CV

Michael Shub
January2022

HIGHER EDUCATION
(indicate your Masters/PhD/Postdoctoral Mentor)

A. Degrees

Ph.D. 1967	University of California, Berkeley, Mathematics
M.A. 1966	University of California, Berkeley, Mathematics
A.B. 1964	Columbia College (Summa Cum Laude)
1969-1970	NATO Postdoctoral Fellowship (Posdoctoral mentor René Thom)

4. EXPERIENCE

City College of The City University of New York and CUNY Graduate Center,	Martin and Michele Cohen Professor, Distinguished Professor Chair, Mathematics Department CCNY	2016-2018 2018-present 2016-2019
CONICET, IMAS Universidad de Buenos Aires	Investigador Principal	2010-2014
University of Toronto	Professor Distinguished Professor	2004-2008 2009-2010
IBM, Thomas J. Watson Research Center	Research Staff Member Manager, Special Math Studies	8/85-2004 1989-97
Queens College and the Graduate School of The City University of New York	Associate Professor Professor	9/73 - 12/74 1/75 - 7/85
University of California at Santa Cruz	Assistant Professor Associate Professor	9/71 - 12/72 1/73 - 6/73
Brandeis University	Lecturer Assistant Professor	9/67 - 6/68 7/68 - 8/71

Other Professional Experience: Algorithms and Complexity in Algebraic Geometry Semester Simons Institute PEDECIBA	 Long term participant Investigador Asociado en el Area de Matematica	 9/14 -10/14 2012 - present
Graduate School of CUNY	Adjunct Professor	2010 - 2016
Université Paul Sabatier, Toulouse	Professeur Invité	6/00
Université de Paris Jussieu	Professeur Invité	6/05, 3/98
Mathematical Sciences Research Center, City University of Hong Kong	Visitor	1/96 - 2/96, 2/97, 5/98, 10/99, 10/12
University of Buenos Aires Mathematics Department	Visitor	12/96 01/09-05/09
Centre De Recerca Matematica	Visitor, Continuous	10/93 - 12/93
Institut D'Estudis Catalans	Computability & Complexity Semester	
International Computer Science Institute	Member	8/90 - 7/91
Columbia University	Adjunct Professor of Computer Science Adjunct Professor of Applied Physics	9/88 - 12/88 2/98 - 5/98
Graduate School of CUNY	Adjunct Professor of Mathematics and of Computer Science	9/86 - 6/91
Mathematical Sciences Research Institute, Berkeley	Geometric Complexity Member Foundations of Computational Mathematics - Organizer	2/86 - 5/86 8/98 - 12/98
University of California at Berkeley	Visiting Professor	Spring 1981 8/90 - 7/91 Spring 1995
Université de Paris-Sud	Professeur Associé	9/76 - 6/77

Orsay, France	Maitre de Conference	2/70 - 5/70
Massachusetts Institute of Technology	Guest	9/72 - 6/73
Instituto de Matematica Pura e Aplicada Rio de Janeiro, Brazil	Visiting Member	6/71 - 9/71 8/80 - 9/80 1/84, 1/85 - 5/85 2/94 - 5/94, 1/97, 1/01, 1/02, 6/06
Institut des Hautes Estudes Scientifiques Bures-sur Yvette, France	Visiting Member	9/69 - 8/70 1/79, 8/99
Mathematics Institute of the University of Warwick	Dynamical Systems Year Visitor	2/69 - 8/69, Summer 1974

5. ACADEMIC AND PROFESSIONAL HONORS (NON-FINANCIAL)

1972 One hour talk on Dynamical Systems, Filtrations and Entropy, 77th Summer Meeting of the American Mathematical Society, Hanover, NH

1989 Elected Fellow of the New York Academy of Sciences

1991 One hour invited talk on The Computational Complexity of Bezout's Theorem Annual Meeting of the Australian Math Society, Melbourne, July

2000 One hour invited address Joint Meeting of The AMS and Hong Kong Math Society, Hong Kong, China, December 2000

2000 Elected Fellow of the American Association for the Advancement of Science

2003 Conference in Honor of Michael Shub - University of California at Berkeley, August 18-22, 2003

2006 45 minute Sectional Speaker “Ordinary Differential Equations and Dynamical Systems” International Congress of Mathematicians, Madrid, Spain

2008 Appointed Profesor Honorario Universidad de Buenos Aires

2010 Elected Fellow of the Fields Institute

2011 One hour invited address Centennial Congress of the Spanish Royal Society of

Mathematics

2012 From Dynamics to Complexity A conference celebrating the work of Mike Shub May 07 - 11, 2012 hosted by the Fields Institute

2013 AMS-SIAM Invited Speaker SIAM Annual Meeting San Diego, July 2013.

2014 One hour Plenary Lecture Foundations of Computational Mathematics, Montevideo, Uruguay, December 2014

2016 Fulbright Specialist Roster

2016 Elected Fellow of the American Mathematical Society

6. RESEARCH, SCHOLARSHIP, AND CREATIVE WORK

(1) Books and book chapters

Hirsch M., Pugh C., and Shub M. *Invariant manifolds*, Lecture Notes on Mathematics, no. 583, (1977) Springer.

Shub M. *Stabilité globale des systèmes dynamiques Asterique*, **56** (1978). Société mathématique de France.

Fathi A., and Shub M. Some dynamics of pseudo-Anosov diffeomorphisms. *Asterisque*, ***66*** (1978). No.6 67, Travaux de Thurston sur les Surfaces 181-207. Société Mathématique de France.

Shub M., *Global Stability of Dynamical Systems*, (1986) Springer (this book is a translation of the French edition with added chapters and corrections).

Shub M., and Vasquez A. T. *Some linearly induced Morse-Smale systems, the QR algorithm and the Toda lattice.* Contemporary Math, **64** (1987) 181-194.

Hirsch M.W., Marsden J. E., and Shub M. (Eds) *From Topology to Computation: Proceedings of the Smalefest*, (1993) Springer.

Renegar J., Shub M., Smale S., (Eds) *Mathematics of Numerical Analysis, Lectures in Applied Math*. **32** (1996) American Math. Soc., Providence, R.I..

Cucker F., and Shub M., (Eds) *Foundations of Computational Mathematics*, (1997) Springer.

Blum L., Cucker F., Shub M., and Smale S., *Complexity and Real Computation*, (1998) Springer.

Forni G., Lyubich M., Pugh C., and Shub M., (Eds) *Partially Hyperbolic Dynamics, Laminations, and Teichmüller Flow*, (2007) American Mathematical Society.

(2) Journal articles

Epstein D., and Shub M. *Expanding endomorphisms of flat manifolds*. Topology, **7** (1968) no.2, 139-141.

Shub M. *Endomorphisms of compact differentiable manifolds*. American Journal of Mathematics, **91** (1969), no. 1, 175-199.

Shub M. *Periodic orbits of hyperbolic diffeomorphisms and flows.* Bulletin of the American Mathematical Society, **75** (1969), no. 1, 57-58.

Shub M., and Williams R. F. *Future stability is not generic*. Proceedings of the American Mathematical Society, **22** (1969), no. 2, 483-484.

Hirsch M., Palis J., Pugh C., and Shub M. *Neighborhoods of hyperbolic sets*. Inventiones Mathematicae, **9** (1970), no. 2, 121-134.

Pugh C., and Shub M. *Linearization of normally hyperbolic diffeomorphisms and flows*. Inventiones Mathematicae, **10** (1970), no. 3, 187-198.

Pugh C., and Shub M. *Omega Stability Theorem for Flows*. Inventiones Mathematicae **11** (1970) 150-158.

Hirsch M. W., Pugh C. C., and Shub M. *Invariant manifolds*. Bulletin of the American Mathematical Society, **76** (1970), no. 5, 1015-1019.

Pugh C., and Shub M. *Ergodic elements of ergodic actions*. Compositio Mathematica, **23** (1971), no. 1, 115-122.

Pugh C., and Shub M. *Ergodicity of Anosov actions.* Inventiones Mathematicae**, 15** (1972), no.1,1-23.

Shub M. *Structurally stable diffeomorphisms are dense*. Bulletin of the American Mathematical Society*,* **78** (1972) no. 5, 817-818.

Shub M., and Smale S. *Beyond hyperbolicity*. Annals of Mathematics, **96** (1972), no. 3, 587-591.

Shub, M. *Dynamical systems, filtrations and entropy*. Bulletin of the American Mathematical Society, **80** (1974), no. 1, 27-41.

Levine H. I., and Shub M. *Stability of foliations*. Transactions of the American Mathematical Society, **184** (1974) 419-437.

Shub M., and Sullivan D. *A remark on the Lefschetz fixed point formula for differentiable maps*. Topology, **13** (1974), no. 2, 189-191.

Shub M., and Sullivan D. *Homology theory and dynamical systems.* Topology, **14** (1975), no. 2, 109-132.

Pugh C., and Shub M. *Axiom A actions*. Inventiones Mathematicae, **29** (1975), no. 1, 7-38.

Nitecki Z., and Shub M. *Filtrations, decompositions, and explosions*. American Journal of Mathematics, **97** (1975), no. 4, 1029-1047

Shub M., and Williams R. F. *Entropy and stability.* Topology**, 14** (1975) no.4, 329-338.

Sacksteder R., and Shub M. *Entropy of a differentiable map.* Advances in Mathematics, **28** (1978) no. 3, 181-185.

Sacksteder R., and Shub M. *Entropy on sphere bundles.* Advances in Mathematics*,* **28** (1978), no. 2, 174-177.

Fried D., and Shub M. *Entropy, linearity and chain-recurrence*. Inst. Hautes Études Sci. Publ. Math, (50), (1979) 203-214.

Franks J., and Shub M. *The existence of Morse–Smale diffeomorphisms*. Topology, **20** (1981), no. 3, 273-290.

Pugh C., and Shub M. *Suspending subshifts.* Contributions to analysis and geometry, (1981) 265-275. Johns

Hopkins University Press.

Shub M., and Smale S. *Computational complexity: on the geometry of polynomials and a theory of cost*. I. Annales scientifiques de l'Ecole normale supérieure, **18** (1985) no.1, 107-142. Elsevier.

Shub M., and Sullivan D. *Expanding endomorphisms of the circle revisited*. Ergodic Theory and Dynamical Systems, **5** (1985) no. 2, 285-289.

Maller M., and Shub M. The integral homology of Smale diffeomorphisms. Topology, **24** (1985) no. 2, 153-164.

Shub M., and Smale S. *Computational complexity: on the geometry of polynomials and a theory of cost: II.* SIAM Journal on Computing, **15** (1986) no. 1, 145-161.

Shub M., and Smale S. *On the existence of generally convergent algorithms*. Journal of Complexity, **2** (1986) no. 2, 2-11.

Blum L., Blum M., and Shub M. *A simple unpredictable pseudo-random number generator*. SIAM Journal on computing, **15** (1986), no.2, 364-383.

Blum L., and Shub M. *Evaluating rational functions: infinite precision is finite cost and tractable on average*. SIAM Journal on Computing, ***15*** (1986) no. 2, 384-398. Also abstracted in IEEE 1984 FOCS.

Weiss N., Wasilkowski G. W., Woźniakowski H., and Shub M. *Average condition number for solving linear equations*. Linear Algebra and Its Applications, **83**, (1986) 79-102.

Shub M. *On the asymptotic behavior of the projective rescaling algorithm for linear programming.* Journal of Complexity, **3** (1987), no. 3, 258-269

Shub M., Tischler D., and Williams R. F. *The Newtonian graph of a complex polynomial*. SIAM journal on mathematical analysis, **19** (1988) no.1 , 246-256.

Pugh C., and Shub M. *Cr stability of periodic solutions and solution schemes.* Applied Mathematics Letters, **1** (1988) no. *3*, 281-285.

Megiddo N., and Shub M. *Boundary behavior of interior point algorithms in linear programming.* Mathematics of Operations Research, **14** (1989) no. 1, 97-146.

Pugh C., and Shub M. *Ergodic attractors.* Transactions of the American Mathematical Society, **312** (1989) no. 1, 1-54.

Blum L., Shub M., and Smale S. *On a theory of computation and complexity over the real numbers: NP-completeness, recursive functions and universal machines.* Bulletin (New Series) of the American Mathematical Society, **21** (1989) no. 1, 1-46. Also abstracted in IEEE 1988 FOCS.

Shub M. *On the distance to the zero set of a homogeneous polynomial.* Journal of Complexity, **5** (1989) no. 3, 303-305.

Shub M., and Weiss B. *Can one always lower topological entropy*?. Ergodic Theory and Dynamical Systems, **11** (1991) no. 3, 535-546.

Renegar J., and Shub M. *Unified complexity analysis for Newton LP methods*. Mathematical programming, ***53*** (1992) no. 1, 1-16.

Bürgisser P., Lickteig T., and Shub M. *Test complexity of generic polynomials.* Journal of Complexity, **8**

(1992) no. 3, 203-215.

Shub M., and Smale S. *Complexity of Bezout's theorem I: Geometric aspects*. Journal of the American Mathematical Society, **6** (1993) no. 2, 459-501.

Shub M., and Smale S. *Complexity of Bezout's theorem. II. Volumes and probabilities.* Computational algebraic geometry (Nice, 1992), Progr. Math, **109**, (1993) 267-285.

Shub M., and Smale S. *Complexity of Bezout' s Theorem: III. Condition Number and Packing.* Journal of Complexity, **9** (1993) no. 1, 4-14.

Edelman A., Kostlan E., and Shub M. How many eigenvalues of a random matrix are real?. Journal of the American Mathematical Society, **7** (1994) no. 1, 247-267.

Shub, M. (1994). Mysteries of mathematics and computation. *The Mathematical Intelligencer*, **16** no. 1, 10-15.

Shub, M. *The implicit function theorem revisited.* IBM Journal of Research and Development. **38** (1994) no. 3, 259-264.

Cucker F., Shub M., and Smale S. *Separation of complexity classes in Koiran's weak model.* Theoretical Computer Science, **133** (1994) no .1, 3-14.

Shub M., and Smale S. *Complexity of Bezout's theorem V: polynomial time*. Theoretical Computer Science, **133** (1994) no. 1, 141-164.

Grayson M., Pugh C., and Shub M. *Stably ergodic diffeomorphisms.* Annals of Mathematics, **140** (1994) no. 2, 295-329.

Shub M., and Smale S. *On the intractability of Hilbert's Nullstellensatz and an algebraic version of "NP= P?".* Duke Mathematical Journal, **81** (1995) no. 1, 47-54.

Shub M., and Smale S. *Complexity of Bézout's theorem IV: probability of success; extensions.* SIAM Journal on Numerical Analysis, **33** (1996) no. 1, 128-148.

Blum L., Cucker F., Shub M., and Smale S. *Complexity and real computation: A manifesto.* International Journal of Bifurcation and Chaos, **6** (1996) no. 1, 3-26

Adler R., Kitchens B., and Shub M. *Stably ergodic skew products*. Discrete and Continuous Dynamical Systems, **2** (1996), 349-350.

Cucker F., and Shub M. *Generalized knapsack problems and fixed degree separations.* Theoretical Computer Science, **161** (1996) no. 1, 301-306.

Pugh C., Shub M., and Wilkinson A. Hölder foliations. *Duke Mathematical Journal*, **86** (1997) no. 3, 517-546. Correction Vol. 105 (2000) 105-106.

Pugh C., and Shub M. *Stably ergodic dynamical systems and partial hyperbolicity.* Journal of Complexity, **13** (1997) no. 1, 125-179.

Brezin J., and Shub M. *Stable ergodicity in homogeneous spaces.* Bulletin of the Brazilian Mathematical Society, **28** (1997) no. 2, 197-210.

Lewis D., and Shub M. *The distribution of the maximum condition number on great circles through a fixed 2× 2 real matrix.* Linear algebra and its applications, **297** (1999) no.1-3, 193-202.

Shub M., and Wilkinson A. *Pathological foliations and removable zero exponents.* Inventiones Mathematicae*,* **139** (2000) no. 3, 495-508.

Pugh C., and Shub M. *Stable ergodicity and julienne quasi-conformality.* Journal of the European Mathematical Society, **2** (2000) no. 1, 1-52.

Dedieu J. P., and Shub M. *Multihomogeneous Newton methods.* Mathematics of Computation, **69** (2000) no. 231, 1071-1098

Dedieu J., and Shub M. *Newton's method for overdetermined systems of equations.* Mathematics of Computation*,* **69** (2000) no. 231, 1099-1115.

Shub M., and Wilkinson A. *Stably ergodic approximation: two examples.* Ergodic Theory and Dynamical Systems, **20** (2000) no. 3, 875-893.

Dedieu J. P., and Shub M. *On simple double zeros and badly conditioned zeros of analytic functions of n variables.* Mathematics of Computation, (2001) 319-327.

Adler R. L., Dedieu J. P., Margulies J. Y., Martens M., and Shub M. *Newton's method on Riemannian manifolds and a geometric model for the human spine.* IMA Journal of Numerical Analysis, **22** (2002) no. 3, 359-390.

Dedieu, J. P., Kim, M. H., Shub, M., & Tisseur, F. *Implicit gamma theorems (I): Pseudoroots and pseudospectra*. Foundations of Computational Mathematics, **3** (2003), 1-32.

Ledrappier F., Shub M., Simó C., and Wilkinson A. *Random versus deterministic exponents in a rich family of diffeomorphisms.* Journal of Statistical Physics, **113** (2003) no. 1, 85-149.

Pugh C., Shub M., and Starkov A. *Corrigendum to: Stable ergodicity and julienne quasi-conformality,* J. Eur. Math. Soc. 2, 1-52. Journal of the European Mathematical Society, **6** (2004) no. 1, 149-151.

Pugh C., and Shub M. *Stable ergodicity (Appendix by A. Starkov).* Bulletin of the American Mathematical Society, **41** (2004) no. 1, 1-41.

Pugh C., Shub M., and Wilkinson A. *Partial differentiability of invariant splittings*. Journal of Statistical Physics, **114** (2004) no. 3, 891-921.

Dedieu J. P., Malajovich G., and Shub M. *On the curvature of the central path of linear programming theory.* Foundations of Computational Mathematics, **5** (2005) no. 2, 145-171.

Shub M. *WHAT IS... a Horseshoe?.* Notices of the American Mathematical Society, **52** (2005) no. 5, 516-517.

Dedieu J. P., and Shub M. *Newton flow and interior point methods in linear programming.* International Journal of Bifurcation and Chaos, **15** (2005) no. 3, 827-839.

Adler R. L., Kitchens B., Martens M., Pugh C., Shub M., and Tresser, C. *Convex dynamics and applications.* Ergodic Theory and Dynamical Systems, **25** (2005) no. 2, 321-352.

Pugh C., Shub M., and Starkov A. *Unique Ergodicity, Stable Ergodicity and the Mautner Phenomenon for Diffeomorhisms.* Discrete Continous Dynamical Systems, Serie A, **14** (2006), 845-855.

Pujals E. R., Robert L., and Shub M., *Expanding maps of the circle rerevisited: positive Lyapunov exponents*

in a rich family. Ergodic Theory and Dynamical Systems, **26** (2006) no. 6, 1931-1937.

De La Llave R., Shub M., and Simó C. *Entropy estimates for a family of expanding maps of the circle.* Discrete Continous Dynamical Systems, Serie B, **10** (2008) no. 2-3, 597-608.

Pujals E. R., and Shub M. *Dynamics of two-dimensional Blaschke products.* Ergodic Theory and Dynamical Systems, **28** (2008) no. 2, 575-585.

Shub M. *Complexity of Bézout's theorem VI: Geodesics in the condition (number) metric.* Foundations of Computational Mathematics, **9** (2009) no. 2, 171-178.

Beltrán C., and Shub M. (2009). *Complexity of Bézout's theorem VII: Distance estimates in the condition metric.* Foundations of Computational Mathematics, **9** (2009) no. 2, 179-195.

Beltrán C., Dedieu J. P., Malajovich G., and Shub M. *Convexity properties of the condition number.* SIAM Journal on Matrix Analysis and Applications, **31** (2010) no. 3, 1491-1506.

Beltrán C., and Shub M. *A note on the finite variance of the averaging function for polynomial system solving.* Foundations of Computational Mathematics, **10** (2010) no. 1, 115-125.

Armentano D., Beltrán C., and Shub M. (2011). *Minimizing the discrete logarithmic energy on the sphere: The role of random polynomials.* Transactions of the American Mathematical Society, **363** (2011) no. 6, 2955-2965.

Pugh C., and Shub M., and Wilkinson, A. *Holder foliations, revisited.* Journal of Modern Dynamics, **6** (2012), 79-120.

Beltrán C., Dedieu J. P., Malajovich G., and Shub, M., *Convexity properties of the condition number II*. SIAM Journal on Matrix Analysis and Applications, **33** (2012) no. 3, 905-939.

Beltrán C., and Shub M., *On the geometry and topology of the solution variety for polynomial system solving.* Foundations of Computational Mathematics, **12** (2012) no. 6, 719-763.

Dedieu J. P., Malajovich G., and Shub M., (2012). *Adaptive step-size selection for homotopy methods to solve polynomial equations.* IMA Journal of Numerical Analysis, **33** (2012) no. 1, 1-29.

Pugh C., and Shub M.*, Periodic points on the 2-sphere.* Discrete and Continuous Dynamical Systems, **34** (2014) no. 3*,* 1171-1182.

Armentano D., and Shub M., *Smale's fundamental theorem of algebra reconsidered.* Foundations of Computational Mathematics, **14** (2014) no. 1, 85-114.

Armentano D., and Shub M., *Erratum to: Smale's Fundamental Theorem of Algebra Reconsidered.* Foundations of Computational Mathematics, **14** (2014) no. 4, 861.

Krick T., Verstraete N., Alonso L. G., Shub D. A., Ferreiro D. U., Shub M., and Sánchez I. E. *Amino acid metabolism conflicts with protein diversity.* Molecular Biology and Evolution, **31** (2014) no. 11, 2905-2912.

Armentano D., Beltrán C., Bürgisser P., Cucker F., and Shub, M. *Condition length and complexity for the solution of polynomial systems.* Foundations of Computational Mathematics, **16** (2016) no. 6, 1401-1422.

Cucker F., Krick, T., and Shub M., *Computing the Homology of Real Projective Sets.* Foundations of Computational Mathematics **18** (2018) 929-970.

Armentano D., Beltrán C., Bürgisser P., Cucker F., and Shub M., *A stable, polynomial-time algorithm for*

the eigenpair problem. Journal of the European Math Society **20** (2018) 1375-1437

Shub,M., My Dynamics Course at Orsay and Jean-Christophe, SMF-Gazette April 2018, 131.

Pujals,E., Sh*ub M. and Yang,Y., Stable and non-symmetric pitchfork bifurcations. Science China Mathematica* ***63*** *(2020) 1837-1852.*

Shub M., Xu,Q. and Xuan,X., Disease Prediction and Maximum Entropy Method. Arxiv and submitted.

(3) Refereed conference proceedings

Shub M. *Expanding maps*. Global Analysis, Proc. Sympos. Pure Math., Vol. XIV, Berkeley, Calif., 1968, American Mathematical Society, (1970), 273-276.

Shub M. *Relative Equilibria and Diagonals*, appendix to S. Smale's paper" Problems on the Nature of Relative Equilibria in Celestial Mechanics", Manifolds. Proc. MUFFIC Summer School on Manifolds, Amsterdam, Springer Lecture Notes in Mathematics, **197** (1971), 199-201.

Shub M. *Instability,* Proceedings of the Symposium on Differential Equations and Dynamical Systems, Lecture Notes in Mathematics. **26** (1971), 28-29. Springer.

Shub M. *Topologically transitive diffeomorphisms of T 4*. Proceedings of the Symposium on Differential Equations and Dynamical Systems, Lecture Notes in Mathematics, **206** (1971), 39-40. Springer.

Shub M. *Morse-Smale diffeomorphisms are unipotent on homology*. In Dynamical systems Proc. Sympos., Univ. Bahia, Salvador, 1971*,* Academic Press, New York *(1973),489-492*.

Shub, M. *Stability and genericity for diffeomorphisms*. In Dynamical systems, Proc. Sympos., Univ. Bahia, Salvador, *1971,* Academic Press, New York (1973) 493-514.

Palis J., Pugh C., Shub M., and Sullivan D. *Genericity theorems in topological dynamics*. Dynamical Systems—Warwick 1974, Lecture Notes in Math, no. 468, (1975) 241-250. Springer

Shub M. *Topological entropy and stability*. Dynamical Systems—Warwick 1974, Lecture Notes in Math, no. 468, (1975) 39-40, Springer.

Shub M., *Homology theory and dynamical systems.* Dynamical Systems—Warwick 1974, Lecture Notes in Math, no. 468, (1975) 36-38, Springer.

Pugh C. C. *On the entropy conjecture: a report on conversations among R. Bowen M. Hirsch, A. Manning, C. Pugh, B. Sanderson, M. Shub and R. Williams.* Dynamical Systems—Warwick 1974, Lecture Notes in Math, no. 468, (1975) 257-261. Springer.

Shub M. *The Lefschetz Fixed Point Formula, Smoothness and Stability*, Dynamical Systems, and International Sympmosium, Vol. 1, Academic Press (1976), 13-28.

Shub, M. *Stability in Dynamical Systems,* Colloques Internationaux Du Centre National de la Recherche Scientifique no. 259 ``Systemes Dynamiques Modeles Economiques", (1977), 69-76.

Shub M. *Alexander cocycles and dynamics*. Asterisque, Vol. (51), "Dynamical Systems III, Warsaw 1977", (1978) 395-413. Société Mathematique de France.

Ruelle D., and Shub M. *Stable manifolds for maps*. Global theory of dynamical systems. Lecture Notes in Mathematics number 819. (1980) 389-392 Springer.

Pugh C. C., and Shub M. (1980). *Differentiability and continuity of invariant manifolds.* Annals of the New York Academy of Sciences, **357** (1980) no. 1, 322-329.

Shub M., and Smale S. *On a Theory of Cost for Equations Solving.* Homotopy Methods and Global Convergence, (1983) 263-266, Plenum Press, New York.

Shub M., and Smale S. *On the average cost of solving polynomial equations*. Geometric Dynamics, (1983) 719-724.

Shub M. *Some remarks on dynamical systems and numerical analysis in Dynamical Systems and Partial Differential Equations*. Proc. VII ELAM., Equinoccio, U. Simón Bolıvar, Caracas, (1986) 69-92.

Shub M. *The geometry and topology of dynamical systems and algorithms for numerical problems*. Proc. of the 1983 Beijing Symposium on Differential Geometry and Differential Equations. (1986) Science Press, Beijing, China.

Shub, M. *On the work of Steve Smale on the theory of computation*. *From Topology to Computation:* Proceedings of the Smalefest*,* 281-30, (1993) Springer.

Shub M. *Some remarks on Bezout's theorem and complexity theory*. From topology to computation: Proceedings of the Smalefest, 443-455, (1993) Springer.

Blum L., Cucker F., Shub M., and Smale S. *Algebraic settings for the problem "P≠ NP?"*. Mathematics of Numerical Analysis, (1996) 125-146. Springer.

Pugh C., and Shub M. *Stable ergodicity and partial hyperbolicity.* International Conference on Dynamical Systems: Montevideo, 1995, A tribute to Ricardo Mane, Pitman Research Notes in Mathematics (1996) no. 362, 182-187.

Pugh C., and Shub M., *Stably Ergodicity and Stable Accessibility,* "Proceedings of US-Chinese Conference: Differential Equations and Applications held in Hangzhou, June 24-29" International Press, (1996) 258-267.

Margulies J. Y., Adler R. L., Kalvin A. D., Martens M., Shub M., Tresser C. P., and Wu C. W. *Deforming Factors in Idiopathic Scoliosis: A Mathematical Tool*. SPINE-PHILADELPHIA-HANLEY AND BELFUS-, **14** (2000) no. 2, 505-510.

Burns K., Pugh C., Shub M., and Wilkinson A. *Recent results about stable ergodicity.* Smooth ergodic theory and its applications. Proceedings of Symposia in Pure Mathematics Vol. 69. American Mathematical Society, **69** (2000) 327-366.

Shub M. *From Dynamics to Computation and Back?*. Foundations of Computational Mathematics: Proceedings of the Smalefest 2000, Hong Kong, 13-17, 2000, (2002) 423-432. World Scientific.

Dedieu J. P., and Shub M. *On Random and Mean Exponents for Unitarily Invariant Probability Measures on GLn (C).* Geometric Methods in Dynamical Systems II – In Honor of Jacob Palis. Asterisque**, 287** (2003), 1-18. Société Mathématique de France.

Shub M., *Non-Zero Lyapunov Exponenets Versus Mean Deterministic Exponenets for a Twist Like Family of Diffeomorphisms of the Two Sphere*- Extended Abstract in XIV International Congress on Mathematical Physics. World Scientific, (2006) 216-223.

Shub, M., *All, most, some differentiable dynamical systems*. Proceedings of the International Congress of Mathematicians, Madrid, Spain, Vol. 3, (2006) 99-120.

Beltrán C., and Shub M., *The complexity and geometry of numerically solving polynomial systems.* Contemporary Mathematics Vol 604, (2013) 71-104.

Invited Addresses:

- Twenty minute talk on Foliations and Stable Manifold, 78th Annual meeting, American Mathematical Society, Las Vegas, Nevada, January 1972.
- One hour talk on Dynamical Systems, Filtrations and Entropy, 77th Summer Meeting of the American Mathematical Society, Hanover, NH, 1972.
- One hour talk on the Qualitative theory of Ordinary Differential Equations at the International Symposium for the dedication of the Lefschetz Center for Dynamical Systems, Brown University, August 1974.
- One hour talk on Dynamical Systems and Topology, Warsaw International Conference on Dynamical Systems and Ergodic Theory, June, 1977.
- One hour talk at the Northwestern University International Conference on Dynamical Systems, June 1979.
- Twenty minute talk Special Session "Differential Equations and Homology", American Math Soc. Conference, Howard University, October, 1979.
- One hour talk on the Cost of Solving Polynomial Equations, International Symposium on Dynamical Systems, IMPA, 1981.
- Twenty minute talk Special Session "Differential and Differential Delay Equations", Amer. Math. Soc. Conference, Bryn Mawr, March 1982.
- Six hours of talks at the Fourth International Symposium on Differential Equations and Differential Geometry, Peking University, Beijing, China, August 29 - September 10, 1983.
- One hour talk on "Remarks on Dynamical Systems and Numerical Analysis", Seventh Latin American School of Mathematics, Caracas, Venezuela, July 16-24, 1984.
- One hour talk on "The QR Algorithm, Linearly Induced Morse-Smale Systems and the Toda Lattice, Kovalevskaya Symposium, Association for Women in Mathematics, Radcliffe College, October 27-28, 1985.
- One hour talk on Solving Polynomial Equations at the MSRI Geometric Complexity Workshop January 1986.
- Thirty minute talk "On the Boundary Behavior of Interior Point Methods for Linear Programming Problems" at the "Progress in Mathematical Programming " conference March 1-4, 1987 Monterey, Ca.
- One hour talk at the Symposium on the Complexity of Approximately Solved Problems, Columbia University, April 21-24, 1987.
- Twenty minute invited talk at the ORSA-TIMS Annual Meeting, Washington D.C., April 1988.
- One hour invited talk at Mid West Dynamics Seminar, Evanston, May 2, 1988.
- One hour invited talk on Dynamics and Computing at the London Math. Soc. Durham Symposium on Dynamics, July 1988.
- Forty-five minute talk on Real Machines for Solving Complex Problems at the Special Sessions on Complex Analysis - Annual Meeting of AMS, Phoenix, January 1989.
- Twenty minute talk on Discrete approximation to Invariant Manifolds for Differential Equations at the Special Sessions on Foundation of Complexity Theory for Numerical Analysis - Annual Meeting of AMS, Phoenix, January 1989.
- Forty-five minute talk on Small Entropy Factors, Dynamics Days, Austin, Texas, January 1990.
- Three one hour talks at the IMPA Complexity Workshop, Rio de Janeiro, January 1990.
- One hour talk on The Computational Complexity of Bezout's Theorem Annual Meeting of the

Australian Mathematical Society, Melbourne July 1991.

- One hour talk (one of five invited lectures) MEGA '92 , Nice, France April 1992.
- One hour and a half and forty five minute invited talks at Parametric Optimization and Complexity Pfalzakademie June 8-12, 1992 on "Complexity Theory" and" Complexity of Homotopy Methods and Bezout's Theorem".
- Principal speaker with Lenore Blum and Steve Smale at Complexity and Computability over the Reals conference at the Boston University Dynamical Systems Institute. Four one hour lectures. July 19-23, 1992.
- One hour invited talk at the MSI Real Algebra and Geometry Workshop August 24-28, 1992 "Volume Estimates, Starting Points and a Packing Problem".
- Half hour invited talk at Symposium 4-Continuous Algorithms and Complexity - 12th World Computer Congress- IFIPS, Madrid, Spain September, 1992.
- Jane and Roland Blumberg Lecture - University of Texas at Austin, April, 1993.
- 20 minute invited talk at the Special Session on Computational Problems Involving Polynomials, Eastern Sectional Meeting of Amer. Math. Soc. Syracuse University, September, 1993.
- One hour Plenary address 2nd Caribbean Conference on Approximation and Optimization, Havana, September, 1993.
- One hour invited talk Continuous Algorithms and Complexity Workshop, Barcelona, October, 1993.
- 3 hour invited address at SEA 93, Centre International de Recherche Mathematiques, Luminy, France, November, 1993.
- 1 hour Palestra de Excelencia da Soc. Bras. Mat., University of Sao Paulo, 1994.
- 1 hour talk at International Conference on Dynamical Systems, IMPA, Rio de Janeiro,Sept.12-16, 1994.
- Plenary address at Colloquium Carolus Magnus: 1200 Years of Science in Central Europe, March 1995.
- Plenary address at Mathematics of Numerical Analysis-Real Number Algorithms ,Park City, Utah, July-August 1995.
- Forty minute invited talk at the special session on "Geometric and Hyperbolic Dynamics" AMS meeting, Boston, October 1995.
- One hour talk on Complexity at the dedication of the Mathematical Sciences Research Center, City University of Hong Kong, January 1996.
- One hour talk at Symposium on Complexity, TJ Watson Research Center, May 1996.
- One hour talk at Dynamics Day, City University of Hong Kong, June 1996.
- One hour talk at Beijing International Conference on Dynamical Systems, June 1996.

- One hour talk at PUC International Conference on Differential Geometry and Dynamical Systems, Rio de Janeiro, August, 1996.
- One hour talk at the Real Machines and Homotopy Workshop, FoCM, IMPA, Rio de Janeiro, Jan 5-11, 1997.
- One hour talk at the Geometry and Complexity Workshop, Fields Institute, May 5-11, 1997.
- One hour Plenary Address at 4th Quadriennal International Conference on Dynamical Systems, IMPA, Rio de Janeiro, July 29- Aug 8, 1997.
- One hour talk at Dynamics and Algorithms Workshop , IMA, Nov 17-21, 1997.
- Principal lecturer (three hours of keynote addresses) at Rencontres Mathematiques-Complexity and Real Computation, Ecole Normale Superieure, Lyon March 1998.
- One hour talk Symposium on Dynamical Systems, Princeton University, January 29-31, 1999.
- One hour talk Midwest Dynamical Systems Seminar, Ann Arbor Michigan, April 15-18, 1999.
- One hour talk Michigan Interdisciplinary Mathematics Meetings II, Ann Arbor, May 6-8, 1999.
- One hour semi-plenary lecture Real Machines and Homotopy Methods Workshop, Foundations of Computational Mathematics, Oxford, July 18-28, 1999.
- Three hours of lectures of a five hour mini-course shared with Keith Burns at American Math Society Summer Research Institute on Smooth Ergodic Theory and Applications, Seattle, Wash., July 26-August 13,1999.
- One hour talk Solving Systems of Equations Workshop, FoCM Semester, City University of Hong Kong, October 11-15,1999.
- One hour plenary address Year 2000 International Conference on Dynamical Systems and

Differential Equations, Kennesaw State University, May 18-21, 2000

- One hour plenary address Session on Algebraic Algorithms and Algebraic Complexity, IMACS/ ACA'2000, St. Petersburg, June 24-28,2000
- One hour plenary address International Conference on Foundations of Computational Mathematics in Honor of Professor Steve Smale's 70th Birthday, City University of Hong Kong, July 13-17, 2000
- One hour plenary address International Conference on Dynamical Systems, IMPA, Rio de Janeiro, July 19-28, 2000
- Forty minute invited address Special Session on Computational Algebraic Geometry at the 2001 Spring Eastern Sectional Meeting of the American Math Soc.
- One hour plenary address Mathematical problems of Non-Linear Dynamics, University of Nizhny Novgorod, Russia , July, 2001
- One hour plenary address Dinamica Caotica Real e Conservativa, IMPA, Rio de Janeiro, January 2002.
- One hour semi-plenary address in the Computational Algebraic Geometry Workshop at FoCM2002, Minneapolis, Minnesota, August, 2002.
- One hour plenary address New Directions in Dynamical Systems, Kyoto, August, 2002.
- One hour invited address Midwest Dynamical Systems Seminar, Northwestern University, April, 2003.
- One hour plenary address Recent Trends in Dynamical Systems, Porto, Portugal July, 2003
- One half hour invited address on Dynamical Systems at the International Congress of Mathematical Physics, Lisbon, July, 2003
- One hour invited address Dynamical Systems and Modeling Workshop Honoring the Hundred Birthday of John Von Neumann , Academy of Sciences, Budapest, Hungary October,2003
- One hour invited address Partial Hyperbolicity and Dynamics Workshop, Buzios, Brazil, November 2004.
- One hour Plenary Address international Symposium on Dynamical Systems and Numerical Analysis in Honor of TY Li's 60th Birthday, National Center of Theoretical Science, Taiwan, May 2005
- One hour invited address Numerics on Manifolds, Luminy, France, May 2005
- Four Lecture Short Course (with C.Pugh) XIV Escuela Latino Americana de Matematica (ELAM) , Solis, Uruguay, December 2005
- One hour invited address, University of Maryland – Penn State Spring Dynamics Meeting in honor of Jasha Sinai's 70th birthday
- One hour invited address in honor of Carles Simo's 60th birthday.
- 45 Minute Sectional Speaker "Ordinary Differential Equations and Dynamical Systems" International Congress of Mathematicians, Madrid Spain 2006
- 50 Minute invited talk Dynamical Systems Special Session at CMS 2006 Annual Meeting, Toronto
- Two hour tutorial lecture on condition numbers and the solution of systems of equations at the Zero Problem Workshop at the Korean Institute for Advanced Studies, Seoul, 2007
- Two hours at the "Chaos and Ergodicity of Realistic Hamiltonian Systems" workshop, CRM, Montreal, December 2007
- 1 hour invited talk at "Dynamics and Complexity" workshop, Montevideo, Uruguay, May,2008
- 45 Minute invited talk in the Special Session on "Complexity" , AMS-SBM Joint International Meeting, Rio de Janeiro, 2008
- 1 hour invited talk at the "Real Computation and Complexity" workshop at the Foundations of Computational Mathematics international meeting, Hong Kong, 2008.
- 1 hour invited talk at GECKO/TERA2008 , Paris, Ecole Polytechnique, November, 2008
- 1 hour invited talk MEGA, Barcelona Spain 2009
- 1 hour invited address International Conference on Dynamical Systems, Buzios, Brazil February, 2010
- 1 hour invited talk MEGA, Barcelona Spain 2009
- 1 hour invited address International Conference on Dynamical Systems, Buzios, Brazil February, 2010
- 1 hour plenary talk MATH AMSUD Workshop, Complexity and Solution of Systems of Polynomial Equations, Montevideo, Uruguay, April 11-15, 2011
- ICERM Topical Workshop: "Mathematical Aspects of P versus NP and its Variants" (August 1-August 5, 2011) One hour talk

- Coloquio Uruguayo de Matemática 20-22 December 2011 40 Plenary address.
- 1 hour plenary talk MATH AMSUD Workshop, Complexity of Algorithms for Solving Equations, Paraty, Brasil, April 16-20, 2012
- 2 hours School of talks in the School of Mathematics “Luis Santalo”, Recent Progress in Real Complexity and Computation, Santander, Spain July 16-20, 2012
- AMS-SIAM Invited Speaker SIAM Annual Meeting San Diego, July 2013
- 40 minute invited talk Mario Wschebor Memorial Conference, Solis Uruguay, December 2013
- 25-minute invited talk polynomial Systems Solving Workshop, Simons Institute, October 2014
- 35 minute invited talk Sphere Packings, Lattices and Designs Workshop, Erwin Schrodinger Institute, Vienna, October, 2014

- 1 hour invited talk Beyond Uniform Hyperboliciy, Provo, Utah, July 2017

- 1 hour invited talk Workshop on Hyperbolic Dynamics, ICTP Trieste July 2017
- 25 minute invited address From Computation to Information, Cambridge, England August 31-September 1, 2017
- 1 hour Plenary talk FoCM 2018
- 1/2 hourPlenary address Complexity of Numerical Computation, August 19-23, 2019, Berlin.
- 1/2 hour Plenary address Problem Session in Honor of Charles Pugh’s 80(+1) Birthday, September 22,2021
- 40 minute Plenary address Symbolic and Numeric Algorithms in Algebraic Geometry, December 13-15, 2021

Other articles

Dedieu J. P., and Shub M. *Newton and predictor-corrector methods for over-determined systems of equations*. (1998) IBM Research Report.

Book reviews

Shub M., *Book Review of Geometric Theory of Dynamical Systems, by Palis and De Melo.* The Mathematical Intelligencer, **6** (1984), no. 1, 69-70.

Shub M., *Book Review of ``Information, Uncertainty*, Complexity" by J.F. Traub G.W. Wasilkowski and H. Wozniakowski SIAM Review, **29** (1987) no. 3, 495-7.

Shub M. *Book Review of Elements of differentiable dynamics and bifurcation theory by David Ruelle Bull*. Amer. Math. Soc. **24** (1991) no. 1, 199-211.

Colloquium and Seminar Lectures Delivered:	
1967-1968	Princeton University
1969-1970	Northeastern University, Boston College, Universite de Geneve
1970-1971	The Johns Hopkins University colloquium; Yale University colloquium; Northwestern University colloquium
1971-1972	Northeastern University, Massachusetts Institute of Technology, SUNY at Albany colloquium; University of California at Berkeley
1972-1973	University of Chicago colloquium; University of California at Berkeley; M.I.T.; Queens College colloquium; SUNY at Stony Brook; Brown University
1974-1975	I.B.M.; SUNY at Stony Brook; Rutgers University

1975-1976	University of California at Berkeley colloquium; New Jersey Institute of Technology College Industry Seminar series; Yale University; Brandeis University-M.I.T.-Harvard joint colloquium
1976-1977	Colloque des Universites Parisians, I.H.E.S., Orsay.
1977-1978	Fordham colloquium, Yale University of California at Berkeley
1978-1979	University of California, Los Angeles; University of California, Berkeley; University of Pennsylvania; I.H.E.S.
1979-1980	Columbia University

1980-1981	University of California, Berkeley and Santa Cruz, Universitat Bremen
1981-1982	Columbia University (Computer Science Department), Ecole Polytechnique Paris, University of California Berkeley, I.B.M., CUNY Logic Seminar
1982-1983	Columbia University Mathematics Colloquium, University of California, Berkeley. Lehman College Colloquium; Boston University Distinguished Lectures Series, 2 lectures; Tufts University; Cornell University Pure and Applied Math Department, 2 lectures.
1984	IMPA, 3 lectures; Columbia University - Complex Analysis Seminar, Adelphi University; Columbia University Computer Science Seminar, University of Illinois at Chicago Circle, Northwestern University Dynamics Seminar and Colloquium
1985	IMPA Dynamics and Geometric Complexity Seminars and Colloquium, University of Sao Paulo Dynamics Seminar, Universidade Federal Do Rio De Janeiro Colloquium, Columbia University Computer Science Seminar, Institute for Advanced Study Dynamics Seminar
1986	IBM Almaden Research Center, U.C. Berkeley Dynamics Seminar and MSRI-Evans Colloquium, MSRI Geometrical Complexity Seminar, Joint Brandeis, Harvard, MIT Colloquium.
1987	Universidad Federal do Cearah, Columbia University IE/OR Dept Linear Programming Seminar, New York Academy of Sciences Math Section, Berkeley Ergodic Theory Seminar, Dynamical Systems Seminar and Departmental Colloquium, Boston University Dynamics Seminar, Clark University Colloquium Institut National Polytechnique de Grenoble, France.
1988	Baruch College colloquium, University of California, Berkeley Dynamics and Geometric Complexity seminars, Dynamical Systems Summer School, Trieste, Italy, Columbia University Computer Science Complexity Seminar.
1989	John von Neuman Center Automatic Groups Conference, Columbia University approximately Solved Problems Conference, SUNY Stony Brook Colloquium, Bellcore, NY, Dynamical Systems CUNY, Rockefeller University, University of Aachen Colloquium, Ecole Polytechniques - Paris, International Computer Science Institute, Stony Brook Dynamics Seminar.

1990	Applied Math Seminar at Cornell, Colloquium at MIT-Harvard-Brown Center for Intelligent Control Systems, Academy of Sciences Weierstrass Institute of DDR, University of California, Berkeley Dynamics Seminar.
1991	Cal Poly, University of California at Santa Cruz colloquia, IBM Almaden Research Center, University of British Columbia joint math computer science colloquium, Reed College colloquium, Cal State at Arcata colloquium.
1992	Seminaire D'Arithmetique et Geometrie Algebrique, Universite de Paris Sud; Berkeley Math Colloquium; Algebra seminar and Colloquium Oregon Oregon State University; Math Colloquium Humboldt University, Berlin; Computer Science Colloquium, Bonn University; Algorithms and Complexity for continuous Problems Workshop- Schloss Dagstuhl October 12-16; Future of the Theory of Computing- Queens College and Courant Institute Computer Science Departments, CUNY Dynamics Seminar-Stably Ergodic Diffeomorphisms
1993	International Computer Science Institute, Berkeley, University of Texas at Austin - Math Colloquium and Dynamical Systems Seminar, Columbia - IBM Seminars on Dynamical Systems and on Mathematics, Economics and Finance; ÝCUNY Dynamics and Geometry Seminar, Bryn-Mawr Haverford Math Colloquium, Autonomous University of Barcelona Dynamics Seminar.
1994	IMPA Rio de Janeiro 3 Complexity and 1 dynamics seminars, Federal University of Rio de Janeiro Mathematics Colloquium, Federal University of Salvador Mathematics Colloquium, Federal University of Belo Horizonte Mathematics and Computer Science Colloquia, Federal University of Porto Alegre Mathematics Colloquium, University of Sao Paulo Computer Science Colloquium, City College of CUNY Math Colloquium, Queens College of CUNY Computer Science Colloquium, SUNY Stony Brook Dynamics Seminar.
1995	UCLA Dynamics and Computing(two seminars), University of Chicago Ergodic Theory Seminar, University of Texas at San Antonio Math Colloquium, University of Houston Non-linear Dynamics Seminar
1996	Guangzhou University, Academia Sinica, Taipei, Harvard Math Dept, MIT Applied Math Colloquium, Rockefeller University Physics Dept., Columbia University Applied Math Colloquium, Columbia University Math Dept., University of Buenos Aires, Computer Science and Math Colloquia
1997	Colloquium and Dynamics Seminar, Northwestern University, Dynamics Seminar SUNY Stony Brook.

1998	Seminaire Michel Herman-Systemes Dynamiques, Five two hour lectures Stable Egrodicity, March, 1998, Paris, Mathematics Colloquium, Universite de Geneve, Les Vendredis de l'IHES, Mathematics Colloquium, University of California at Santa Cruz, Mathematics Colloquium and Applied Dynamics Seminar, University of Maryland, College Park
1999	University of Colorado at Boulder, Applied Math Colloquium, Cornell University, Colloquium and Dynamics Seminar
2000	Courant Institute, Dynamics seminar, SUNY Stony Brook, Dynamics Seminar
2001	IMPA Dynamics Seminar, Penn State Mathematics Colloquium, NY Joint Dynamics Seminar
2002	Johns Hopkins University, Rutgers Newark and New Jersey Institute of Technology Joint Mathematics Colloquium, SUNY Stoney Brook Dynamics Seminar, University of California at Berkeley Mathematics Colloquium
2003	University of Toronto Mathematics Colloquium and Dynamical Systems Seminar, University of Cantabria, Santander, Spain Seminar, Notre Dame University Mathematics Colloquium, Toyota Technology Institute University of Chicago Seminar, Technical University of Budapest Dynamics Seminar, Erwin Schrodinger Institute, Vienna Dynamics Seminar
2004	Courant Institute, Dynamics Seminar, University of Porto, Mathematics Center Colloquium, University of Barcelona, Dynamics Seminar
2005	Universite de Paris, Jussieu-Mathematics Colloquium , University of Rome-Tor Vergata, Dynamical Systems Seminar, University of Buenos Aires, Mathematics Colloquium Vergata, Dynamical Systems Seminar
2006	McMaster University, Optimization Seminar, McMaster University Nelson Lecturer, Queens University Mathematics Colloquium, IMPA Dynamics Seminar
2007 2008	Toyota Technology Institute, Seminar, Northwestern University Mathematics Colloquium, Mathematics Colloquium Universite de Monreal SUNY Stoney Brook Dynamics Seminar, UNAM Mathematics Institute Colloquium, Universidad de Buenos Aires Mathematics Colloquium, IMPA Dynamics Seminar,
2009	University of Buenos Aires lecture series, University of Montevideo-dynamics seminar, Universidad de Barcelona-Math Colloquium, City University of New York-Complex Analysis seminar
2010	Universidad Federal de Rio de Janiero-Mathematics Seminar, University de la Republica, Montevideo, Math Colloquium, New York Number Theory seminar

2011	Universidad de Buenos Aires Computibilidad y Complejidad, CUNY Complex Analysis and Dynamics Student and general seminars, CCNY Mathematics Colloquium.
2012	IMPA, Dynamics Seminar, Math Colloquium Universidad de la Republica, Montevideo, Fedral University of Rio de Janeiro,Math Colloquium, CUNY Topology Seminar
2013	Universidad Nacional Cordoba, Lie Groups and Differential Geometry Seminar, University of Buenos Aires Math Colloquium, Bronx Community College of CUNY Mathematics Colloquium, , Univeridad de la Republica, Montevideo, Dynamics Seminar
2014	Mathematics Colloquium, PUC_Santiago, Chile, Polynomial System Solving Seminar, Simons Institute, Berkeley, Dynamical Systems Seminar, Universidad de le Republica, Montevideo
2016	Math Colloquium,CCNY
	Dynamical System Seminar, IMPA
2018	Symbolic-Numeric Computing Seminar, CUNY-GC
2020	University of Chicago (Wilkinson class), Graduate Student Colloquium CUNY

7. GRANTS, FELLOWSHIPS, AND AWARDS

(1) Grants

7/73-08/05	Principal Investiagor, National Science Foundation research grant.
2004	NSERC Discovery Grant 2004-2009

NSF

Dynamical Systems and Topology
Award Number:7407040; Principal Investigator:Michael Shub; Co-Principal Investigator:; Organization:CUNY Queens College;NSF Organization:DMS Start Date:07/01/1974; Award Amount:$46,600.00; Relevance:96.0;

NSF grant MCS 78-02721 I did not find records for this grant.

Dynamical Systems and Topology (Mathematical Sciences)
Award Number:8201267; Principal Investigator:Michael Shub; Co-Principal Investigator:Dennis Sullivan; Organization:CUNY Queens College;NSF Organization:DMS Start Date:06/01/1982; Award Amount:$302,610.00; Relevance:96.0;

Dynamical Systems and Differential Geometry
Award Number:8313076; Principal Investigator:Michael Shub; Co-Principal Investigator:Richard Sacksteder; Organization:CUNY Graduate School University Center;NSF Organization:OISE Start Date:02/01/1984; Award Amount:$16,425.00; Relevance:96.0;

Mathematical Sciences: Dynamical Systems, Geometry, Complexity and Topology
Award Number:8601550; Principal Investigator:Michael Shub; Co-Principal Investigator:Dennis Sullivan; Organization:CUNY Queens College;NSF Organization:DMS Start Date:07/01/1986; Award Amount:$262,716.00; Relevance:96.0;

Mathematical Sciences: Dynamical Systems and Complexity
Award Number:8900443; Principal Investigator:Michael Shub; Co-Principal Investigator:; Organization:IBM Thomas J Watson Research Center;NSF Organization:DMS Start Date: 06/01/1989; Award Amount:$36,800.00; Relevance:96.0;

Mathematical Sciences: Continuous Complexity and Dynamics
Award Number:9303372; Principal Investigator:Michael Shub; Co-Principal Investigator:; Organization:IBM Thomas J Watson Research Center;NSF Organization:DMS Start Date: 07/01/1993; Award Amount:$100,123.00; Relevance:96.0;

Mathematical Sciences: Continuous Complexity and Dynamical Systems
Award Number:9616920; Principal Investigator:Michael Shub; Co-Principal Investigator:; Organization:IBM Thomas J Watson Research Center;NSF Organization:DMS Start Date: 08/15/1997; Award Amount:$61,000.00; Relevance:96.0;

Mathematical Sciences: Continuous Complexity and Dynamics
Award Number:9988809; Principal Investigator:Michael Shub; Co-Principal Investigator:; Organization:IBM Thomas J Watson Research Center;NSF Organization:DMS Start Date: 08/15/2000; Award Amount:$59,379.00; Relevance:96.0;

The data above is taken from publically available NSF data except for NSF grant

2017	Smale Institute Award ($15,000)
2018	Smale Institute Award ($15,000)
2021	Smale Institue Award ($30,000)

(4) Fellowships and scholarships

6/64-6/67	N.S.F. Graduate Fellowship
9/72-8/74	Alfred P. Sloan Foundation Research Fellowship

(1) Inventions and patents (including patent numbers)

United States Patent 6,662,148 December 9, 2003 Computation of shapes of three-dimensional linkage structures based on optimization techniques Adler; Roy L. (Chappaqua, NY), Dedieu; Jean-Pierre (Toulouse Cedex, FR), Kalvin; Alan D. (Irvington, NY), Margulies; Joseph Y. (Pleasantville, NY), Martens; Marco (Chappaqua, NY), Shub; Michael (New York, NY)
United States Patent 6,807,530 October 19, 2004 Method and apparatus for remote commerce with customer anonymity Shub; Michael (New York, NY), Tresser; Charles Philippe (Mamaroneck, NY), Wu; Chai Wah (Ossining, NY)
United States Patent 6,873,977 March 29, 2005 Achieving buyer-seller anonymity for unsophisticated users under collusion amongst intermediaries Aggarwal; Alok (Chappaqua, NY), Dubey; Pradeep K. (New Delhi, IN), Jutla; Charanjit Singh (Elmsford, NY), Kumar; Vijay (New Delhi, IN), Martens; Marco (Chappaqua, NY), Shub; Michael Ira (New York, NY), Tresser; Charles P. (Mamaroneck, NY), Wu; Chai Wah (Poughquaq, NY)
United States Patent 7,370,366 May 6, 2008 Data management system and method Lacan; Francis M. (London, GB), Perez; Ronald (Mount Kisco, NY), Shub; Michael I. (New York, NY), Tresser; Charles P. (New York, NY)

United States Patent 7,818,581 October 19, 2010
Data management system
Lacan; Francis M. (London, GB), Perez; Ronald (Mount Kisco, NY), Shub; Michael I. (New York, NY), Tresser; Charles P. (New York, NY)

Industry boards and Government Panels

1999	University Relations Task Force, IBM Research

1989	Science and Technology Centers Panel NSF. Led University of Maryland Science & Technology Center site visit, April
1999	Optimization Panel, National Science Foundation - Computer Science
2002	CNRS Commité d'Evaluation du Laboratoire de Topologie et du Laboratoire Gevrey de Mathematiques Physique de l' Université de Bourgogne

Conference boards, panels, workshops, etc.

1984	Workshop on the Geometry & Topology of Dynamical Systems (with John Franks) – MSRI, Berkeley, June 1994
1986	Workshop on Geometric Complexity (with S. Smale and A. Chorin) MSRI, Berkeley, January, 1986
1988	Organized sessions on "Variations of Newton's Method on Mathematical Programming I and II" for the International Symposium on Mathematical Programming, Tokyo, August, 1988
1990	From Topology to Computation: Unity and Diversity in Mathematics, Berkeley (with M. Hirsch, G. Debreu, N. Kopell, J. Marsden, J. Palis, T. Tromba, A Weinstein) August, 1990
1992	Organizing Committee for International Meeting for Continuous Algorithms and Complexity at the 12th World Computer Congress- IFIPS 92 Madrid, Spain, September 1992
1994	Program Committee for Workshop on Geometry, Topology and Markets, Fields Institute, July 1994

1995	Organizing Committee for Mathematics of Numerical Analysis – Real Number Algorithms, Park City, Utah July-August 1995 also organized the Workshop on Real Machines (with Felipe Cucker) and the panel discussion "Does Numerical Analysis Need a Model of Computation?" with participants A.Chorin, A.Iserles, B.Parlett, S.Smale and S.Winograd at this meeting.
1995	Scientific Committee for Solutions d'Equations Algebrique 95, CIRM Luminy, France, November 13 -17, 1995
1995	Organizing Committee for Real Computation and Complexity Workshop, Dagstuhl Germany, Novemember 6 -10, 1995
1996	Organizing Commitee for Symposium on Complexity (in honor of Shmuel Winograd's 6oth birthday) TJ Watson Research Center, May 1996 (with Alok Aggarwal and Alan Hoffman)
1997	Chair of the Organizing Committee "Foundations of Computational Mathematics" IMPA, Rio de Janeiro, January 5 -11,1997
1998	Co-chair Organizing Committee for Real Computation and Complexity Workshop, Dagstuhl Germany, June 15-19,1998 (with F.Cucker, T. Lickteig and M-F. Roy)
1998	Co-chair Organizing Committee for MSRI Semester on Foundations of Computational Mathematics (with Felipe Cucker and Arieh Iserles)
1998	Co-organizer Workshop on "Solving Systems of Equations" at MSRI, September 14 -18, 1998 (with J.P. Dedieu, M-F. Coste-Roy, and B. Sturmfels)
1999	Executive Committee-Foundations of Computational Mathematics, Oxford, July 18 - 28, 1999
2000	Program Committee-International Conference on Computational Mathematics in Honor of Professor Steve Smale's 70th Birthday, City University Hong Kong, July13-17, 2000
2001	Organizing Committee, International Conference on Partial Hyperbolicity, Nortwestern University, May 29 – June 3, 2001
2002	Executive, Plenary and Workshop Committees for FoCM2002, Minneapolis, Minn., August 2002

2002	CNRS Commite d'Evaluation du Laboratoire de Topologie et du Laboratoire Gevrey de Mathematiques Physique de l' Université de Bourgogne
2004	Advisory Commission of the Centre of Mathematics of the University of Porto (CMUP)
2005	Executive, Plenary and Workshop Committees for FoCM 2005, Santander Spain, July 2005
2006 2007	Organizer, Partially Hyperbolic Dynamics, Laminations and Teichmuller Flow, January 5 - 9, 2006 Fields Institute Organizer, Foundations of Computational Mathematics Thematic Program.
2009 2012 2015 2017	Co-Organizer with Teresa Krick, Felipe Cucker, Adrian Lewis, Askold Khovansky of the Workshop on Complexity of Numerical Computation at the Fields Institute, Oct 20 - 24, 2009 Co-organizer with Teresa Krick and Adrian Turjansky "CI3 - Conferencias Internacionales de Investigación Interdisciplinaria"New paradigms in the relationship between Mathematics and the Applied Sciences Learning Theory and Immunology, Universidad de Buenos Aires, April 9 -13, 2012 Scientific Committee, Random Processes and Optimal Configurations, Buenos Aires, Argentina, July ,2015 Co-Organizer with Steve Smale and Indika Rajapakse Workshop on Computational Biology with Emphasis on the Genome, Foundations of Computational Mathematics, Barcelona, July 2017

(7) Review panels

(8) Editorial panels and/or agencies, journals or presses for whom the candidate is a reviewer

1983 - 86	Member at Large of the Council of the American Mathematical Society
1985 - 86	Nominating Committee of the American Mathematical Society
1989	Science and Technology Centers Panel NSF. Led University of Maryland Science & Technology Center site visit, April
1990 - 94	AMS-IMS-SIAM Committee on Joint Summer Research Conferences in Mathematics
1990 - 93	AMS-SIAM Committee on Applied Mathematics
1995 - 1997	Founding Chair of Foundations of Computational Mathematics
1997 - 1999	Ex-Chair of Foundations of Computational Mathematics
1999	Optimization Panel, National Science Foundation - Computer Science
1999	University Relations Task Force, IBM Research
1999 - 2014	Board of Directors, Society for the Foundations of Computational Mathematics

2002	CNRS Commité d'Evaluation du Laboratoire de Topologie et du Laboratoire Gevrey de Mathematiques Physique de l' Université de Bourgogne
2004	Advisory Commission of the Centre of Mathematics of the University of Porto
2005	University of Buenos Aires, Hiring and Promotion Review Committee
2007	CMS Committee to propose Canadian speakers in "ODE and Dynamical Systems" to the ICM 2010
2007	Committee to Select Plenary Speakers for the AMS-SBM Joint International Meeting, Rio de Janeiro, 2008
2007 - 2009	Organizer, Foundations of Computational Mathematics Thematic Program, Fields Institute Fall 2009
2008	Chair, FOCM Nominating Committee for the Chair, Secretary and Treasurer Chair, FoCM Committee to Select Plenary Speakers for 2011
2009	FoCM Nominating Committee for the next Chair, Secretary, Treasurer
2010	2011 and 2012 CRM-Fields-PIMS Prize Selection Committee
2010 - 2012	Miembro de la Comisión Evaluadora de los Investigadores de Matemática PEDICEBA
2013	Department of International Relations of the Chilean National Commission for Scientific and Technological Research (CONICYT) Comision Evaluadora

Editorial Boards

(10) Membership in professional societies

1983 - 86	Member at Large of the Council of the American Mathematical Society
1985 - 86	Nominating Committee of the American Mathematical Society
1990 - 94	AMS-IMS-SIAM Committee on Joint Summer Research Conferences in Mathematics
1990 - 93	AMS-SIAM Committee on Applied Mathematics
1997 - 1999	Ex-Chair of Foundations of Computational Mathematics

1999 - 2014	Board of Directors, Society for the Foundations of Computational Mathematics
2007	Committee to Select Plenary Speakers for the AMS-SBM Joint International Meeting, Rio de Janeiro, 2008
2008 2009	FoCM Committee to Select Plenary Speakers for 2011 FoCM Nominating Committee for the next Chair, Secretary, Treasurer
2018	Plenary Committee to choose speakers for FoCM 2020 in Vancouver

Ph.D. Students

1971 Hugh Porteous (With D.B.A. Epstein) Existence of Anosov Diffeomorphisms on Flat Manifolds. Mr. Porteous was a student at Warwick.

1973 Allan Gottlieb -- Necessary conditions for the persistence of Invariant manifolds. Mr. Gottlieb was a student at Brandeis University.

1977 Michael Maller -- Diffeomorphisms of non-simply connected manifolds. Mr. Maller was a student at Warwick.

1980 Helena Wisniewski -- Rate of approach of minima and sinks. Ms. Wisniewski was a student at CUNY.

1985 Diego Benardete - Topological Equivalence of one parameter subgroups acting on homogeneous spaces. Mr. Bernardete was a student at CUNY.

1985 Myong-Hi Kim - Computational Complexity of Euler type algorithms for the roots of complex polynomials. Ms. Kim was a student at CUNY.

1986 Walter Miller - Differentiating Invariant Manifolds for Dynamical Systems with applications to Melnikov theory. Mr. Miller was a student at CUNY.

2010 Mario Morfin (with Charles Pugh)- Kupka- Smale Theorems for Tangent Bundle Dynamics. Mr. Morfin was a student at the University of Toronto.

2010 Pablo Carrasco (with Charles Pugh) – Partially Hyperbolic Dynamical Systems. With All Leaves Compact. Mr. Carrasco was a student at the University of Toronto.

2012 Diego Armentano (with JP Dedieu and Mario Wschebor) Complexity and Random Polynomials –Universidad se la Republica, Montevideo, Uruguay and Université