

## References

- AO Akemann C. and Ostrand P. : Computing norms in group  $C^*$ -algebras. Amer. J. Math. 98 (1976) 1015-1047.
- AS Akcoglu M. A. and Sucheston L. : Dilations of positive contractions on  $L_p$ -spaces. Canad. Math. Bull. 20 (1977) 285-292.
- A Amir D. : Characterizations of inner product spaces. Birkhauser, 1986.
- An1 Ando T. : On a pair of commutative contractions. Acta Sci. Math. 24 (1963) 88-90.
- An2 Ando T. : Unitary dilation for a triple of commuting contractions. Bull. Acad. Polon. Sci. 24 (1976), 851-853.
- AFJS Arias A., Figiel T., Johnson W. and Schechtman G. : Banach spaces which have the 2-summing property. Trans. Amer. Math. Soc. To appear.
- Ar1 Arveson W. : Subalgebras of  $C^*$ -algebras. Acta Math. 123 (1969) 141-224. Part II. Acta Math. 128 (1972) 271-308.
- Ar2 Arveson W. : Ten lectures on operator algebras. CBMS 55. Amer. Math. Soc. Providence (RI) 1984.
- Be Bennett G. : Schur multipliers. Duke Math J. 44 (1977) 603-639.
- BGM Bernard A. , Garnett J. and Marshall D. : Algebras generated by inner functions. J. Funct. Anal. 25 (1977) 275-285.
- BP1 Blecher D. and Paulsen V. : Tensor products of operator spaces. J. Funct. Anal. 99 (1991) 262-292.
- BP2 Blecher D. and Paulsen V. : Explicit construction of universal operator algebras and applications to polynomial factorization. Proc. Amer. Math. Soc. 112 (1991) 839-850.
- Ble Blei R. : Multidimensional extensions of the Grothendieck inequality and applications. Arkiv för Mat. 17 (1979) 51-68.
- Blo1 Blower G. : A multiplier characterization of analytic UMD spaces. Studia Math. 96 (1990) 117-124.
- Blo2 Blower G. : On the complete polynomial bound of certain operators. Quarterly J. Math. Oxford 43 (1992) 149-156.
- Bo Bourgain J. : On the similarity problem for polynomially bounded operators on Hilbert space. Israel J. Math. 54 (1986) 227-241.
- B1 Bożejko M. : Remarks on Herz-Schur multipliers on free groups. Math. Ann. 258 (1981) 11-15.
- B2 Bożejko M. : Littlewood functions, Hankel multipliers and power bounded operators on a Hilbert space. Colloquium Math. 51 (1987) 35-42.
- B3 Bożejko M. : Positive definite bounded matrices and a characterization of amenable groups. Proc. A.M.S. 95 (1985) 357-360.
- B4 Bożejko M. : Positive-definite kernels, length functions on groups and a non-commutative von Neumann inequality. Studia Math. 95 (1989) 107-118.
- B5 Bożejko M. : Uniformly bounded representations of free groups. J. für die Reine und Angewandte Math. 377 (1987) 170-186.

- BF1      Bożejko M. and Fendler G. : Herz-Schur multipliers and completely bounded multipliers of the Fourier algebra of a locally compact group. *Boll. Unione Mat. Ital.* (6) 3-A (1984) 297-302.
- BF2      Bożejko M. and Fendler G. : Herz-Schur multipliers and uniformly bounded representations of discrete groups. *Arch. Math.* 57 (1991) 290-298.
- BR      Bratelli O. and Robinson D. : Operator algebras and quantum statistical mechanics II. Springer Verlag, New-York, 1981.
- Bu      Bunce J. W. : The similarity problem for representations of  $C^*$ -algebras. *Proc. Amer. Math. Soc.* 81 (1981) 409-414.
- CCFW    Carlson J., Clark D., Foias C. and Williams J. : Projective Hilbert  $A(D)$ -modules. Preprint.
- C1      Christensen E. : Extensions of derivations. *J. Funct. Anal.* 27 (1978) 234-247.
- C2      Christensen E. : Extensions of derivations II. *Math. Scand.* 50 (1982) 111-122.
- C3      Christensen E. : On non self adjoint representations of operator algebras. *Amer. J. Math.* 103 (1981) 817-834.
- C4      Christensen E. : Similarities of  $II_1$  factors with property  $\Gamma$ . *Journal Operator Theory* 15 (1986) 281-288.
- C5      Christensen E. : Perturbation of operator algebras II. *Indiana Math. J.* 26 (1977), 891-904.
- CS      Christensen E. and Sinclair A. : A survey of completely bounded operators. *Bull. London Math. Soc.* 21 (1989) 417-448.
- CRW    Coifman R., Rochberg R. and Weiss G. : Applications of transference: The  $L^p$  version of von Neumann's inequality and the Littlewood-Paley-Stein theory. *Proc. Conf. Math. Res. Inst. Oberwolfach, Intern. ser. Numer. Math.* vol. 40 (1978) 53-63, Birkhauser, Basel, 1978.
- CLW    Cole B., Lewis K. and Wermer J. : Pick conditions on a uniform algebra and von Neumann inequalities. *J. Funct. Anal.* 107 (1992) 235-254.
- CW      Cole B. and Wermer J. : Pick interpolation, von Neumann inequalities, and hyperconvex sets. *Complex Potential Theory* (edited by P. M. Gauthier). *Nato ASI series (Proceedings, Montreal, July 26-august 6, 1993)* Kluwer Acad. Pub. Dordrecht, 1994.
- Co      Connes A. : Classification of injective factors, Cases  $II_1, II_\infty, III_\lambda, \lambda \neq 1$ . *Ann. Math.* 104 (1976) 73-116.
- Cow1    Cowling M. : Unitary and Uniformly bounded representations of some simple Lie groups. *CIME Course 1980. Liguori, Napoli, 1982*, p. 49-128.
- Cow2    Cowling M. : Harmonic analysis on some nilpotent groups. *Topics in modern harmonic Analysis Vol 1* I. N. D. A. M. Roma, 1983, p. 81-123.
- Cow3    Cowling M. : Rigidity for lattices in semisimple Lie groups: von Neumann algebras and ergodic actions. *Rend. Sem. Mat. Univers. Politecn. Torino* 47 (1989) 1-37.
- Cow4    Cowling M. : Sur les coefficients des représentations unitaires des groupes de Lie simples. *Springer Lecture Notes in Math.* 739 (1979) 132-178.
- CoF    Cowling M. and Fendler G. : On representations in Banach spaces. *Math. Ann.* 266 (1984) 307-315.
- CoH    Cowling M. and Haagerup U. : Completely bounded multipliers of the Fourier algebra of a simple Lie group of real rank one. *Invent. Math.* 96 (1989) 507-549.
- CD      Crabb M. and Davie A. : von Neumann's inequality for Hilbert space operators. *Bull. London Math. Soc.* 7 (1975) 49-50.
- Cu      Cuntz J. : Simple  $C^*$ -algebras generated by isometries. *Comm. Math. Phys.* 57 (1977) 173-185.
- Dah    Daher M. : PhD Thesis, Université Paris 7, October 1993.
- Dad    Davidson K. : Nest algebras. *Pitman Research notes in Math.* 191. Longman, London, New-York, 1988.

- Dav Davie A. M. : Quotient algebras of uniform algebras. *J. London Math. Soc.* 7 (1973) 31-40.
- De Dean D. : The equation  $L(E, X^{**}) = L(E, X)^{**}$  and the principle of local reflexivity. *Proc. Amer. Math. Soc.* 40 (1973) 146-148.
- DCH de Cannière J. and Haagerup U. : Multipliers of the Fourier algebras of some simple Lie groups and their discrete subgroups. *Amer. J. Math.* 107 (1985) 455-500.
- DF Defant A. and Floret K. : Tensor norms and operator ideals. North-Holland, 1993.
- DJT Diestel J. , Jarchow H. and Tonge A. : Absolutely summing operators. Cambridge Univ. Press, 1995.
- Di1 Dixmier J. : Les moyennes invariantes dans les semi-groupes et leurs applications. *Acta Sci. Math. Szeged* 12 (1950) 213-227.
- Di2 Dixmier J. : les algèbres d'opérateurs dans l'espace Hilbertien (Algèbres de von Neumann). Gauthier-Villars, Paris, 1969. (Translated into: von Neumann algebras, North-Holland, 1981.)
- Dix1 Dixon P. : The von Neumann inequality for polynomials of degree greater than two. *J. London Math. Soc.* 14 (1976) 369-375.
- Dix2 Dixon P. :  $Q$ -algebras. Unpublished Lecture Notes. Sheffield University. 1975.
- DD Dixon P. and Drury S. : Unitary dilations, polynomial identities and the von Neumann inequality. *Math. Proc. Cambridge Phil. Soc.* 99 (1986) 115-122.
- DP Douglas V. and Paulsen V. : Hilbert modules over function algebras. Pitman Longman 1989.
- Dr Drury S. : Remarks on von Neumann's inequality. Banach spaces, Harmonic analysis, and probability theory. *Proceedings* (edited by R. Blei and S. Sydney), Storrs 80/81. Springer Lecture Notes 995, 14-32.
- EM Ehrenpreis L. and Mautner F. : Uniformly bounded representations of groups. *Proc. Nat. Acad. Sc.* 41 (1955) 231-233.
- ER Effros E. and Ruan Z.J. : A new approach to operator spaces. *Canad. Math. Bull.* 34 (1991) 329-337.
- Ey Eymard P. : L'algèbre de Fourier d'un groupe localement compact. *Bull. Soc. Math. France* 92 (1964) 181-236.
- Fe1 Fendler G. : A uniformly bounded representation associated to a free set in a discrete group. *Colloq. Math.* 59 (1990) 223-229.
- Fe2 Fendler G. : Herz-Schur multipliers and coefficients of bounded representations. Thesis Heidelberg.
- FTN Figa-Talamanca A. and Nebbia C. : Harmonic analysis and representation theory for groups acting on homogeneous trees. Cambridge Univ. Press, LMS Lecture notes series 162, Cambridge, 1990.
- FTP Figa-Talamanca A. and Picardello M. : Harmonic Analysis on Free groups. Marcel Dekker, New-York, 1983.
- Fi Fisher S. : The convex hull of the finite Blaschke products. *Bull. A.M.S.* 74 (1968) 1128-1129.
- Fic Ficken F.A. : Note on the existence of scalar products in normed linear spaces. *Annals of Math.* 45 (1944) 362-366.
- Fo Foguel S. : A counterexample to a problem of Sz.-Nagy. *Proc. Amer. Math. Soc.* 15 (1964) 788-790.
- Foi Foias C. : Sur certains théorèmes de J. von Neumann concernant les ensembles spectraux. *Acta Sci. Math.* 18 (1957) 15-20.
- FW Foias C. and Williams J. P. : On a class of polynomially bounded operators. Preprint (unpublished, approximately 1976).
- Fou Fournier J. : An interpolation problem for coefficients of  $H^\infty$  functions. *Proc. Amer. Math. Soc.* 42 (1974) 402-408.

- Fug Fuglede B. : A commutativity theorem for normal operators. Proc. Nat. Acad. Sci. U.S.A. 36 (1950) 35-40.
- Gi1 Gilbert J. :  $L^p$ -convolution operators and tensor products of Banach spaces. Bull. Amer. Math. Soc. 80 (1974) 1127-1132.
- Gi2 Gilbert J. : Convolution operators and Banach space tensor products, I, II, III. Unpublished preprints.
- GL Gilbert J. and Leih T. : Factorization, Tensor Products and Bilinear forms in Banach space Theory. In "Notes in Banach spaces" (edited by E. Lacey). University of Texas Press, Austin 1980.
- Gr Greenleaf F. : Invariant means on topological groups. Van Nostrand, New York 1969.
- G Grothendieck A. : Résumé de la théorie métrique des produits tensoriels topologiques. Boll. Soc. Mat. São-Paulo 8 (1956) 1-79.
- Gu Guralnick R. : A note on commuting pairs of matrices. Lin. and Multilin. Alg. 31 (1992) 71-75.
- H1 Haagerup U. : Solution of the similarity problem for cyclic representations of  $C^*$ -algebras. Annals of Math. 118 (1983) 215-240.
- H2 Haagerup U. : An example of a non-nuclear  $C^*$ -algebra which has the metric approximation property. Invent. Mat. 50 (1979) 279-293.
- H3 Haagerup U. : Injectivity and decomposition of completely bounded maps. In "Operator algebras and their connection with topology and ergodic theory", Springer Lecture Notes in Math. 1132 (1985) 91-116.
- H4 Haagerup U. : Decomposition of completely bounded maps on operator algebras. Unpublished manuscript. Sept.1980.
- H5 Haagerup U. : A new upper bound for the complex Grothendieck constant. Israel J. Math. 60 (1987) 199-224.
- H6 Haagerup U. :  $M_0 A(G)$  functions which are not coefficients of uniformly bounded representations. Handwritten manuscript 1985.
- HP1 Haagerup U. and Pisier G. : Linear operators between  $C^*$ -algebras. Duke Math. J. 71 (1993) 889-925.
- HP2 Haagerup U. and Pisier G. : Factorization of analytic functions with values in non-commutative  $L_1$ -spaces. Canad. J. Math. 41 (1989) 882-906.
- Had Hadwin D. : Dilations and Hahn decompositions for linear maps. Canad. J. Math. 33 (1981) 826-839.
- Ha1 Halmos P. : Ten problems in Hilbert space. Bull. Amer. Math. Soc. 76 (1970) 887-933.
- Ha2 Halmos P. : Introduction to Hilbert space. Chelsea. New-York, 1957.
- HaN Havin V. P. and Nikolski N. K. (editors) : Linear and complex analysis problem book 3. Part 1. Lecture Notes in Math. 1573, Springer Verlag, Heidelberg, 1994.
- Hel Helemskii A. Ya. : The homology of Banach and topological algebras. Kluwer Academic Publishers, Dordrecht, 1989.
- Her1 Herz C. S. : Une généralisation de la notion de transformée de Fourier-Stieltjes. Ann. Inst. Fourier (Grenoble) 24 (1974) 145-157.
- Her2 Herz C. S. : The theory of  $p$ -spaces with an application to convolution operators. Trans. Amer. Math. Soc. 154 (1971) 69-82.
- Ho1 Holbrook J. : Distortion coefficients for cryptocontractions. Lin. Alg. and Appl. 18 (1977) 229-256.
- Ho2 Holbrook J. : Distortion coefficients for crypto-unitary operators. Lin. Alg. and Appl. 19 (1978) 189-205.
- Ho3 Holbrook J. : Spectral dilations and polynomially bounded operators. Indiana Univ. Math. J. 20 (1971) 1027-1034.
- Ho4 Holbrook J. : Polynomials in a matrix and its commutant. Linear Alg. Appl. 48 (1982) 293-301.

- Ho5 Holbrook J. : Inequalities of von Neumann type for small matrices. in "Function Spaces" (edited by K. Jarosz). Marcel Dekker, New-York, 1992.
- Ho6 Holbrook J. : Interpenetration of ellipsoids and the polynomial bound of a matrix. Preprint, Sept. 1993.
- J Johnson B. E. : Cohomology in Banach algebras. *Memoirs Amer. Math. Soc.* 127 (1972).
- Jo Jolissaint P. : A characterization of completely bounded multipliers of Fourier algebras. *Colloquium Math.* 63 (1992) 311-313.
- JoV Jolissaint P. and Valette A. : Normes de Sobolev et convoluteurs bornés sur  $L^2(G)$ . *Ann. Inst. Fourier* 41 (1991) 797-822.
- K1 Kadison R. : On the orthogonalization of operator representations. *Amer. J. Math.* 77 (1955) 600-620.
- K2 Kadison R. : A note on the similarity problem. *J. Operator Theory* 26 (1991) 389-405.
- K3 Kadison R. : On an inequality of Haagerup-Pisier. *J. Op. Theory* 29 (1993) 57-68.
- K4 Kadison R. : Derivations of operator algebras. *Ann. Math.* 83 (1966) 280-293.
- KR Kadison R. and Ringrose J. : Fundamentals of the theory of operator algebras, vol. II. Academic Press. New-York, 1986.
- Ka Kahane J.P. : Some random series of functions. Heath Math. Monograph. 1968. New edition Cambridge Univ. Press, 1985.
- Ke1 Kesten H. : Symmetric random walks on groups. *Trans. Amer. Math. Soc.* 92 (1959) 336-354.
- Ke2 Kesten H. : Full Banach mean values on countable groups. *Math. Scand.* 7 (1959) 146-156.
- Ki Kirchberg E. : The derivation and the similarity problem are equivalent. Preprint. August 94.
- Kö König H. : On the complex Grothendieck constant in the  $n$ -dimensional case. *Proc. of the Strobl Conf. Austria 1989*, (edited by P. Mueller and W. Schachermayer) London Math. Soc. Lect. Notes 158 (1990) 181-198.
- Kr1 Krivine J.L. : Constantes de Grothendieck sur les sphères et fonctions de type positif. *Adv. in Math.* 31 (1979) 16-30.
- Kr2 Krivine J.L. : Sur la constante de Grothendieck. *C. R. Acad. Sci. Paris Ser. A* 284 (1977) 445-446.
- KS Kunze R.A. and Stein E. : Uniformly bounded representations and Harmonic Analysis of the  $2 \times 2$  real unimodular group. *Amer. J. Math.* 82 (1960) 1-62.
- Kw Kwapien S. : On operators factorizable through  $L_p$ -space. *Bull. Soc. Math. France Mémoire* 31-32 (1972) 215-225.
- Le Lebow A. : A power bounded operator which is not polynomially bounded. *Mich. Math. J.* 15 (1968) 397-399.
- L1 Leinert M. : Faltungsooperatoren auf gewissen diskreten Gruppen. *Studia Math.* 52, (1974) 149-158.
- L2 Leinert M. : Abschätzung von Normen gewisser Matrizen und eine Anwendung. *Math. Ann.* 240 (1979) 13-19.
- LeM1 Le Merdy C. : Factorizations of  $p$ -completely bounded multilinear maps. Preprint (1993). To appear in *Pacific J. Math.*
- LeM2 Le Merdy C. : Representation of a quotient of a subalgebra of  $B(X)$ . Preprint (1994). To appear in *Math. Proc. Camb. Phil. Soc.*
- LeM3 Le Merdy C. : Analytic factorizations and completely bounded maps. *Israel J. Math.* 88 (1994) 381-409.
- LP Lindahl L. and Poulsen F. : Thin sets in Harmonic Analysis. Marcel Dekker. New-York. 1971.
- LiP Lindenstrauss J. and Pelczynski A. : Absolutely summing operators in  $\mathcal{L}_p$ -spaces and their applications. *Studia Math.* 29 (1968) 275-326.

- LT      Lindenstrauss J. and Tzafriri L. : Classical Banach spaces II. Springer Verlag Berlin, 1979.
- LR      Lopez J. and Ross K. : Sidon sets. Marcel Dekker. New-York. 1975.
- Los      Losert V. : Properties of the Fourier algebra that are equivalent to amenability. Proc. Amer. Math. Soc. 92 (1984) 347-354.
- Lo      Lotto B. : Von Neumann's inequality for commuting, diagonalizable contractions, I. Proc. Amer. Math. Soc. To appear.
- LoS      Lotto B. and Steger T. : Same title II. To appear.
- LuP      Lust-Piquard F. : Opérateurs de Hankel 1-sommants de  $\ell^1(\mathbb{N})$  dans  $\ell^\infty(\mathbb{N})$  et multiplicateurs de  $H^1(T)$ . Comptes Rendus Acad. Sci. Paris. 299 (1984) 915-918.
- LuPP      Lust-Piquard F. and Pisier G. : Non commutative Khintchine and Paley inequalities. Arkiv fr Mat. 29 (1991) 241-260.
- MZ1      Mantero A.M. and Zappa A. : The Poisson transform on free groups and uniformly bounded representations. J. Funct. Anal. 51 (1983) 372-399.
- MZ2      Mantero A.M. and Zappa A. : Uniformly bounded representations and  $L_p$ -convolution theorems on a free group. Harmonic Analysis (Proc. Cortona 1982) Springer Lecture Notes 992 (1983) 333-343.
- M      Mascioni V. : Ideals of the disc algebra, operators related to Hilbert space contractions, and complete boundedness. Houston J. Math. 20 (1994) 299-311.
- Mat      Mathieu M. : The  $cb$ -norm of a derivation. In "Algebraic Methods in Operator Theory" (edited by R. Curto and P. Jørgensen) Birkhauser, Boston, 1994, pp. 144-152.
- Ma      Maurey B. : Un théorème de prolongement. C. R. Acad. Sci. Paris A 279 (1974) 329-332.
- Mi      Misra G. : Curvature inequalities and extremal problems of bundle shifts. J. Operator Theory 11 (1984) 305-318.
- MS1      Misra G. and Sastry S. : Completely contractive modules and associated extremal problems. J. Funct. Anal. 91 (1990) 213-220.
- MS2      Misra G. and Sastry S. : Bounded modules, extremal problems and a curvature inequality. J. Funct. Anal. 88 (1990) 118-134.
- MI      Mlak W. : Algebraic polynomially bounded operators. Ann. Pol. Math. 29 (1974) 133-139.
- Na      Nakazi T. : Commuting dilations and uniform algebras. Canad. J. Math. 42 (1990) 776-789.
- Ne      Nebbia C. : Multipliers and asymptotic behaviour of the Fourier algebra of non amenable groups. Proc. Amer. Math. Soc. 84 (1982) 549-554.
- Nel      Nelson E. : The distinguished boundary of the unit operator ball. Proc. Amer. Math. Soc. 12 (1961) 994-995.
- vN      von Neumann J. : Eine spektraltheorie für allgemeine operatoren eines unitären raumes. Math. Nachr. 4 (1951) 258-281.
- Ni      Nikolskii N. : Treatise on the shift operator. Springer Verlag, Berlin 1986.
- Pag      Page L. : Bounded and compact vectorial Hankel operators. Trans. Amer. Math. Soc. 150 (1970) 529-540.
- Par1      Parrott S. : Unitary dilations for commuting contractions. Pacific J. Math. 34 (1970) 481-490.
- Par2      Parrott S. : On a quotient norm and the Sz.-Nagy-Foias lifting theorem. J. Funct. Anal. 30 (1978) 311-328.
- Pat      Paterson A. : Amenability. A.M.S. Math. Surveys 29 (1988).
- Pa1      Paulsen V. : Completely bounded maps and dilations. Pitman Research Notes in Math. 146, Longman, Wiley, New York, 1986.
- Pa2      Paulsen V. : Completely bounded maps on  $C^*$ -algebras and invariant operator ranges. Proc. Amer. Math. Soc. 86 (1982) 91-96.

- Pa3 Paulsen V. : Every completely polynomially bounded operator is similar to a contraction. *J. Funct. Anal.* 55 (1984) 1-17.
- Pa4 Paulsen V. : Completely bounded homomorphisms of operator algebras. *Proc. Amer. Math. Soc.* 92 (1984) 225-228.
- Pa5 Paulsen V. : Representations of function algebras, abstract operator spaces and Banach space geometry. *J. Funct. Anal.* 109 (1992) 113-129.
- Pa6 Paulsen V. : Completely bounded maps on  $C^*$ -algebras and invariant operator ranges. *Proc. Amer. Math. Soc.* 86 (1982) 91-96.
- PPP Paulsen V. , Percy C. and Petrovic S. : On centered and weakly centered operators. *J. Funct. Anal.* 128 (1995) 87-101.
- Ped Pedersen G. :  $C^*$ -algebras and their automorphism groups. Academic Press, London, 1979.
- Pe1 Peller V. : Estimates of functions of power bounded operators on Hilbert space. *J. Oper. Theory* 7 (1982) 341-372.
- Pe2 Peller V. : An analogue of an inequality of J. von Neumann, isometric dilation of contractions, and approximation by isometries in spaces of measurable functions. *Trudy Inst. Steklov*, 155 (1981) 103-150, English translation in *Proc. Steklov Inst. Math.* (1983) 101-145.
- Pe3 Peller V. : Analog of J. von Neumann's inequality for  $L_p$  space. *Dokl. Akad. Nauk SSSR* 231 (1976) 539-542. (Russian)
- Pet Petrovic S. : A dilation Theory for Polynomially Bounded Operators. *J. Funct. Anal.* 108 (1992) 458-469.
- Pi Pier J.P. : Amenable locally compact groups. Wiley, Interscience, New York 1984.
- Pie Pietsch A. : Operator ideals. North-Holland Amsterdam 1978.
- P1 Pisier G. : Factorization of linear operators and the Geometry of Banach spaces. CBMS (Regional conferences of the A.M.S.) no 60, (1986) Reprinted with corrections 1987.
- P2 Pisier G. : Factorization of operator valued analytic functions. *Advances in Math.* 93 (1992) 61-125.
- P3 Pisier G. : Multipliers and lacunary sets in non-amenable groups. *Amer. J. Math.* 117 (1995) 337-376.
- P4 Pisier G. : Completely bounded maps between sets of Banach space operators. *Indiana Univ. Math. J.* 39 (1990) 251-277.
- P5 Pisier G. : Grothendieck's theorem for noncommutative  $C^*$ -algebras with an appendix on Grothendieck's constants. *J. Funct. Anal.* 29 (1978) 397-415.
- P6 Pisier G. : Complex interpolation and regular operators between Banach lattices. *Arch. Math. (Basel)* 62 (1994) 261-269.
- P7 Pisier G. : Non-commutative vector valued  $L_p$ -spaces and completely  $p$ -summing maps. Preprint To appear.
- Po1 Popescu G. : Von Neumann inequality for  $(B(H)^n)_1$ . *Math. Scand.* 68 (1991) 292-304.
- Po2 Popescu G. : Non-commutative disc algebras and their representations. 1994, Preprint to appear.
- Po3 Popescu G. : Positive-definite functions on free semigroups. Preprint, 1994, to appear.
- Po4 Popescu G. : Multi-analytic operators on Fock space. *Math. Ann.* to appear.
- PyS Pytlik T. and Szwarc R. : An analytic family of uniformly bounded representations of free groups. *Acta Math.* 157 (1986) 287-309.
- Ri Ringrose J. : Cohomology theory for operator algebras. *Proc. Symp. Pure Math.* 38 (1982) 229-252.
- Rob Robertson A.G. : Uniformly bounded group representations into a finite von Neumann algebra. Preprint 1993.

- RR Rosenblum M. and Rovnyak J. : Hardy classes and operator theory. Oxford Univ. Press, New York, 1985.
- Ro Rota G.C. : On models for linear operators. *Comm. Pure Appl. Math.* 13 (1960) 468-472.
- R1 Rudin W. : Fourier analysis on groups. Interscience. New York, 1962.
- R2 Rudin W. : Convex combinations of unimodular functions. *Bull. A.M.S.* 75 (1969) 795-797.
- R3 Rudin W. : Functional Analysis. McGraw-Hill, New-York 1973.
- R4 Rudin W. : Real and Complex Analysis. Third edition, Mc Graw-Hill, New-York, 1987.
- S Sakai S. : Derivations of  $W^*$ -algebras. *Ann. Math.* 83 (1966) 273-279.
- Sa Sarason D. : Generalized interpolation in  $H^\infty$ . *Trans. Amer. Math. Soc.* 127 (1967) 179-203.
- SS Sinclair A. and Smith R. : Hochschild cohomology of von Neumann algebras. LMS Lecture notes series. Cambridge Univ. Press, 1994.
- Sm Smith R. : Completely bounded maps between  $C^*$ -algebras. *J. London Math. Soc.* 27 (1983) 157-166.
- St Stampfli J. : The norm of a derivation. *Pacific J. Math.* 33 (1970) 737-747.
- Sti Stinespring W. : Positive functions on  $C^*$ -algebras. *Proc. Amer. Math. Soc.* 6 (1966) 211-216.
- SN Sz.-Nagy B. : Completely continuous operators with uniformly bounded iterates. *Publ. Math. Inst. Hungarian Acad. Sci.* 4 (1959) 89-92.
- SNF Sz.-Nagy B. and Foias C. Harmonic analysis of operators on Hilbert space. Akademiai Kiadó, Budapest 1970.
- TJ Tomczak-Jaegermann N. : On the Rademacher averages and the moduli of convexity and smoothness of the Schatten classes  $S_p$ . *Studia Math.* 50 (1974) 163-182.
- To 1 Tonge A. : The von Neumann inequality for polynomials in several Hilbert Schmidt operators. *J. London Math. Soc.* 18 (1978) 519-526.
- To 2 Tonge A. : Polarisation and the 2 dimensional Grothendieck inequality. *Proc. Cambridge Phil. Soc.* 95 (1984) 313-318.
- Va1 Valette A. : Les représentations uniformément bornées associées à un arbre réel. *Bull. Soc. Math. Belgique* 42 (1990) 747-760.
- Va2 Valette A. : Cocycles d'arbres et représentations uniformément bornées. *C. R. Acad. Sci. Paris* 310 (1990) 703-708.
- V1 Varopoulos N. : On an inequality of von Neumann and an application of the metric theory of tensor products to Operators Theory. *J. Funct. Anal.* 16 (1974) 83-100.
- V2 Varopoulos N. : Tensor algebras over discrete spaces. *J. Funct. Anal.* 3 (1969) 321-335.
- V3 Varopoulos N. : On a commuting family of contractions on a Hilbert space. *Rev. Roumaine Math. Pures Appl.* 21 (1976) 1283-1285.
- VZ Vasilescu F.H. and Zsido L. : Uniformly bounded groups in finite  $W^*$ -algebras. *Acta Sci. Math.* 36 (1974) 189-192.
- Wi1 Wittstock G. : Ein operatorwertigen Hahn-Banach Satz. *J. Funct. Anal.* 40 (1981) 127-150.
- Wi2 Wittstock G. : On matrix order and convexity. *Functional analysis: surveys and recent results. Math. Studies* 90, p. 175-188. North Holland, Amsterdam, 1984.
- W1 Wysoczanski J. : Characterization of amenable groups and the Littlewood functions on free groups. *Colloquium Math.* 55 (1988) 261-265.
- W2 Wysoczanski J. : An analytic family of uniformly bounded representations of a free product of discrete groups. *Pacific J. Math.* 157 (1993) 373-385.



- W3      Wysoczanski J. : Radial Herz-Schur multipliers on free products of discrete groups. *Journal Funct. Anal.* 129 (1995) 268-292.
- Zs      Zsidó L. : The norm of a derivation in a  $W^*$ -algebra. *Proc. Amer. Math. Soc.* 38 (1973) 147-150.

# Subject Index

Amenable group 2, 6, 35, 37, 49, 51  
Ando's dilation theorem, Ando's inequality 17, 23, 77, 78, 88  
Anticommutation relations 65  
Arveson's distance formula 90  
Berger's result 77  
Blaschke product 21, 22  
Blecher-Paulsen's result 78  
Bochner's integration 82, 133  
Bourgain's estimate 81, 83, 91  
 $C^*$ -algebra 2, 41, 49, 70, 74, 107, 116  
Canonical anticommutation relations 65  
Class  $C_\rho$  77  
Coefficients of representations 30, 44, 50, 123  
Commuting contractions 22, 23, 28, 77, 84, 85, 101  
Commuting isometries 19, 20  
Completely bounded 56  
Completely contractive 56  
Completely isometric 56  
Completely polynomially bounded 75, 76  
Completely positive 56, 60, 76  
Compression 24, 26, 70, 72, 73  
Cotype 42, 139  
Crabb-Davie example 23  
Cuntz algebra 124  
Cyclic homomorphism 116  
Cyclic set 123, 128  
Cyclic vector 3, 120  
Derivation 3, 89, 74, 75, 91  
Dilation 14, 17, 28, 76  
Disc algebra 4, 16, 76  
Dixmier's theorem 2, 6  
Extension of *c.b.* maps 60  
Factorization of *c.b.* maps 57  
Factorization through Hilbert space 54  
Fock space 28

- Fourier algebra 50, 110
- Fourier multipliers 112, 113
- Free group, free set 7, 33, 39, 40, 41, 49, 51, 52, 132
- Grothendieck's constants 96, 99, 102
- Grothendieck's inequality 82, 92, 98
- Grothendieck's theorem 92
- Hahn-Banach theorem 53, 57
- Halmos problem 4
- Hankel, Hankelian 11, 52, 110, 114
- Hankel matrix 11, 52
- Herz-Schur multiplier 50, 107, 110, 113
- Homomorphism 2, 25, 26, 71, 72, 73, 74, 76, 86
- Hyperfinite 127
- Hyper-reflexive 90, 91
- Injective tensor product 63
- Inner derivation 3, 74, 75
- Invariant mean 6, 7, 35, 37
- Invariant subspace 9, 19, 24, 26, 72
- Isometry 17, 18
- Kesten-Hulanicki criterion 35, 49
- Krivine's proof of Grothendieck's theorem 96
- Lacunary 52
- $L_p$ -space 29, 103
- Matsaev's conjecture 29
- Maurey's extension theorem 139
- Möbius transformation 21, 87
- Multilinear *c.b.* map 142
- Multiplier 50, 51, 92, 96, 98, 103, 105, 106, 107, 109, 110, 113
- Mutually commuting contractions 22, 23, 28, 77, 78, 84, 85, 101
- Nagy's dilation theorem 14, 76, 77
- Nehari's theorem 108, 109
- Non-commutative Grothendieck theorem 116
- Nondegenerate homomorphism 124
- Nest algebra 28, 90
- Nuclear  $C^*$ -algebra 125, 131
- Operator algebra 25
- Operator space 109, 112
- Orthogonalizable 2
- Parrott's example 23, 86
- Paulsen's theorem 76
- $p - c.b.$  maps 133
- Peller's questions 52, 113, 114
- Polar decomposition 13, 74
- Polynomially bounded 4, 46, 47
- Positive contraction on  $L_p$  29

Positive definite 49  
 Power bounded 4, 42, 47, 52, 113  
 Quotient of  $L_p$  103  
 Radial 51  
 Reduced  $C^*$ -algebra 107  
 Reducing subspace 18  
 Related operators 81, 141  
 Renorming 4  
 Representation 1  
 $*$ -representation 2, 60, 72, 74  
 Rota's theorem 78  
 Russo-Dye theorem 2, 22  
 Sarason's theorem 24, 26  
 Schatten class 112  
 Schur's criterion 48  
 Schur multiplier 92, 96, 98, 103, 105, 106, 113  
 Semi-group 42, 44  
 Semi-invariant subspace 9, 24, 26, 76  
 Shift 18  
 Similar 4  
 Similarity 4  
 Strongly polynomially bounded 83  
 Subspace of  $L_p$  103  
 Subspace of a quotient of  $L_p$  103, 140  
 Sz.-Nagy's dilation 14, 76, 77  
 Trace class 108  
 Type 139  
 Uniform algebra 85  
 Uniform convexity 49  
 Uniformly bounded representation 1, 33, 35, 42, 52  
 Unitarizable 1, 32, 35, 40, 51, 52  
 Unitary operator 1, 74  
 Unitary representation 1, 30, 123  
 Varopoulos's counterexample 23, 99, 101  
 von Neumann's inequality 3, 13, 17, 21, 22, 26, 28, 29, 77, 102  
 Wold decomposition 18

# Notation Index

$A$  81

$A(D)$  4 (disc algebra)

$A(D^2)$  77, 86 (bidisc algebra)

$A(\Omega)$  86, 91 (analytic functions on  $\Omega$ , continuous on the closure)

$A(G)$  50 (Fourier algebra, coefficients of the left regular representation  $\lambda$ )

$B(G)$  30, 49 (coefficients of unitary representations of  $G$ )

$B_\lambda(G)$  49 (the dual of  $C_\lambda^*(G)$ )

$B_c(G)$  50 (coefficients of the representations uniformly bounded by  $c$ )

$B(H)$  vii (bounded linear operators on  $H$ )

$B(X, Y)$  56 (bounded linear operators from  $X$  to  $Y$ )

$C_\lambda^*(G)$  49, 107 (reduced  $C^*$ -algebra of  $G$ )

$C^*(G)$  41 (full  $C^*$ -algebra of  $G$ )

$E \otimes F$  94 (algebraic tensor product of  $E$  and  $F$ )

$E \hat{\otimes} F$  63 (injective tensor product of  $E$  and  $F$ )

$E \hat{\otimes}_{\gamma_2^*} F$  94 ( $\gamma_2^*$  tensor product of  $E$  and  $F$ )

$\mathbb{F}_N$  or  $\mathbb{F}_\infty$  39 (free group on  $N$  or infinitely many generators)

$\gamma_2(u)$  55 (norm of factorization through Hilbert)

$\gamma_2^*(u)$  94 (dual norm to the norm of factorization through Hilbert)

$\gamma_p(u)$  103 (norm of factorization through  $L_p$ )

$\gamma_{S_p}(u)$  103 (norm of factorization through a subspace of  $L_p$ )

$\gamma_{Q_p}(u)$  103 (norm of factorization through a quotient of  $L_p$ )

$\gamma_{SQ_p}(u)$  103 (norm of factorization through a subspace of a quotient of  $L_p$ )

$\Gamma_2(X, Y)$  55 (space of operators factorizing through Hilbert)

$\Gamma_p(X, Y)$  103 (space of operators factorizing through  $L_p$ )

$\Gamma_{S_p}(X, Y)$  103 (space of operators factorizing through a subspace of  $L_p$ )

$\Gamma_{Q_p}(X, Y)$  103 (space of operators factorizing through a quotient of  $L_p$ )

$\Gamma_{SQ_p}(X, Y)$  103 (operators factorizing through a subspace of a quotient of  $L_p$ )

$H_p$  81 (Hardy space on the circle)

$H_1(S_1)$  108 (Hardy space of trace class valued functions on the circle)

$H_\infty(M)$  45, 46 (bounded  $M$ -valued analytic functions)

$K_G, K_G^{\mathbb{R}}, K_G^{\mathbb{C}}$  96, 99, 102 (Grothendieck's constants, real and complex)

$L_p$  81 ( $L_p$  on the unit circle with normalized Haar measure)

$L_\infty$  81 ( $L_\infty$  on the unit circle with normalized Haar measure)

$L_p(X)$  82 (the space of  $X$ -valued  $p$ -integrable functions, in Bochner's sense)

$L_\infty(M_n)$  82 (the space of  $M_n$ -valued  $L_\infty$  functions on the unit circle)

- $\lambda$  30 (left regular representation on a group)
- $M(G)$  51 (bounded multipliers on  $C_\lambda^*(G)$ )
- $M_0(G)$  50 (completely bounded multipliers on  $C_\lambda^*(G)$ =Herz-Schur ones)
- $M_\varphi$  92 (operator associated to a Schur multiplier  $\varphi$ )
- $M_n$  54 ( $n \times n$  matrices with complex entries)
- $M_n(S)$  56 ( $n \times n$  matrices with entries in  $S$ )
- $\rho$  30 (right regular representation on a group)
- $S_1$  108 (the space of trace class operators)
- $S_p$  112, 113, 114 (Schatten  $p$ -class)
- $\otimes$  56 (algebraic tensor product)
- $T_p(G)$   $T_p(\mathcal{S})$  31, 32
- $\|u\|_{cb}$  56 (completely bounded norm of  $u$ )
- $\|u\|_{pcb}$  133 ( $p$ -completely bounded norm of  $u$ )
- $\|u\|_v$  63 (injective norm of  $u$ )
- $X \otimes Y$  56 (algebraic tensor product of  $X$  and  $Y$ )
- $(y_i) < (x_j)$  54, 135
- $(y_i) <_p (x_j)$  103
- $(z_i) < (x_i)$  57

# Lecture Notes in Mathematics

For information about Vols. 1–1439

please contact your bookseller or Springer-Verlag

Vol. 1440: P. Latiolais (Ed.), *Topology and Combinatorial Groups Theory. Seminar, 1985–1988*. VI, 207 pages. 1990.

Vol. 1441: M. Coornaert, T. Delzant, A. Papadopoulos. *Géométrie et théorie des groupes*. X, 165 pages. 1990.

Vol. 1442: L. Accardi, M. von Waldenfels (Eds.), *Quantum Probability and Applications V. Proceedings, 1988*. VI, 413 pages. 1990.

Vol. 1443: K.H. Dovermann, R. Schultz, *Equivariant Surgery Theories and Their Periodicity Properties*. VI, 227 pages. 1990.

Vol. 1444: H. Korezlioglu, A.S. Ustunel (Eds.), *Stochastic Analysis and Related Topics VI. Proceedings, 1988*. V, 268 pages. 1990.

Vol. 1445: F. Schulz, *Regularity Theory for Quasilinear Elliptic Systems and – Monge Ampère Equations in Two Dimensions*. XV, 123 pages. 1990.

Vol. 1446: *Methods of Nonconvex Analysis. Seminar, 1989*. Editor: A. Cellina. V, 206 pages. 1990.

Vol. 1447: J.-G. Labesse, J. Schwermer (Eds.), *Cohomology of Arithmetic Groups and Automorphic Forms. Proceedings, 1989*. V, 358 pages. 1990.

Vol. 1448: S.K. Jain, S.R. López-Permouth (Eds.), *Non-Commutative Ring Theory. Proceedings, 1989*. V, 166 pages. 1990.

Vol. 1449: W. Odyniec, G. Lewicki, *Minimal Projections in Banach Spaces*. VIII, 168 pages. 1990.

Vol. 1450: H. Fujita, T. Ikebe, S.T. Kuroda (Eds.), *Functional-Analytic Methods for Partial Differential Equations. Proceedings, 1989*. VII, 252 pages. 1990.

Vol. 1451: L. Alvarez-Gaumé, E. Arbarello, C. De Concini, N.J. Hitchin, *Global Geometry and Mathematical Physics. Montecatini Terme 1988. Seminar*. Editors: M. Francaviglia, F. Gherardelli. IX, 197 pages. 1990.

Vol. 1452: E. Hlawka, R.F. Tichy (Eds.), *Number-Theoretic Analysis. Seminar, 1988–89*. V, 220 pages. 1990.

Vol. 1453: Yu.G. Borisovich, Yu.E. Gliklikh (Eds.), *Global Analysis – Studies and Applications IV*. V, 320 pages. 1990.

Vol. 1454: F. Baldassari, S. Bosch, B. Dwork (Eds.), *p-adic Analysis. Proceedings, 1989*. V, 382 pages. 1990.

Vol. 1455: J.-P. Francoise, R. Roussarie (Eds.), *Bifurcations of Planar Vector Fields. Proceedings, 1989*. VI, 396 pages. 1990.

Vol. 1456: L.G. Kovács (Ed.), *Groups – Canberra 1989. Proceedings*. XII, 198 pages. 1990.

Vol. 1457: O. Axelsson, L.Yu. Kolotilina (Eds.), *Preconditioned Conjugate Gradient Methods. Proceedings, 1989*. V, 196 pages. 1990.

Vol. 1458: R. Schaaf, *Global Solution Branches of Two Point Boundary Value Problems*. XIX, 141 pages. 1990.

Vol. 1459: D. Tiba, *Optimal Control of Nonsmooth Distributed Parameter Systems*. VII, 159 pages. 1990.

Vol. 1460: G. Toscani, V. Boffi, S. Rionero (Eds.), *Mathematical Aspects of Fluid Plasma Dynamics. Proceedings, 1988*. V, 221 pages. 1991.

Vol. 1461: R. Gorenflo, S. Vessella, *Abel Integral Equations*. VII, 215 pages. 1991.

Vol. 1462: D. Mond, J. Montaldi (Eds.), *Singularity Theory and its Applications. Warwick 1989, Part I*. VIII, 405 pages. 1991.

Vol. 1463: R. Roberts, I. Stewart (Eds.), *Singularity Theory and its Applications. Warwick 1989, Part II*. VIII, 322 pages. 1991.

Vol. 1464: D. L. Burkholder, E. Pardoux, A. Sznitman, *Ecole d'Été de Probabilités de Saint-Flour XIX-1989*. Editor: P. L. Hennequin. VI, 256 pages. 1991.

Vol. 1465: G. David, *Wavelets and Singular Integrals on Curves and Surfaces*. X, 107 pages. 1991.

Vol. 1466: W. Banaszczyk, *Additive Subgroups of Topological Vector Spaces*. VII, 178 pages. 1991.

Vol. 1467: W. M. Schmidt, *Diophantine Approximations and Diophantine Equations*. VIII, 217 pages. 1991.

Vol. 1468: J. Noguchi, T. Ohsawa (Eds.), *Prospects in Complex Geometry. Proceedings, 1989*. VII, 421 pages. 1991.

Vol. 1469: J. Lindenstrauss, V. D. Milman (Eds.), *Geometric Aspects of Functional Analysis. Seminar 1989–90*. XI, 191 pages. 1991.

Vol. 1470: E. Odell, H. Rosenthal (Eds.), *Functional Analysis. Proceedings, 1987–89*. VII, 199 pages. 1991.

Vol. 1471: A. A. Panchishkin, *Non-Archimedean L-Functions of Siegel and Hilbert Modular Forms*. VII, 157 pages. 1991.

Vol. 1472: T. T. Nielsen, *Bose Algebras: The Complex and Real Wave Representations*. V, 132 pages. 1991.

Vol. 1473: Y. Hino, S. Murakami, T. Naito, *Functional Differential Equations with Infinite Delay*. X, 317 pages. 1991.

Vol. 1474: S. Jackowski, B. Oliver, K. Pawłowski (Eds.), *Algebraic Topology, Poznań 1989. Proceedings*. VIII, 397 pages. 1991.

Vol. 1475: S. Busenberg, M. Martelli (Eds.), *Delay Differential Equations and Dynamical Systems. Proceedings, 1990*. VIII, 249 pages. 1991.

Vol. 1476: M. Bekkali, *Topics in Set Theory*. VII, 120 pages. 1991.

Vol. 1477: R. Jajte, *Strong Limit Theorems in Noncommutative  $L_2$ -Spaces*. X, 113 pages. 1991.

Vol. 1478: M.-P. Malliavin (Ed.), *Topics in Invariant Theory. Seminar 1989–1990*. VI, 272 pages. 1991.

- Vol. 1479: S. Bloch, I. Dolgachev, W. Fulton (Eds.), *Algebraic Geometry. Proceedings, 1989*. VII, 300 pages. 1991.
- Vol. 1480: F. Dumortier, R. Roussarie, J. Sotomayor, H. Żoladek, *Bifurcations of Planar Vector Fields: Nilpotent Singularities and Abelian Integrals*. VIII, 226 pages. 1991.
- Vol. 1481: D. Ferus, U. Pinkall, U. Simon, B. Wegner (Eds.), *Global Differential Geometry and Global Analysis. Proceedings, 1991*. VIII, 283 pages. 1991.
- Vol. 1482: J. Chabrowski, *The Dirichlet Problem with  $L^2$ -Boundary Data for Elliptic Linear Equations*. VI, 173 pages. 1991.
- Vol. 1483: E. Reithmeier, *Periodic Solutions of Nonlinear Dynamical Systems*. VI, 171 pages. 1991.
- Vol. 1484: H. Delfs, *Homology of Locally Semialgebraic Spaces*. IX, 136 pages. 1991.
- Vol. 1485: J. Azéma, P. A. Meyer, M. Yor (Eds.), *Séminaire de Probabilités XXV*. VIII, 440 pages. 1991.
- Vol. 1486: L. Arnold, H. Crauel, J.-P. Eckmann (Eds.), *Lyapunov Exponents. Proceedings, 1990*. VIII, 365 pages. 1991.
- Vol. 1487: E. Freitag, *Singular Modular Forms and Theta Relations*. VI, 172 pages. 1991.
- Vol. 1488: A. Carbone, M. C. Pedicchio, G. Rosolini (Eds.), *Category Theory. Proceedings, 1990*. VII, 494 pages. 1991.
- Vol. 1489: A. Mielke, *Hamiltonian and Lagrangian Flows on Center Manifolds*. X, 140 pages. 1991.
- Vol. 1490: K. Metsch, *Linear Spaces with Few Lines*. XIII, 196 pages. 1991.
- Vol. 1491: E. Lluis-Puebla, J.-L. Loday, H. Gillet, C. Soulé, V. Snaith, *Higher Algebraic K-Theory: an overview*. IX, 164 pages. 1992.
- Vol. 1492: K. R. Wicks, *Fractals and Hyperspaces*. VIII, 168 pages. 1991.
- Vol. 1493: E. Benoît (Ed.), *Dynamic Bifurcations. Proceedings, Luminy 1990*. VII, 219 pages. 1991.
- Vol. 1494: M.-T. Cheng, X.-W. Zhou, D.-G. Deng (Eds.), *Harmonic Analysis. Proceedings, 1988*. IX, 226 pages. 1991.
- Vol. 1495: J. M. Bony, G. Grubb, L. Hörmander, H. Komatsu, J. Sjöstrand, *Microlocal Analysis and Applications. Montecatini Terme, 1989*. Editors: L. Cattabriga, L. Rodino. VII, 349 pages. 1991.
- Vol. 1496: C. Foias, B. Francis, J. W. Helton, H. Kwakernaak, J. B. Pearson,  *$H_\infty$ -Control Theory*. Como, 1990. Editors: E. Mosca, L. Pandolfi. VII, 336 pages. 1991.
- Vol. 1497: G. T. Herman, A. K. Louis, F. Natterer (Eds.), *Mathematical Methods in Tomography. Proceedings 1990*. X, 268 pages. 1991.
- Vol. 1498: R. Lang, *Spectral Theory of Random Schrödinger Operators*. X, 125 pages. 1991.
- Vol. 1499: K. Taira, *Boundary Value Problems and Markov Processes*. IX, 132 pages. 1991.
- Vol. 1500: J.-P. Serre, *Lie Algebras and Lie Groups*. VII, 168 pages. 1992.
- Vol. 1501: A. De Masi, E. Presutti, *Mathematical Methods for Hydrodynamic Limits*. IX, 196 pages. 1991.
- Vol. 1502: C. Simpson, *Asymptotic Behavior of Monodromy*. V, 139 pages. 1991.
- Vol. 1503: S. Shokranian, *The Selberg-Arthur Trace Formula (Lectures by J. Arthur)*. VII, 97 pages. 1991.
- Vol. 1504: J. Cheeger, M. Gromov, C. Okonek, P. Pansu, *Geometric Topology: Recent Developments*. Editors: P. de Bartolomeis, F. Tricerri. VII, 197 pages. 1991.
- Vol. 1505: K. Kajitani, T. Nishitani, *The Hyperbolic Cauchy Problem*. VII, 168 pages. 1991.
- Vol. 1506: A. Buium, *Differential Algebraic Groups of Finite Dimension*. XV, 145 pages. 1992.
- Vol. 1507: K. Hulek, T. Peternell, M. Schneider, F.-O. Schreyer (Eds.), *Complex Algebraic Varieties. Proceedings, 1990*. VII, 179 pages. 1992.
- Vol. 1508: M. Vuorinen (Ed.), *Quasiconformal Space Mappings. A Collection of Surveys 1960-1990*. IX, 148 pages. 1992.
- Vol. 1509: J. Aguadé, M. Castellet, F. R. Cohen (Eds.), *Algebraic Topology - Homotopy and Group Cohomology. Proceedings, 1990*. X, 330 pages. 1992.
- Vol. 1510: P. P. Kulish (Ed.), *Quantum Groups. Proceedings, 1990*. XII, 398 pages. 1992.
- Vol. 1511: B. S. Yadav, D. Singh (Eds.), *Functional Analysis and Operator Theory. Proceedings, 1990*. VIII, 223 pages. 1992.
- Vol. 1512: L. M. Adleman, M.-D. A. Huang, *Primality Testing and Abelian Varieties Over Finite Fields*. VII, 142 pages. 1992.
- Vol. 1513: L. S. Block, W. A. Coppel, *Dynamics in One Dimension*. VIII, 249 pages. 1992.
- Vol. 1514: U. Krengel, K. Richter, V. Warstat (Eds.), *Ergodic Theory and Related Topics III, Proceedings, 1990*. VIII, 236 pages. 1992.
- Vol. 1515: E. Ballico, F. Catanese, C. Ciliberto (Eds.), *Classification of Irregular Varieties. Proceedings, 1990*. VII, 149 pages. 1992.
- Vol. 1516: R. A. Lorentz, *Multivariate Birkhoff Interpolation*. IX, 192 pages. 1992.
- Vol. 1517: K. Keimel, W. Roth, *Ordered Cones and Approximation*. VI, 134 pages. 1992.
- Vol. 1518: H. Stichtenoth, M. A. Tsfasman (Eds.), *Coding Theory and Algebraic Geometry. Proceedings, 1991*. VIII, 223 pages. 1992.
- Vol. 1519: M. W. Short, *The Primitive Soluble Permutation Groups of Degree less than 256*. IX, 145 pages. 1992.
- Vol. 1520: Yu. G. Borisovich, Yu. E. Gliklikh (Eds.), *Global Analysis - Studies and Applications V*. VII, 284 pages. 1992.
- Vol. 1521: S. Busenberg, B. Forte, H. K. Kuiken, *Mathematical Modelling of Industrial Process*. Bari, 1990. Editors: V. Capasso, A. Fasano. VII, 162 pages. 1992.
- Vol. 1522: J.-M. Delort, F. B. I. Transformation. VII, 101 pages. 1992.
- Vol. 1523: W. Xue, *Rings with Morita Duality*. X, 168 pages. 1992.
- Vol. 1524: M. Coste, L. Mahé, M.-F. Roy (Eds.), *Real Algebraic Geometry. Proceedings, 1991*. VIII, 418 pages. 1992.
- Vol. 1525: C. Casacuberta, M. Castellet (Eds.), *Mathematical Research Today and Tomorrow*. VII, 112 pages. 1992.



- Vol. 1526: J. Azéma, P. A. Meyer, M. Yor (Eds.), *Séminaire de Probabilités XXVI*. X, 633 pages. 1992.
- Vol. 1527: M. I. Freidlin, J.-F. Le Gall, *Ecole d'Eté de Probabilités de Saint-Flour XX – 1990*. Editor: P. L. Hennequin. VIII, 244 pages. 1992.
- Vol. 1528: G. Isac, *Complementarity Problems*. VI, 297 pages. 1992.
- Vol. 1529: J. van Neerven, *The Adjoint of a Semigroup of Linear Operators*. X, 195 pages. 1992.
- Vol. 1530: J. G. Heywood, K. Masuda, R. Rautmann, S. A. Solonnikov (Eds.), *The Navier-Stokes Equations II – Theory and Numerical Methods*. IX, 322 pages. 1992.
- Vol. 1531: M. Stoer, *Design of Survivable Networks*. IV, 206 pages. 1992.
- Vol. 1532: J. F. Colombeau, *Multiplication of Distributions*. X, 184 pages. 1992.
- Vol. 1533: P. Jipsen, H. Rose, *Varieties of Lattices*. X, 162 pages. 1992.
- Vol. 1534: C. Greither, *Cyclic Galois Extensions of Commutative Rings*. X, 145 pages. 1992.
- Vol. 1535: A. B. Evans, *Orthomorphism Graphs of Groups*. VIII, 114 pages. 1992.
- Vol. 1536: M. K. Kwong, A. Zettl, *Norm Inequalities for Derivatives and Differences*. VII, 150 pages. 1992.
- Vol. 1537: P. Fitzpatrick, M. Martelli, J. Mawhin, R. Nussbaum, *Topological Methods for Ordinary Differential Equations*. Montecatini Terme, 1991. Editors: M. Furi, P. Zecca. VII, 218 pages. 1993.
- Vol. 1538: P.-A. Meyer, *Quantum Probability for Probabilists*. X, 287 pages. 1993.
- Vol. 1539: M. Coornaert, A. Papadopoulos, *Symbolic Dynamics and Hyperbolic Groups*. VIII, 138 pages. 1993.
- Vol. 1540: H. Komatsu (Ed.), *Functional Analysis and Related Topics*, 1991. Proceedings. XXI, 413 pages. 1993.
- Vol. 1541: D. A. Dawson, B. Maisonneuve, J. Spencer, *Ecole d'Eté de Probabilités de Saint-Flour XXI – 1991*. Editor: P. L. Hennequin. VIII, 356 pages. 1993.
- Vol. 1542: J. Fröhlich, Th. Kerler, *Quantum Groups, Quantum Categories and Quantum Field Theory*. VII, 431 pages. 1993.
- Vol. 1543: A. L. Dontchev, T. Zolezzi, *Well-Posed Optimization Problems*. XII, 421 pages. 1993.
- Vol. 1544: M. Schürmann, *White Noise on Bialgebras*. VII, 146 pages. 1993.
- Vol. 1545: J. Morgan, K. O'Grady, *Differential Topology of Complex Surfaces*. VIII, 224 pages. 1993.
- Vol. 1546: V. V. Kalashnikov, V. M. Zolotarev (Eds.), *Stability Problems for Stochastic Models*. Proceedings, 1991. VIII, 229 pages. 1993.
- Vol. 1547: P. Harmand, D. Werner, W. Werner, *M-ideals in Banach Spaces and Banach Algebras*. VIII, 387 pages. 1993.
- Vol. 1548: T. Urabe, *Dynkin Graphs and Quadrilateral Singularities*. VI, 233 pages. 1993.
- Vol. 1549: G. Vainikko, *Multidimensional Weakly Singular Integral Equations*. XI, 159 pages. 1993.
- Vol. 1550: A. A. Gonchar, E. B. Saff (Eds.), *Methods of Approximation Theory in Complex Analysis and Mathematical Physics IV*. 222 pages, 1993.
- Vol. 1551: L. Arkeryd, P. L. Lions, P. A. Markowich, S. R. S. Varadhan, *Nonequilibrium Problems in Many-Particle Systems*. Montecatini, 1992. Editors: C. Cercignani, M. Pulvirenti. VII, 158 pages. 1993.
- Vol. 1552: J. Hilgert, K.-H. Neeb, *Lie Semigroups and their Applications*. XII, 315 pages. 1993.
- Vol. 1553: J.-L. Colliot-Thélène, J. Kato, P. Vojta, *Arithmetic Algebraic Geometry*. Trento, 1991. Editor: E. Ballico. VII, 223 pages. 1993.
- Vol. 1554: A. K. Lenstra, H. W. Lenstra, Jr. (Eds.), *The Development of the Number Field Sieve*. VIII, 131 pages. 1993.
- Vol. 1555: O. Liess, *Conical Refraction and Higher Microlocalization*. X, 389 pages. 1993.
- Vol. 1556: S. B. Kuksin, *Nearly Integrable Infinite-Dimensional Hamiltonian Systems*. XXVII, 101 pages. 1993.
- Vol. 1557: J. Azéma, P. A. Meyer, M. Yor (Eds.), *Séminaire de Probabilités XXVII*. VI, 327 pages. 1993.
- Vol. 1558: T. J. Bridges, J. E. Furter, *Singularity Theory and Equivariant Symplectic Maps*. VI, 226 pages. 1993.
- Vol. 1559: V. G. Sprindžuk, *Classical Diophantine Equations*. XII, 228 pages. 1993.
- Vol. 1560: T. Bartsch, *Topological Methods for Variational Problems with Symmetries*. X, 152 pages. 1993.
- Vol. 1561: I. S. Molchanov, *Limit Theorems for Unions of Random Closed Sets*. X, 157 pages. 1993.
- Vol. 1562: G. Harder, *Eisensteinkohomologie und die Konstruktion gemischter Motive*. XX, 184 pages. 1993.
- Vol. 1563: E. Fabes, M. Fukushima, L. Gross, C. Kenig, M. Röckner, D. W. Stroock, *Dirichlet Forms*. Varenna, 1992. Editors: G. Dell'Antonio, U. Mosco. VII, 245 pages. 1993.
- Vol. 1564: J. Jorgenson, S. Lang, *Basic Analysis of Regularized Series and Products*. IX, 122 pages. 1993.
- Vol. 1565: L. Boutet de Monvel, C. De Concini, C. Procesi, P. Schapira, M. Vergne, *D-modules, Representation Theory, and Quantum Groups*. Venezia, 1992. Editors: G. Zampieri, A. D'Agnolo. VII, 217 pages. 1993.
- Vol. 1566: B. Edixhoven, J.-H. Evertse (Eds.), *Diophantine Approximation and Abelian Varieties*. XIII, 127 pages. 1993.
- Vol. 1567: R. L. Dobrushin, S. Kusuoka, *Statistical Mechanics and Fractals*. VII, 98 pages. 1993.
- Vol. 1568: F. Weisz, *Martingale Hardy Spaces and their Application in Fourier Analysis*. VIII, 217 pages. 1994.
- Vol. 1569: V. Totik, *Weighted Approximation with Varying Weight*. VI, 117 pages. 1994.
- Vol. 1570: R. deLaubenfels, *Existence Families, Functional Calculi and Evolution Equations*. XV, 234 pages. 1994.
- Vol. 1571: S. Yu. Pilyugin, *The Space of Dynamical Systems with the  $C^0$ -Topology*. X, 188 pages. 1994.
- Vol. 1572: L. Göttsche, *Hilbert Schemes of Zero-Dimensional Subschemes of Smooth Varieties*. IX, 196 pages. 1994.
- Vol. 1573: V. P. Havin, N. K. Nikolski (Eds.), *Linear and Complex Analysis – Problem Book 3 – Part I*. XXII, 489 pages. 1994.

- Vol. 1574: V. P. Havin, N. K. Nikolski (Eds.), *Linear and Complex Analysis – Problem Book 3 – Part II. XXII*, 507 pages. 1994.
- Vol. 1575: M. Mitrea, *Clifford Wavelets, Singular Integrals, and Hardy Spaces*. XI, 116 pages. 1994.
- Vol. 1576: K. Kitahara, *Spaces of Approximating Functions with Haar-Like Conditions*. X, 110 pages. 1994.
- Vol. 1577: N. Obata, *White Noise Calculus and Fock Space*. X, 183 pages. 1994.
- Vol. 1578: J. Bernstein, V. Lunts, *Equivariant Sheaves and Functors*. V, 139 pages. 1994.
- Vol. 1579: N. Kazamaki, *Continuous Exponential Martingales and BMO*. VII, 91 pages. 1994.
- Vol. 1580: M. Milman, *Extrapolation and Optimal Decompositions with Applications to Analysis*. XI, 161 pages. 1994.
- Vol. 1581: D. Bakry, R. D. Gill, S. A. Molchanov, *Lectures on Probability Theory*. Editor: P. Bernard. VIII, 420 pages. 1994.
- Vol. 1582: W. Balser, *From Divergent Power Series to Analytic Functions*. X, 108 pages. 1994.
- Vol. 1583: J. Azéma, P. A. Meyer, M. Yor (Eds.), *Séminaire de Probabilités XXVIII*. VI, 334 pages. 1994.
- Vol. 1584: M. Brokate, N. Kenmochi, I. Müller, J. F. Rodriguez, C. Verdi, *Phase Transitions and Hysteresis*. Montecatini Terme, 1993. Editor: A. Visintin. VII, 291 pages. 1994.
- Vol. 1585: G. Frey (Ed.), *On Artin's Conjecture for Odd 2-dimensional Representations*. VIII, 148 pages. 1994.
- Vol. 1586: R. Nilsen, *Difference Spaces and Invariant Linear Forms*. XII, 186 pages. 1994.
- Vol. 1587: N. Xi, *Representations of Affine Hecke Algebras*. VIII, 137 pages. 1994.
- Vol. 1588: C. Scheiderer, *Real and Étale Cohomology*. XXIV, 273 pages. 1994.
- Vol. 1589: J. Bellissard, M. Degli Esposti, G. Forni, S. Graffi, S. Isola, J. N. Mather, *Transition to Chaos in Classical and Quantum Mechanics*. Montecatini Terme, 1991. Editor: S. Graffi. VII, 192 pages. 1994.
- Vol. 1590: P. M. Soardi, *Potential Theory on Infinite Networks*. VIII, 187 pages. 1994.
- Vol. 1591: M. Abate, G. Patrizio, *Finsler Metrics – A Global Approach*. IX, 180 pages. 1994.
- Vol. 1592: K. W. Breitung, *Asymptotic Approximations for Probability Integrals*. IX, 146 pages. 1994.
- Vol. 1593: J. Jorgenson & S. Lang, D. Goldfeld, *Explicit Formulas for Regularized Products and Series*. VIII, 154 pages. 1994.
- Vol. 1594: M. Green, J. Murre, C. Voisin, *Algebraic Cycles and Hodge Theory*. Torino, 1993. Editors: A. Albano, F. Bardelli. VII, 275 pages. 1994.
- Vol. 1595: R.D.M. Accola, *Topics in the Theory of Riemann Surfaces*. IX, 105 pages. 1994.
- Vol. 1596: L. Heindorf, L. B. Shapiro, *Nearly Projective Boolean Algebras*. X, 202 pages. 1994.
- Vol. 1597: B. Herzog, *Kodaira-Spencer Maps in Local Algebra*. XVII, 176 pages. 1994.
- Vol. 1598: J. Berndt, F. Tricerri, L. Vanhecke, *Generalized Heisenberg Groups and Damek-Ricci Harmonic Spaces*. VIII, 125 pages. 1995.
- Vol. 1599: K. Johannson, *Topology and Combinatorics of 3-Manifolds*. XVIII, 446 pages. 1995.
- Vol. 1600: W. Narkiewicz, *Polynomial Mappings*. VII, 130 pages. 1995.
- Vol. 1601: A. Pott, *Finite Geometry and Character Theory*. VII, 181 pages. 1995.
- Vol. 1602: J. Winkelmann, *The Classification of Three-dimensional Homogeneous Complex Manifolds*. XI, 230 pages. 1995.
- Vol. 1603: V. Ene, *Real Functions – Current Topics*. XIII, 310 pages. 1995.
- Vol. 1604: A. Huber, *Mixed Motives and their Realization in Derived Categories*. XV, 207 pages. 1995.
- Vol. 1605: L. B. Wahlbin, *Superconvergence in Galerkin Finite Element Methods*. XI, 166 pages. 1995.
- Vol. 1606: P.-D. Liu, M. Qian, *Smooth Ergodic Theory of Random Dynamical Systems*. XI, 221 pages. 1995.
- Vol. 1607: G. Schwarz, *Hodge Decomposition – A Method for Solving Boundary Value Problems*. VII, 155 pages. 1995.
- Vol. 1608: P. Biane, R. Durrett, *Lectures on Probability Theory*. VII, 210 pages. 1995.
- Vol. 1609: L. Arnold, C. Jones, K. Mischaikow, G. Raugel, *Dynamical Systems*. Montecatini Terme, 1994. Editor: R. Johnson. VIII, 329 pages. 1995.
- Vol. 1610: A. S. Üstünel, *An Introduction to Analysis on Wiener Space*. X, 95 pages. 1995.
- Vol. 1611: N. Knarr, *Translation Planes*. VI, 112 pages. 1995.
- Vol. 1612: W. Kühnel, *Tight Polyhedral Submanifolds and Tight Triangulations*. VII, 122 pages. 1995.
- Vol. 1613: J. Azéma, M. Emery, P. A. Meyer, M. Yor (Eds.), *Séminaire de Probabilités XXIX*. VI, 326 pages. 1995.
- Vol. 1614: A. Koselev, *Regularity Problem for Quasilinear Elliptic and Parabolic Systems*. XXI, 255 pages. 1995.
- Vol. 1615: D. B. Massey, *Lê Cycles and Hypersurface Singularities*. XI, 131 pages. 1995.
- Vol. 1616: I. Moerdijk, *Classifying Spaces and Classifying Topoi*. VII, 94 pages. 1995.
- Vol. 1617: Vadim Yurinsky, *Sums and Gaussian Vectors*. XI, 305 pages. 1995.
- Vol. 1618: Gilles Pisier, *Similarity Problems and Completely Bounded Maps*. VII, 156 pages. 1996.
- Vol. 1538 – Second Edition: P.-A. Meyer, *Quantum Probability for Probabilists*. X, 312 pages. 1995.

# General Remarks

Lecture Notes are printed by photo-offset from the master-copy delivered in camera-ready form by the authors. For this purpose Springer-Verlag provides technical instructions for the preparation of manuscripts.

Careful preparation of manuscripts will help keep production time short and ensure a satisfactory appearance of the finished book. The actual production of a Lecture Notes volume normally takes approximately 8 weeks.

Authors receive 50 free copies of their book. No royalty is paid on Lecture Notes volumes.

Authors are entitled to purchase further copies of their book and other Springer mathematics books for their personal use, at a discount of 33,3 % directly from Springer-Verlag.

Commitment to publish is made by letter of intent rather than by signing a formal contract. Springer-Verlag secures the copyright for each volume.

Addresses:

Professor A. Dold  
Mathematisches Institut  
Universität Heidelberg  
Im Neuenheimer Feld 288  
D-69120 Heidelberg  
Federal Republic of Germany

Professor F. Takens  
Mathematisch Instituut  
Rijksuniversiteit Groningen  
Postbus 800  
NL-9700 AV Groningen  
The Netherlands

Springer-Verlag, Mathematics Editorial  
Tiergartenstr. 17  
D-69121 Heidelberg  
Federal Republic of Germany  
Tel.: \*49 (6221) 487-410