

Publications and Patents
Brian Marcus

Research Publications

1. Unique ergodicity of some flows related to Axiom A diffeomorphisms, *Israel J. Math* 21 (1975) 111-132.
2. Unique ergodicity of the horocycle flow: variable curvature case, *Israel J. Math* 21 (1975) 133-144.
3. Reparametrizations of uniquely ergodic flows, *J. Diff. Eqns.*, 22 (1976) 227-235.
4. Unique ergodicity of horocycle foliations (with R. Bowen), *Israel J. Math* 26 (1977) 43-67.
5. Ergodic properties of horocycle flows for surfaces of negative curvature, *Annals of Math* 105 (1977) 81-105.
6. The horocycle flow is mixing of all degrees, *Inventiones Math.* 46 (1978) 201-209.
7. Topological mixing of higher degrees (with S. Goodman) *AMS Proceedings*, 72 (1978) 561-565.
8. Topological entropy and equivalence of dynamical systems (with R. Adler) *Memoirs AMS #219* (1979) (announced in: *Finitistic coding for shifts of finite type* (with R. Adler) *Springer-Verlag Lecture Notes in Mathematics*, v. 668 (1978) 1-11).
9. Factors and extensions of full shifts, *Monats. fur Math.*, 88 (1979) 239-247.
10. Measures of maximal entropy for a class of skew products (with S. Newhouse) *Springer-Verlag Lecture Notes in Mathematics*, v. 729 (1979) 105-125.
11. Balancing ergodic averages (with K. Petersen) *Springer-Verlag Lecture Notes in Mathematics*, v. 729 (1979) 126-144.
12. Periodic points for ergodic toral automorphisms, *Monats. fur Math.*, 89 (1980) 121-129.
13. Continuous homomorphisms of Bernoulli shifts (with A. del Junco, M. Keane, B. Kitchens, L. Swanson) *Ergodic theory and dynamical systems I*, Birkhauser Press, (1981) 91-112.
14. Topological conjugacy of horocycle flows, *Amer. J. Math.* (1983) 623-632.
15. Transmission rates and factors of Markov chains (with K. Petersen and S. Williams) *Contemporary Mathematics*, 26 (1984) 279-294.
16. Worst Case Patterns for Magnetic Buried Servo (with P. Siegel) *IEEE Transactions on Magnetics* 20 (1984) 906-908.
17. Sofic systems and encoding data, *IEEE Transactions on Information Theory*, 31 (1985) 366-377.
18. Finite Group Actions on Subshifts of Finite Type (with R. Adler and B. Kitchens) *Ergodic theory and Dynamical systems*, 5 (1985) 1-25.
19. Classification of Finite-to-one Factor Maps of Shifts of Finite Type (with R. Adler and

- B. Kitchens) Ergodic Theory and dynamical systems, 5 (1985) 485-500.
20. A Note on Minimal Covers for Sofic Systems (with M. Boyle and B. Kitchens) Proceedings AMS, 95 (1985) 403-411.
 21. State splitting for Variable Length Graphs (with R. Adler, B. Kitchens, and J. Friedman) IEEE Transactions on Information Theory 32 (1986) 108-113.
 22. Resolving Maps and the Dimension Group for shifts of finite type (with M. Boyle and P. Trow), Memoirs AMS, v.70, no. 377 (1987).
 23. On Codes with spectral nulls at rational submultiples of the symbol frequency (with P. Siegel), IEEE Transactions on Information Theory 33 (1987) 557-569.
 24. Sliding-block coding for input-restricted channels (with R. Karaded), IEEE Transactions on Information theory, 34 (1988) 2-27.
 25. Constrained codes for partial response channels (with P. Siegel), Proceedings of 1988 Beijing International Workshop on Information Theory, DI-1
 26. Entropy at a weight-per-symbol and an imbedding theorem for Markov chains (with S. Tuncel), Inventiones Mathematicae, 102 (1990), 235-266.
 27. Eventual factor maps and compositions of closing maps (with B. Kitchens and P. Trow), Ergodic Theory and Dynamical Systems, 11 (1991), 85-113.
 28. The weight-per-symbol polytope and scaffolds of invariants associated with Markov chains (with S. Tuncel), Ergodic Theory and Dynamical Systems, 11 (1991), 129- 180.
 29. Variable length state splitting with applications to average run-length constrained (ARC) codes (with C. Heegard and P. Siegel), IEEE Transactions on Information Theory, 37 (1991) 759-777.
 30. Bounds on the number of states in encoder graphs for input- constrained channels (with R. Roth) IEEE Transactions on Information Theory, 37 (1991) 742-758.
 31. Automorphisms of Markov chains and the weight-per-symbol polytope, (with W. Krieger and S. Tuncel), Transactions AMS, 333 (1992), 531-566.
 32. Large deviation theorems for empirical types of Markov chains constrained to thin sets (with P. Algoet) IEEE Transactions on Information Theory, 38(1992) 1276-1291.
 33. Improved Gilbert-Varshamov bounds for constrained systems, (with R. Roth) IEEE Transactions on Information Theory, 38 (1992), 1213-1221.
 34. Finite State Modulation Codes for Data Storage (with P. Siegel and J. Wolf), IEEE Journal on Selected Areas of Communication, 10 (1992) 5-37.
 35. Matrices of polynomials, positivity, and finite equivalence of Markov chains (with S. Tuncel), J. AMS , 6(1993), 131- 147.
 36. Surjective extensions of sliding-block codes (with J. Ashley, D. Perrin, S. Tuncel) SIAM J. Discrete Math. 6 (1993) 582-611.
 37. Minimal presentations for irreducible sofic shifts (with N. Jonoska) IEEE Transactions on Information Theory 40 (1994), 1818-1827.

38. Construction of polynomial-size encoders with small decoding look-ahead for input-constrained channels (with J. Ashley and R. Roth), *IEEE Transactions on Information Theory*, 41 (1995) 55-76.
39. Canonical encoders for sliding block decoders (with J. Ashley), *SIAM J. Discrete Math.*, 8 (1995), 555-605.
40. Boundary measures of Markov chains (with E. Cawley and S. Tuncel), *Israel J. Math.*, 94 (1996), 111-123.
41. On the decoding delay of encoders for input-constrained channels (with J. Ashley and R. Roth), *IEEE Transactions on Information Theory*, 42 (1996), 1948-1956.
42. The classification of one-sided Markov chains (with J. Ashley and S. Tuncel), *Ergodic Theory and Dynamical Systems*, 17 (1997), 269-295.
43. Homogeneous shifts, (with N.T. Sindhushayana and M. Trott), *IMA J. Math. Control and Information*, 14 (1997), 255–287
44. A generalized state-splitting algorithm (with J. Ashley), *IEEE Transactions on Information Theory*, 43 (1997), 1326–1338.
45. Modulation coding for pixel-matched holographic data storage (with G. Burr, J. Ashley, H. Coufal, R. Grygier, J. Hoffnagle, M. Jefferson), *Optics Letters* 22 (1997) 639–641.
46. Performance and error propagation in decision feedback channels (with C. M. Melas, J. Ashley, M. Blaum), *IEEE Transactions on Magnetics*, 33 (1997), 2773–2775.
47. Two-dimensional low-pass filtering codes (with J. Ashley), *IEEE Transactions on Communications*, 46 (1998), 724–727.
48. Optimizing the holographic digital data storage channel (with G. Burr, J. Ashley, M. Jefferson, J. Hoffnagle, H. Coufal), *SPIE Conference Proceedings*, 1998.
49. Coding tradeoffs for high-density holographic data storage (with G. Burr), *SPIE Conference Proceedings (symposium on optical science, engineering, and instrumentation)*, v, 3802 (1999), 18 – 29.
50. Time-varying encoders for constrained systems: an approach to limiting error propagation (with J. Ashley), *IEEE Transactions on Information Theory*, 46 (2000), 1038 – 1043.
51. Iterative decoding of tail-biting trellises and connections with symbolic dynamics, (with G.D. Forney, F. Kschischang, and S Tuncel), *IMA Volumes in Mathematics and its Applications*, v. 123 (2000), 239 – 264.
52. Lossless sliding-block compression of constrained systems (with J. Fan and R. Roth), *IEEE Transactions on Information Theory*, 46 (2000), 624 – 632 (extended abstract appeared in *Proceedings of 37th Annual Allerton Conference on Communications, Control and Computing*, 1999).
53. Deriving performance bounds for ISI channels using Gallager codes (with A. Kavcic, M. Mitzenmacher, B.Wilson) announced in: *Proceedings of ISIT 2001*, p. 345.
54. Resolving Markov chains onto Bernoulli shifts via Positive Polynomials (with S. Tun-

- cel), AMS Memoirs (2001), vol. 150, no. 710 (announced in: On large powers of positive polynomials, (with S. Tuncel), Electronic Research Announcements AMS, 5 (1999), 91-101).
55. Art of constructing low complexity encoders/decoders for constrained block codes (with D. Modha), IEEE Journal on selected areas in communications, 19 (2001), 589-601.
 56. Maximum transition run codes for generalized partial response channels (with R. Cidecyian, E. Eleftheriou, and D. Modha), IEEE Journal on selected areas in communications, 19 (2001), 619-634.
 57. Kalman filtering applied to timing recovery in tracking mode (with P. Chaichanavong, J. Campello, R. New and B. Wilson), Electronic Proceedings of MTNS02, August, 2002.
 58. Constrained systems with unconstrained positions (with J. Campello, R. New, and B. Wilson), IEEE Transactions on Information Theory, 48 (2002), 866 – 879.
 59. Optimal block-type decodable encoders for constrained systems (with P. Chaichanavong), IEEE Transactions on Information Theory, 49 (2003), 1231 - 1250.
 60. Joint estimation of data and timing in the presence of inter-symbol interference, (with B.A. Wilson, R. New, J. Campello), IEEE Transactions on Magnetics, 39 (2003), 2582 - 2584.
 61. Constraint Gain (with J. Fan and L. Poo), IEEE Transactions on Information Theory 50 (2004), 1989-2001.
 62. Stabilization of block-type-decodability properties (with P. Chaichanavong), SIAM J. Discrete Mathematics, 19 (2005), 321 - 344.
 63. Trade-off functions for constrained systems with unconstrained positions (with P. Chaichanavong and T-L Poo), 52 (2006), IEEE Transactions on Information Theory, 1425 - 1449.
 64. Time-Varying Maximum Run Constraints (with T-L Poo), 52 (2006), IEEE Transactions on Information Theory, 4464-4480.
 65. Analyticity of Entropy Rate of Hidden Markov Chains (with G. Han), 52 (2006), IEEE Transactions on Information Theory, 5251 - 5266.
 66. Derivatives of Entropy Rate in Special Families of Hidden Markov Chains (with G. Han), IEEE Transactions on Information Theory, 53, 2642 - 2652, 2007.
 67. Maximum insertion rate and multi-dimensional capacity of constraints (with E. Loidor, T.-L. Poo, and P. Chaichanavong), Proceedings of IEEE International Symposium on Information Theory, 2008, 1458 – 1462.
 68. Asymptotics of noisy constrained channel capacity (with G. Han), Annals of Applied Probability, 19 (2009), 1063-1091.
 69. Asymptotics of entropy rate in special families of Hidden Markov Chains (with G. Han), IEEE Transactions on Information Theory, 56 (2010), 1287 - 1295.
 70. Improved Lower Bounds on Capacities of Symmetric 2-Dimensional Constraints using

Rayleigh Quotients (with E. Loidor), IEEE Transactions on Information Theory, 56 (2010), 1624 - 1639.

71. A note on a complex Hilbert metric with application to domain of analyticity for entropy rate of hidden Markov processes (with G. Han and Y. Peres), Entropy of Hidden Markov Processes and Connections to Dynamical Systems, London Mathematical Society Lecture Notes, 385, 2011, 98 – 116.
72. Independence Entropy of Z^d shift spaces (with E. Loidor and R. Pavlov), Acta Applicandae Mathematicae, Special Volume, dedicated to the memory of Hang Kim, to appear.
73. Concavity of Mutual Information Rate for Input-Restricted Finite-State Memoryless Channels at High SNR (with G. Han), IEEE Transactions on Information Theory, to appear.
74. Approximating entropy for a class of Z^2 Markov Random Fields and pressure for a class of functions on Z^2 shifts of finite type, (with R. Pavlov), Ergodic Theory and Dynamical Systems, to appear.

Textbook

- An Introduction to Symbolic Dynamics and Coding (with D. Lind), Cambridge University Press, 1995 (reprinted in 1999).

Edited Books

1. Codes, Systems and Graphical Models (with J. Rosenthal), IMA Volumes in Mathematics and its Applications, v. 123, Springer, 2000.
2. Entropy of Hidden Markov Processes and Connections to Dynamical Systems (with K. Petersen and T. Weissman), London Mathematical Society Lecture Notes, v. 385, Cambridge University Press, 2011.

Book Chapters

1. Constrained systems and coding for recording channels (with R. Roth and P. Siegel), Chapter 20, Volume II of Handbook of Coding Theory (ed., V.S. Pless and W. C. Huffman), Elsevier Press, 1998
2. Modulation codes for holographic recording, Holographic Storage, ed. H. Coufal, D. Psaltis, G. Sincerbach, Springer-Verlag, 2000, 283-292.
3. Modulation Codes for Storage Systems (with E. Soljanin), Handbook of Computer Engineering, CRC Press, 2001, pp. 34-51 (reprinted in Coding and Signal Processing for Magnetic Recording Systems, ed. B. Vasic and E. M. Kurtas, CRC Press, 2004).
4. Symbolic Dynamics, in Encyclopedia of Complexity and System Science, Editor: Robert Meyers, Springer Press, July, 2009, 8888-8910.
5. Variable length codes and Finite Automata, (M-P Beal, J. Berstel, B. Marcus, D.

Perrin, C. Reutenauer, P. Siegel), book chapter in Selected Topics in Information and Coding Theory, Editors: I. Woungang, S. Misra, S.C. Misra, World Scientific Publishing, March, 2010.

Other Expository Publications

1. The impact of Roy Adler's work on symbolic dynamics and applications to data storage, Contemporary Mathematics, 135 (1992), 33-56.
2. Symbolic dynamics and its connections to coding theory, automata theory and system theory, AMS Proc. Symp. Appl. Math., v. 50 (1995), 95-108.
3. Multilingual Dictionary: system theory, coding theory, symbolic dynamics and automata theory (with D. Forney, N.T. Sindhushayana, and M. Trott), AMS Proc. Symp. Appl. Math., v. 50 (1995) 109-138.
4. Holographic Optical Data Storage: Promise and Progress, (with J. Ashley, et. al.), Laser Focus World, 32 (1996) 81-93.
5. Symbolic dynamics and coding applications, IEEE-IT Newsletter, June, 1996.
6. Holographic Data Storage, (with J.Ashley, et. al.), IBM J. Res. Develop. 44 (2000), 341-366.
7. Optical data storage enters a new dimension (with G. Burr, et. al.), Physics World, 13 (2000), 37 - 42.
8. Symbolic Dynamics (with S. Williams), Scholarpedia article, accepted November, 2008, http://www.scholarpedia.org/article/Symbolic_dynamics

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1. "Antenna Structures: Evaluation of Field Measurements of Reflector Distortions", Tech. Report 32-1526 DSN Progress Report JPL-Caltech 1971 pp. 113-121 (with S. Katow)
2. "Ternary (2,6) Run-Length Limited Coding Method", IBM Technical Disclosure Bulletin, v.26, no. 7A, 1983 pp.3368-3369. (with R. Adler, B. Kitchens, and P. Siegel)
3. "An almost-symmetric (0, 3/6) PRML code," IBM Technical Disclosure Bulletin, v.32, no. 5B, 1989 (with P. Siegel)

Patents

1. A. Patel, B. Marcus and P. Siegel, Method and apparatus for implementing a PRML code, U.S. Patent 4786890, 1989.
2. J. Ashley, G. Jaquette, B. Marcus and P. Seger, Runlength limited encoding/decoding with robust resync, U.S. Patent 5969649, 1999.
3. J. Ashley and B. Marcus, Two-dimensional lowpass filtering code apparatus and method, U. S. Patent 5907581, 1999.

4. C. M. Melas and B. Marcus, Hard disk drive read channel with half speed timing, U. S. Patent 5946354, 1999.
5. J. Ashley, M. Blaum, B. Marcus, and C.M. Melas, Error propagation limiting encoder/decoder for multilevel decision feedback equalization, U.S. Patent 6141783, 2000.
6. J. Ashley and B. Marcus, Encoding and detection of balanced codes, U. S. Patent 6016330, 2000.
7. D. Modha and B. Marcus, System and method for constructing low complexity block coders, U.S. Patent 6430713, 2002.
8. J. Campello, B. Marcus, R. New, and B. Wilson, Soft Output Viterbi Algorithm with error filters, U.S. Patent 6708308, 2004.
9. R. Cidecyian, E. Eleftheriou, B. Marcus, D. Modha, and R. Olson, MTR code with constraint for no colliding dibits and with precompensation, U.S. Patent 6768603, 2004.
10. M. Blaum, G. Jaquette, B. Marcus and C. M.Melas, Method and apparatus for encoding data to guarantee isolated transitions in a magnetic recording system, U.S. Patent 6985320, 2006.
11. J. Campello, B. Marcus, R. New, and B. Wilson, Data Channel with joint data estimation and timing recovery, U.S. Patent 7113555, 2006.
12. M. Blaum, G. Jaquette, B. Marcus, and C. M. Melas, Method system and program for synchronization and resynchronization of a data stream, U.S. Patent 7116736, 2006.