

## FOREWORD

This special volume of *Theory and Applications of Categories* is dedicated to our colleague Professor Walter Tholen on the occasion of his 60th birthday and in appreciation of his remarkable contribution to various parts of general category theory and categorical algebra and topology<sup>1</sup>.

The main dates from Walter's *curriculum vitae* are the following: Ph.D. from the University of Münster in 1974; Habilitation from Fernuniversität Hagen in 1978; Full Professor position at York University in Toronto from 1988. This period of more than 30 years has been full of success in his own research, in writing — of over 100 publications altogether, and in collaboration with colleagues from so many countries of the world. Walter also co-authored a monograph, and co-edited two books.

Walter's mathematical ideas and theorems speak about abstract adjoint functors and monadicity, factorization systems, closure operators, lax algebras and related structures of categorical topology, sophisticated exactness properties of Grothendieck descent and semi-abelian category theory, and many other things. We will not attempt to describe them even briefly, but simply propose instead the reading of Walter's papers which are listed below. They are always enlightening, precise and beautiful.

We thank the editors of *Theory and Applications of Categories* for the opportunity to prepare this volume.

The Guest Editors:

*M. M. Clementino, G. Janelidze, J. Rosický, and R. Rosebrugh*

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<sup>1</sup>We also note that in October of 2007 there was a workshop in Coimbra in honour of the 60'th birthdays of Walter Tholen and Jiří Adámek. A volume of *Cahiers de topologie et géométrie différentielle catégoriques* will honour Adámek's 60'th birthday.

## PUBLICATIONS OF PROFESSOR WALTER THOLEN

- [1] (with D. Pumplin) Covollständigkeit vollständiger Kategorien (German), *Manuscripta Math.* 11 (1974) 127–140.
- [2] Adjungierte Dreiecke, Colimites und Kan-Erweiterungen (German), *Math. Ann.* 217 (1975) 121–129.
- [3] (with G. Greve) Adjoint co-triangles, *Math. Colloq. Univ. Cape Town* 10 (1975/76) 81–92.
- [4] (with R. Börger) Abschwächungen des Adjunktionsbegriffs (German), *Manuscripta Math.* 19 (1976) 19–45.
- [5]  $M$ -functors, Nordwestdeutsches Kategorienseminar (Tagung, Bremen, 1976), pp. 178–185. Math.-Arbeitspapiere, No. 7, Teil A: Math. Forschungspapiere, Univ. Bremen, Bremen, 1976.
- [6] Factorizations of cones along a functor, *Quaestiones Math.* 2 (1977/78) 335–353.
- [7] On Wyler’s taut lift theorem, *General Topology and Appl.* 8 (1978) 197–206.
- [8] (with R. Börger) Cantors Diagonalprinzip für Kategorien (German), *Math. Z.* 160 (1978) 135–138.
- [9] Zum Satz von Freyd und Kelly (German), *Math. Ann.* 232 (1978) 1–14.
- [10] Semitopological functors I, *J. Pure Appl. Algebra* 15 (1979) 53–73.
- [11] (with M.B. Wischnewsky) Semitopological functors II. External characterizations, *J. Pure Appl. Algebra* 15 (1979) 75–92.
- [12] Lifting semifinal liftings, in: *Lecture Notes in Math.* 719 (1979), pp. 376–385.
- [13] General machines and concrete functors. Fundamentals of computation theory, *Math. Res.* 2 (Akademie-Verlag, Berlin, 1979), pp. 443–449.
- [14] (with M.B. Wischnewsky) Structure functors. External characterizations. Structure of topological categories, *Math.-Arbeitspapiere* 18 (Univ. Bremen, Bremen, 1979), pp. 241–252.
- [15] (with R. Börger) Remarks on topologically algebraic functors, *Cahiers Topologie Géom. Différentielle* 20 (1979) 155–177.
- [16] (with R. Street, M.B. Wischnewsky and H. Wolff) Semitopological functors III. Lifting of monads and adjoint functors, *J. Pure Appl. Algebra* 16 (1980) 299–314.
- [17] Note on total categories, *Bull. Austral. Math. Soc.* 21 (1980) 169–173.
- [18] MacNeille completion of concrete categories with local properties, *Comment. Math. Univ. St. Paul.* 28 (1980) 179–202.
- [19] (with R. Börger, M.B. Wischnewsky and H. Wolff) Compact and hypercomplete categories, *J. Pure Appl. Algebra* 21 (1981) 129–144.
- [20] (with H. Wolff) Extensions of factorization systems, *Cahiers Topologie Géom. Différentielle* 22 (1981) 175–190.
- [21] Injective objects and cogenerating sets, *J. Algebra* 73 (1981) 139–155.
- [22] Amalgamations in categories, *Algebra Universalis* 14 (1982) 391–397.
- [23] Birkhoff’s theorem for categories, *Lecture Notes in Math.* 915 (1982), pp. 351–357.
- [24] (with G. Greve and J. Szigeti) Lifting tensor products along nonadjoint functors, *Cahiers Topologie Géom. Différentielle* 23 (1982) 363–378.

- [25] (with J. MacDonal) Decomposition of morphisms into infinitely many factors, *Lecture Notes in Math.* 962 (1982), pp. 175–189.
- [26] (with E.W. Kiss, L. Márki and P. Pröhle) Categorical algebraic properties. A compendium on amalgamation, congruence extension, epimorphisms, residual smallness, and injectivity, *Studia Sci. Math. Hungar.* 18 (1982) 79–140.
- [27] Completions of categories and shape theory, *Sigma Ser. Pure Math.* 3 (Heldermann, Berlin, 1983), pp. 593–607.
- [28] Factorizations, localizations, and the orthogonal subcategory problem, *Math. Nachr.* 114 (1983) 63–85.
- [29] Pro-categories and multiadjoint functors, *Canad. J. Math.* 36 (1984) 144–155.
- [30] (with R. Börger) Concordant-dissonant and monotone-light, *Sigma Ser. Pure Math.* 5 (Heldermann, Berlin, 1984), pp. 90–107.
- [31] Factorizations, fibres and connectedness, *Sigma Ser. Pure Math.* 5 (Heldermann, Berlin, 1984), pp. 549–566.
- [32] Prereflections and reflections, *Comm. Algebra* 14 (1986) 717–740.
- [33] (with M. Korostenski) On left-cancellable classes of morphisms, *Comm. Algebra* 14 (1986) 741–766.
- [34] Partial products in reflective and coreflective subcategories, *Rend. Circ. Mat. Palermo* (2) Suppl. No. 12 (1986) 133–138.
- [35] Exponentiable monomorphisms, *Quaestiones Math.* 9 (1986) 443–458.
- [36] Reflective subcategories, *Topology Appl.* 27 (1987) 201–212.
- [37] (with R. Dyckhoff) Exponentiable morphisms, partial products and pullback complements, *J. Pure Appl. Algebra* 49 (1987) 103–116.
- [38] (with E. Giuli and S. Mantovani) Objects with closed diagonals, *J. Pure Appl. Algebra* 51 (1988) 129–140.
- [39] Diagonal theorems in topology and elsewhere, General topology and its relations to modern analysis and algebra, VI (Prague, 1986), 559–566, *Res. Exp. Math.* 16, Heldermann, Berlin, 1988.
- [40] (with J. Rosický) Orthogonal and prereflective subcategories, *Cah. Topol. Géom. Différ. Catég.* 29 (1988) 203–215.
- [41] (with A. Tozzi) Completions of categories and initial completions, *Cah. Topol. Géom. Différ. Catég.* 30 (1989) 127–156.
- [42] (with J. Adámek and H. Herrlich) Monadic decompositions, *J. Pure Appl. Algebra* 59 (1989) 111–123.
- [43] (with D. Dikranjan and E. Giuli) Closure operators II, *Categorical topology and its relation to analysis, algebra and combinatorics* (Prague, 1988), pp. 297–335, World Sci. Publ., Teaneck, NJ, 1989.
- [44] (with G. Dimov) A characterization of representable dualities, *Categorical topology and its relation to analysis, algebra and combinatorics* (Prague, 1988), pp. 336–357, World Sci. Publ., Teaneck, NJ, 1989.
- [45] (with M.C. Pedicchio) Multiplicative structures over sup-lattices, *Arch. Math.* (Brno) 25 (1989) 107–114.
- [46] (with R. Börger) Total categories and solid functors, *Canad. J. Math.* 42 (1990) 213–229.

- [47] (with M.C. Pedicchio) Localizations of locally presentable categories and exact topologies, *J. Pure Appl. Algebra* 64 (1990) 293–301.
- [48] (with J. Adámek) Total categories with generators, *J. Algebra* 133 (1990) 63–78.
- [49] (with M. Korostenski) Prelocalizations and natural numbers, *Quaestiones Math.* 13 (1990) 301–320.
- [50] (with H.-E. Porst) Concrete dualities, in: *Res. Exp. Math.* 18 (Heldermann, Berlin, 1991), pp. 111–136.
- [51] (with R. Börger) Strong, regular and dense generators, *Cah. Topol. Géom. Différentielle Catég.* 32 (1991) 257–276.
- [52] (with R. Börger) Totality of colimit closures, *Comment. Math. Univ. Carolin.* 32 (1991) 761–768.
- [53] (with G. Janelidze) How algebraic is the change-of-base functor?, in: *Lecture Notes in Math.* 1488 (1991), pp. 174–186.
- [54] (with M. Sobral) Effective descent morphisms and effective equivalence relations, in: *CMS Conf. Proc.* 13 (Amer. Math. Soc., Providence, RI, 1992), pp. 421–433.
- [55] (with G.D. Dimov) Groups of dualities, *Trans. Amer. Math. Soc.* 336 (1993) 901–913.
- [56] (with M. Korostenski) Factorization systems as Eilenberg-Moore algebras, *J. Pure Appl. Algebra* 85 (1993) 57–72.
- [57] (with J. Reiterman and M. Sobral) Composites of effective descent maps, *Cah. Topol. Géom. Différ. Catég.* 34 (1993) 193–207.
- [58] (with R. Börger and A. Tozzi) Lexicographic sums and fibre-faithful maps, *Appl. Categ. Structures* 1 (1993) 59–83.
- [59] Closure operators, *Rend. Istit. Mat. Univ. Trieste* 25 (1993) 451–465.
- [60] (with J. Reiterman) Effective descent maps of topological spaces, *Topology Appl.* 57 (1994) 53–69.
- [61] (with G. Janelidze) Facets of descent, I, *Appl. Categ. Structures* 2 (1994) 245–281.
- [62] (with J. Rosický) Accessibility and the solution set condition, *J. Pure Appl. Algebra* 98 (1995) 189–208.
- [63] (with H. Hu) Limits in free coproduct completions, *J. Pure Appl. Algebra* 105 (1995) 277–291.
- [64] (with H. Hu) Quasi-coproducts and accessible categories with wide pullbacks, *Appl. Categ. Structures* 4 (1996) 387–402.
- [65] (with J. Adámek and H. Hu) On pure morphisms in accessible categories, *J. Pure Appl. Algebra* 107 (1996) 1–8.
- [66] (with M.M. Clementino) Tychonoff’s Theorem in a category, *Proc. Amer. Math. Soc.* 124 (1996) 3311–3314.
- [67] Objects with dense diagonals, in: *Proc. Workshop on Categorical Topology*, L’Aquila 1994 (Kluwer, Dordrecht 1996), pp 213–220.
- [68] (with M.M. Clementino and E. Giuli) Topology in a category: compactness, *Port. Math.* 53 (1996) 397–433.
- [69] (with H. Hu) A note on free regular and exact completions, and their infinitary generalizations, *Theory Appl. Categ.* 2 (1996) 113–132.
- [70] (with G. Janelidze) Facets of descent, II, *Appl. Categ. Structures* 5 (1997) 229–248.

- [71] (with M.M. Clementino) Separation versus connectedness, *Topology Appl.* 75 (1997) 143–179.
- [72] (with M. M.Clementino) A characterization of the Vietoris topology, *Topology Proc.* 22 (1997) 71–95.
- [73] (with M.M. Clementino) Separated and connected maps, *Appl. Categ. Structures* 6 (1998) 373–401.
- [74] (with G. Janelidze and L. Márki) Locally semisimple coverings, *J. Pure Appl. Algebra* 128 (1998) 281–289.
- [75] (with G. Janelidze) Functorial factorization, well-pointedness and separability, *J. Pure Appl. Algebra* 142 (1999) 99–130.
- [76] (with G. Janelidze) Extended Galois theory and dissonant morphisms, *J. Pure Appl. Algebra* 143 (1999) 231–253.
- [77] A categorical guide to separation, compactness and perfectness, *Homology, Homotopy Appl.* 1 (1999) 147–161.
- [78] (with X. Dong) Representations of relations by partial maps, *Appl. Categ. Structures* 8 (2000) 339–350.
- [79] (with E. Giuli) Openness with respect to a closure operator, *Appl. Categ. Structures* 8 (2000) 487–502.
- [80] (with J. Adámek and L. Sousa) Totality of product completions, *Comment. Math. Univ. Carolinae* 41 (2000) 9–24.
- [81] (with A. Pultr) Localic enrichment of categories, *Cah. Topol. Géom. Différ. Catég.* 41 (2000) 121–142.
- [82] (with M.M. Clementino and E. Giuli) What is a quotient map with respect to a closure operator?, *Appl. Categ. Structures* 9 (2001) 139–151.
- [83] (with G. Richter) Perfect maps are exponentiable - categorically, *Theory Appl. Categ.* 8 (2001) 457–464.
- [84] Essential weak factorization systems, in: *Contributions to General Algebra* 13 (2001) 321–333.
- [85] (with M. M. Clementino) A note on local compactness, *Rend. Istit. Mat. Univ. Trieste* 32, suppl. 2 (2001) 17–31.
- [86] (with G. Janelidze and L. Márki) Semi-abelian categories, *J. Pure Appl. Algebra* 168 (2002) 367–386.
- [87] (with J. Rosický) Lax factorization algebras, *J. Pure Appl. Algebra* 175 (2002) 355–382.
- [88] (with J. Adámek, H. Herrlich and J. Rosický) Injective hulls are not natural, *Algebra Universalis* 48 (2002) 379–388.
- [89] (with J. Adámek, H. Herrlich and J. Rosický) Weak factorization systems and topological functors, *Appl. Categ. Structures* 10 (2002) 237–249.
- [90] (with J. Adámek, H. Herrlich and J. Rosický) On a generalized Small-Object Argument for the injective subcategory problem, *Cah. Topol. Géom. Différ. Catég.* 43 (2002) 83–106.
- [91] (with A. Pultr) Free Quillen factorization systems, *Georgian Math. J.* 9 (2002) 807–820.
- [92] (with M.M. Clementino and D. Hofmann) The convergence approach to exponentiable maps, *Port. Math.* 60 (2003) 139–160.

- [93] (with M.M. Clementino) Metric, topology, multicategory - a common approach, *J. Pure Appl. Algebra* 179 (2003) 13–47.
- [94] (with J. Rosický) Left-determined model categories and universal homotopy theories, *Trans. Amer. Math. Soc.* 355 (2003) 3611–3623.
- [95] (with M. M. Clementino and D. Hofmann) One setting for all: metric, topology, uniformity, approach structure, *Appl. Categ. Structures* 12 (2004) 127–154.
- [96] (with M. M. Clementino and D. Hofmann) Exponentiability in categories of lax algebras, *Theory Appl. Categ.* 11 (2003) 337–352.
- [97] (with G. Janelidze and M. Sobral) Beyond Barr Exactness: Effective Descent Morphisms. In: *Categorical Foundations. Special Topics in Order, Topology, Algebra and Sheaf Theory*, edited by M.C. Pedicchio and W. Tholen (Cambridge University Press, New York 2004).
- [98] (with M. M. Clementino and E. Giuli) A Functional Approach to General Topology. In: *Categorical Foundations. Special Topics in Order, Topology, Algebra and Sheaf Theory*, edited by M.C. Pedicchio and W. Tholen (Cambridge University Press, New York 2004).
- [99] (with D. Dikranjan and S. Watson) Classification of closure operators for categories of topological spaces, in: W. Gähler and G. Preuss (editors), *Categorical Structures and Their Applications* (World Scientific, Singapore 2004), pp. 69–98.
- [100] (with X. Guo and M. Sobral) Descent equivalence, *Cah. Topol. Géom. Différ. Catég.* 45 (2004) 301–315.
- [101] (with G. Janelidze) Facets of descent III: Monadic descent for rings and algebras, *Appl. Categ. Structures* 12 (2004) 416–477.
- [102] (with M. Mahmoudi and C. Schubert) Universality of coproducts in categories of lax algebras, *Appl. Categ. Structures* 14 (2006) 243–249.
- [103] (with M. M. Clementino and D. Dikranjan) Torsion theories and radicals in normal categories, *J. Algebra* 305 (2006) 98–129.
- [104] (with D. Hofmann) Kleisli compositions for topological spaces, *Topology Appl.* 153 (2006) 2952–2961.
- [105] (with M. Grandis) Natural weak factorization systems, *Arch. Math.* (Brno) 42 (2006) 397–408.
- [106] Saunders Mac Lane 1909-2005, Meeting a Grand Leader. *Sci. Math. Jpn.* (Mathematica Japonica New Series) 63 (2006) 13–24.
- [107] (with E. Giuli) A topologist’s view of Chu spaces, *Appl. Categ. Structures* 15 (2007) 573–598.
- [108] (with J. Rosický) Factorization, fibration and torsion, *J. Homotopy Relat. Struct.* 2 (2007) 295–314.
- [109] (with G. Janelidze) Characterization of torsion theories in general categories, *Contemporary Math.* 431 (Amer. Math. Soc., Providence 2007) 249–256.

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