

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. Corrections: in the statement of Theorem 6, "irreducible" should be replaced by "mixing;" in the Note immediately following the statement of Theorem 6, "on either one-sided level" should be replaced by "in the category of regular isomorphism."
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). Correction: the first condition in Remark 3.9 is incorrect. The condition at the end of this remark is correct. This is corrected by deleting the material in that remark from just past "iff" to just before "(1)."
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. Karabed), *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. Tunçel), AMS Memoirs (2001), vol. 150, no. 710 (announced in: On large powers of positive polynomials, (with S. Tunçel), 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. Asymptotics of noisy constrained channel capacity (with G. Han), *Annals of Applied Probability*, 19 (2009), 1063-1091.
68. Asymptotics of entropy rate in special families of Hidden Markov Chains (with G. Han), *IEEE Transactions on Information Theory*, 56 (2010) 1287 - 1295.
69. 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, pp. 1458 - 1462).
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), *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 in memory of Hang Kim, 196 (2013) 297 - 317.
73. Concavity of Mutual Information Rate for Input-Restricted Finite-State Memoryless Channels at High SNR (with G. Han), *IEEE Transactions on Information Theory*, 58 (2012), 1534 - 1548.

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 (with R. Pavlov), *Ergodic Theory and Dynamical Systems*, 33 (2013), 186–220
75. Entropy rate of continuous-state hidden Markov chains, (with G. Han), *IEEE International Symposium on Information Theory*, 2010, 1468 – 1472.
76. One-dimensional Markov random fields, Markov chains and topological Markov fields, (with N. Chandgotia, G. Han, T. Meyerovitch and R. Pavlov), *AMS Proceedings*, 142 (2014), 227-242.
77. Computing bounds for entropy of Z^d stationary Markov random fields, (with R. Pavlov), *SIAM J. Discrete Math*, 27 (2013), 1544-1558.
78. An integral representation for topological pressure in terms of conditional probabilities, (with R. Pavlov), *Israel J. Math.* 207 (2015), no. 1, 395-433.
79. Analyticity of Entropy Rate of Continuous-State Hidden Markov Chains, (with G. Han), *IEEE Transactions on Information Theory*, vol. 61, no. 6, pp. 3013-3028, 2015.
80. Representation and poly-time approximation for pressure of Z^2 lattice models in the non-uniqueness region, (with S. Adams, R. Briceno, and R. Pavlov) *J. Stat. Mech.* February 2016, Volume 162, Issue 4, pp 1031–1067.
81. Mixing properties for Hom-shifts and the distance between walks in associated graphs, (with N. Chandgotia), *Pacific J. Math*, May, 2018, v. 294, 41 – 69.
82. Mean sensitive, mean equicontinuous and almost periodic functions for dynamical systems, *Discrete and Continuous Dynamical Systems - Series A (DCDS-A)*, (with F. Garcia-Ramos) to appear, Feb. 2019, v. 39, issue 2, 729 – 746.
83. Equivalence of relative Gibbs and relative equilibrium measures for actions of countable amenable groups, (with S. Barbieri, R. Gomez Aiza, and S. Taati), *Nonlinearity*, 33(5): 2409-2454, 2020.
84. Gibbsian representations of continuous specifications: the theorems of Kozlov and Sullivan revisited (with S. Barbieri, R. Gómez, T. Meyerovitch, and S. Taati) *Communications in Mathematical Physics*, 382, 1111-

1164, 2021.

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86. Markov capacity for factor codes with an unambiguous symbol (with G. Han and C. Wu), arXiv:2210.12251, submitted for publication, 2022.

Book

- An Introduction to Symbolic Dynamics and Coding (with D. Lind), Cambridge University Press, 1995 (reprinted in 1999), 2nd edition, Cambridge Mathematical Library, 2021.

Edited Book

- Codes, Systems and Graphical Models (with J. Rosenthal), *IMA Volumes in Mathematics and its Applications*, v. 123, Springer, 2000.

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. Sincerbox, Sringer-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, expository article in *Encyclopedia of Complexity and System Science*, Springer Press, 2008.
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*, World Scientific Press (in press).

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, 2008, http://www.scholarpedia.org/article/Symbolic_dynamics
9. The lasting impact of Roy Adler's work (with B. Kitchens and B. Weiss), JMD, 13, v-ix.

Published Technical reports

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)

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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.
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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/deocder for multilevel decision feedback equalization, U.S. Patent 6141783, 2000.
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8. J. Campello, B. Marcus, R. New, and B. Wilson, Soft Output Viterbi Algorithm with error filters, U.S. Patent 6708308, 2004.
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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 Office 7116736, 2006.