikálny časopis* **16** (1966), 329–336.
- [45] Higher degrees of distributivity in lattices and lattice ordered groups. *Czechoslovak Math. J.* **18** (1968), 356–376.
- [46] Lattice ordered algebras generated by systems of ideals. *Colloq. Math.* **20** (1969), 31–44.
- [47] Disjoint subsets of a partially ordered group. *Arch. Math. (Basel)* **20** (1969), 572–577.
- [48] On some problems concerning disjointness in partially ordered groups. *Acta Fac. Rer. Nat. Univ. Comen. Math.* **22** (1969), 47–56.
- [49] Partially ordered groups with two disjoint elements. *Colloq. Math.* **21** (1970), 39–44.
- [50] The mixed product decompositions of partially ordered groups. *Czechoslovak Math. J.* **20** (1970), 184–206.
- [51] ℓ -subgroups of a lattice ordered group. *J. London Math. Soc.* **2** (1970), 366–368.
- [52] M -polars in lattices. *Časopis Pěst. Mat.* **95** (1970), 252–255.
- [53] On subgroups of a pseudo lattice ordered group. *Pacific J. Math.* **34** (1970), 109–115.
- [54] Weak product decompositions of discrete lattices. *Czechoslovak Math. J.* **21** (1971) 399–412.
- [55] Lattice ordered groups with a basis (with O. Dreveňák). *Math. Nachr.* **53** (1972), 217–236.
- [56] Cardinal properties of lattice ordered groups. *Fund. Math.* **74** (1972), 85–98.
- [57] Distributivity in lattice ordered groups. *Czechoslovak Math. J.* **22** (1972), 108–125.
- [58] Cantor-Bernstein theorem for lattice ordered groups. *Czechoslovak Math. J.* **22** (1972), 159–175.
- [59] Weak product decompositions of partially ordered sets. *Colloq. Math.* **25** (1972), 177–190.
- [60] Homogeneous lattice ordered groups. *Czechoslovak Math. J.* **22** (1972), 325–337.
- [61] Conditionally α -complete sublattices of a distributive lattice. *Algebra Universalis* **2** (1972), 255–261.
- [62] Lattice ordered groups of finite breadth. *Colloq. Math.* **27** (1973), 13–20.
- [63] Center of a complete lattice. *Czechoslovak Math. J.* **23** (1973), 125–138.
- [64] On σ -complete lattice ordered groups. *Czechoslovak Math. J.* **23** (1973), 164–174.
- [65] Lattice ordered groups with complete epimorphic images. *Colloq. Math.* **21** (1974), 21–28.
- [66] Quasiorder on systems of directed sets. *Matematický časopis* **24** (1974), 173–177.
- [67] Normal prime filters of a lattice ordered group. *Czechoslovak Math. J.* **24** (1974), 91–96.
- [68] Splitting property of lattice ordered groups. *Czechoslovak Math. J.* **24** (1974), 257–269.
- [69] Conditionally orthogonally complete ℓ -groups. *Math. Nachr.* **65** (1975), 153–162.
- [70] Unoriented graphs of modular lattices. *Czechoslovak Math. J.* **25** (1975), 240–246.
- [71] Modular lattices of locally finite length. *Acta Sci. Math.* **37** (1975), 79–82.
- [72] Center of a bounded lattice. *Matematický časopis* **25** (1975), 339–343.
- [73] Sublattices with saturated chains. *Czechoslovak Math. J.* **25** (1975), 442–444.

- [74] Cardinal sums of linearly ordered groups. *Czechoslovak Math. J.* **25** (1975), 568–575.
- [75] Product of torsion classes of lattice ordered groups. *Czechoslovak Math. J.* **25** (1975), 576–585.
- [76] Principal projection bands of a Riesz space. *Colloq. Math.* **36** (1976), 195–203.
- [77] Lattice ordered groups with cyclic linearly ordered subgroups. *Časopis Pěst. Mat.* **101** (1976), 88–90.
- [78] Pairs of lattices with common congruence relations, in: *Colloq. Math. Soc. János Bolyai* **14** (1976), pp. 171–183.
- [79] W -isomorphisms of distributive lattices. *Czechoslovak Math. J.* **26** (1976), 330–338.
- [80] Strongly projectable lattice ordered groups. *Czechoslovak Math. J.* **26** (1976), 642–652.
- [81] Lattices with a third distributive operation (with M. Kolibiar). *Math. Slovaca* **27** (1977), 287–292.
- [82] Radical classes and radical mappings of lattice ordered groups, in: *Symposia Mathematica* **31** (1977), Academic Press, New York–London, pp. 451–477.
- [83] Archimedean kernel of a lattice ordered group. *Czechoslovak Math. J.* **28** (1978), 140–154.
- [84] Generalized Dedekind completion of a lattice ordered group. *Czechoslovak Math. J.* **28** (1978), 294–311.
- [85] Maximal Dedekind completion of an abelian lattice ordered group. *Czechoslovak Math. J.* **28** (1978), 611–631.
- [86] Orthogonal hull of a strongly projectable lattice ordered group. *Czechoslovak Math. J.* **28** (1978), 484–504.
- [87] On algebraic operations of a lattice ordered group. *Colloq. Math.* **61** (1979), 35–44.
- [88] Generalized lattice identities in lattice ordered groups. *Czechoslovak Math. J.* **30** (1980), 127–134.
- [89] Isometries of lattice ordered groups. *Czechoslovak Math. J.* **30** (1980), 142–152.
- [90] Weak isomorphisms of lattice ordered groups. *Czechoslovak Math. J.* **30** (1980), 438–444.
- [91] Products of radical classes of lattice ordered groups. *Acta Math. Univ. Comenianae* **39** (1980), 31–42.
- [92] On isometries of non-abelian lattice ordered groups. *Math. Slovaca* **31** (1981), 171–175.
- [93] On value selectors and torsion classes of lattice ordered groups. *Czechoslovak Math. J.* **31** (1981), 306–313.
- [94] Prime selectors and torsion classes of lattice ordered groups. *Czechoslovak Math. J.* **31** (1981), 325–337.
- [95] On the lattice of torsion classes of lattice ordered groups. *Czechoslovak Math. J.* **31** (1981), 510–513.
- [96] On the lattice of radical classes of linearly ordered groups. *Studia Sci. Math. Hungar.* **19** (1981), 76–86.
- [97] On linearly ordered subgroups of a lattice ordered group. *Časopis Pěst. Mat.* **107** (1982), 175–179.
- [98] Projectable kernel of a lattice ordered group. *Universal Algebra and Applications*, in: *Banach Center Publ. Vol 9* (1982), pp. 105–112.
- [99] Torsion radicals of lattice ordered groups. *Czechoslovak Math. J.* **32** (1982), 347–365.
- [100] Distributivity of intervals of torsion radicals. *Czechoslovak Math. J.* **32** (1982), 548–555.
- [101] On lexico extensions of lattice ordered groups. *Math. Slovaca* **33** (1983), 81–84.
- [102] On the lattice of semisimple classes of linearly ordered groups. *Časopis Pěst. Mat.* **107** (1982), 183–190.

THE 70TH BIRTHDAY OF PROFESSOR JÁN JAKUBÍK

- [103] On K -radical classes of lattice ordered groups. *Czechoslovak Math. J.* **33** (1983), 149–163.
- [104] Isometries of multilattice groups (with M. Kolibiar). *Czechoslovak Math. J.* **33** (1983), 602–612.
- [105] On isometries of lattices. *Math. Slovaca* **34** (1984), 177–184.
- [106] On lattices determined up to isomorphisms by their graphs. *Czechoslovak Math. J.* **34** (1984), 305–314.
- [107] Kernels of lattice ordered groups defined by properties of sequences. *Časopis Pěst. Mat.* **109** (1984), 290–298.
- [108] On radical classes of abelian linearly ordered groups. *Math. Slovaca* **35** (1985), 141–154.
- [109] On isomorphisms of graphs of lattices. *Czechoslovak Math. J.* **35** (1985), 188–200.
- [110] Graph isomorphism of semimodular lattices. *Math. Slovaca* **35** (1985), 229–232.
- [111] On weak direct decompositions of lattices and graphs. *Czechoslovak Math. J.* **35** (1985), 269–277.
- [112] Covering graphs and subdirect decompositions of partially ordered sets. *Math. Slovaca* **36** (1986), 151–162.
- [113] On strictly positive lattice ordered semigroups. *Czechoslovak Math. J.* **36** (1986), 31–34.
- [114] Radical subgroups of lattice ordered groups. *Czechoslovak Math. J.* **36** (1986), 285–297.
- [115] Lexicographic product decompositions of a linearly ordered group. *Czechoslovak Math. J.* **36** (1986), 553–563.
- [116] Completion of a cyclically ordered group (with Š. Černák). *Czechoslovak Math. J.* **37** (1987), 157–174.
- [117] Closure operators on the lattice of radical classes of lattice ordered groups. *Czechoslovak Math. J.* **38** (1988), 71–77.
- [118] K -radical classes of abelian linearly ordered groups. *Math. Slovaca* **38** (1988), 33–44.
- [119] Representations of cyclically ordered groups (with G. Pringerová). *Časopis Pěst. Mat.* **113** (1988), 197–208.
- [120] Unequivocal linearly ordered groups. *Czechoslovak Math. J.* **38** (1988), 245–255.
- [121] Convergences and complete distributivity of lattice ordered groups. *Math. Slovaca* **38** (1988), 269–272.
- [122] Weak isometries of lattice ordered groups. *Math. Slovaca* **38** (1988), 133–138.
- [123] Radical classes of cyclically ordered groups (with G. Pringerová). *Math. Slovaca* **38** (1988), 255–268.
- [124] Sequential convergences in Boolean algebras. *Czechoslovak Math. J.* **38** (1988), 520–530.
- [125] On summability in convergence ℓ -groups. *Časopis Pěst. Mat.* **113** (1988), 286–292.
- [126] On direct product decompositions of directed sets. *Math. Slovaca* **38** (1988), 45–49.
- [127] Lexicographic factors of a linearly ordered group. *Czechoslovak Math. J.* **39** (1989), 111–119.
- [128] Retracts of abelian cyclically ordered groups. *Arch. Math. (Brno)* **25** (1989), 13–18.
- [129] On some types of kernels of a convergence ℓ -groups. *Czechoslovak Math. J.* **39** (1989), 239–247.
- [130] Retracts of abelian lattice ordered groups. *Czechoslovak Math. J.* **39** (1989), 477–489.
- [131] Direct product decompositions of directed groups. *Czechoslovak Math. J.* **39** (1989), 618–621.
- [132] Maximal convergences and minimal proper convergences in ℓ -groups (with M. Harminc). *Czechoslovak Math. J.* **39** (1989), 631–640.
- [133] On a radical class of lattice ordered groups. *Czechoslovak Math. J.* **39** (1989), 641–643.

- [134] Lattice ordered groups having a largest convergence. *Czechoslovak Math. J.* **39** (1989), 717–729.
- [135] Retract varieties of lattice ordered groups. *Czechoslovak Math. J.* **40** (1990), 104–112.
- [136] On lattice ordered groups having a unique addition. *Czechoslovak Math. J.* **40** (1990), 311–314.
- [137] On disjoint subsets of a complete lattice ordered group. *Časopis Pěst. Mat.* **115** (1990), 165–170.
- [138] On completions of linearly ordered groups. *Časopis Pěst. Mat.* **115** (1990), 278–282.
- [139] On torsion classes generated by radical classes of lattice ordered groups. *Arch. Math. (Brno)* **26** (1990), 115–119.
- [140] Convergences and higher degrees of distributivity of lattice ordered groups and of Boolean algebras. *Czechoslovak Math. J.* **40** (1990), 453–458.
- [141] Cyclically ordered groups with unique addition. *Czechoslovak Math. J.* **40** (1990), 534–538.
- [142] On directed interpolation groups. *Czechoslovak Math. J.* **40** (1990), 648–658.
- [143] Valuations on modular lattices. *Math. Bohem.* **116** (1991), 391–395.
- [144] Selfduality of the system of intervals of a partially ordered set. *Czechoslovak Math. J.* **41** (1991), 135–140.
- [145] Completions and closures of cyclically ordered groups. *Czechoslovak Math. J.* **41** (1991), 160–169.
- [146] Maximal antichains in a partially ordered set. *Czechoslovak Math. J.* **41** (1991), 75–84.
- [147] Mixed product decompositions of directed groups. *Czechoslovak Math. J.* **41** (1991), 429–435.
- [148] Lattice ordered groups with unique addition must be archimedean. *Czechoslovak Math. J.* **41** (1991), 559–563.
- [149] Sequential convergences on ℓ -groups without Urysohn's axiom. *Czechoslovak Math. J.* **42** (1992), 1–16.
- [150] On convexities of lattices. *Czechoslovak Math. J.* **42** (1992), 325–330.
- [151] Sequential convergences on free lattice ordered groups. *Math. Bohem.* **117** (1992), 48–54.
- [152] Sequential convergences in lattices. *Math. Bohem.* **117** (1992), 239–250.
- [153] On projective intervals in a modular lattice. *Math. Bohem.* **117** (1992), 293–298.
- [154] Partially ordered sets with nondistributive lattice of maximal antichains. *Czechoslovak Math. J.* **42** (1992), 685–691.
- [155] On directed groups with additional operations. *Math. Bohem.* **118** (1993), 11–17.
- [156] Complete retract mappings of a complete lattice ordered group. *Czechoslovak Math. J.* **43** (1993), 301–318.
- [157] On systems of sequences of reals. *Tatra Mountains 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 (with M. Csontóová). *Math. Bohem.* **118** (1993), 359–379.
- [160] On strong superlattices. *Math. Slovaca* **44** (1994), 131–138.
- [161] Direct limits of cyclically ordered groups (with G. Pringerová). *Czechoslovak Math. J.* **44** (1994), 231–250.
- [162] On convexities of d -groups. *Czechoslovak Math. J.* **44** (1994), 305–314.