

Curriculum Vitae

Michele Pavon

(Dated: June 22, 2018)

Present Position and Address:

Professor at the
Dipartimento di Matematica “Tullio Levi-Civita”
Università di Padova
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Education:

Ph.D. in mathematics, University of Kentucky, May 1979
“Laurea” in mathematics, University of Padua, July 1974.

Areas of interest:

Linear Stochastic Estimation, Optimal Control, Riccati Equations, Nelson’s Stochastic
Mechanics, Control of Quantum Mechanical Systems, Maximum Entropy Problems,
Optimal mass transport.

Academic Experience and Visiting:

- 2017-2018 Courant Institute of Mathematical Sciences, New York University, visiting scholar.
- Feb. 2017 Department of Engineering, Cambridge University, UK, visiting scholar.
- 2013-2014 Courant Institute of Mathematical Sciences, New York University, visiting scholar.
- July-Aug. 2012 Institut fuer Angewandte Mathematik, Universitaet Heidelberg, Germany, A. von Humboldt fellow.
- Sept.-Oct. 2011, Nagoya University, Dept. of Aerospace Engineering, visiting scholar.
- January 2002- present, Università di Padova, Dipartimento di Matematica, Professor.
- July 1986-December 2001 Università di Padova, Dipartimento di Elettronica e Informatica, Professor.
- Feb. 2003 Mittag-Leffler Institut, Stockholm, Sweden.
- Feb. 2002 Escuela Politecnica Superior, Universidad Carlos III de Madrid, Spain.
- Jul.-Aug. 1997 Universität Würzburg, Mathematisches Institut, A. von Humboldt fellow.
- Aug. 1995 Universität Kiel, Mathematisches Seminar, A. von Humboldt fellow.
- Fall 1994 University of California at Davis, Institute of Theoretical Dynamics, Visiting Professor.

Academic Experience and Visiting (continued) :

- July-Aug. 1992 Universität Kiel, Mathematisches Seminar, A. von Humboldt fellow.
- July-Aug. 1991 Universität Kiel, Mathematisches Seminar, A. von Humboldt fellow.
- Aug.90-Jan. 91 Universität Kiel, Mathematisches Seminar, A. von Humboldt fellow.
- Spring, Fall 1986 Arizona State University, Department of Mathematics, Visiting Associate Professor.
- Spring 1985 Università' di Padova, Dipartimento di Statistica, Lecturer.
- Summer 1984 Universität Konstanz, Fakultät für Statistik, F.R.G., Visiting Fellow.
- Spring 1984 Università' di Padova, Dipartimento di Statistica, Lecturer.
- Fall 1983 Universität Hamburg, Institut für Mathematische Stochastik, F.R.G., Visiting Fellow.
- 1982-83 Rijksuniversiteit Groningen, Mathematisch Instituut, The Netherlands, Visiting Fellow.
- Spring 1982 Florida State University, Department of Statistics, Visiting Assistant Professor.
- Spring 1981 University of Kentucky, Department of Mathematics, Visiting Assistant Professor.
- June 1980 University of Kentucky, Department of Mathematics, Visiting Scientist.

Academic Experience and Visiting (continued) :

- Sept. 1975-Sept. 1979 University of Kentucky, Department of Mathematics, Research Assistant.
- 1974-1975 Università' di Padova, Seminario Matematico, Research Assistant.

Personal: Born in Venice, Italy, on October 12, 1950. Languages: Italian, English, German (working knowledge).

Honors:

- Co-recipient (with Y. Chen and T. Georgiou) of the IEEE Control Systems Society 2017 George S. Axelby Outstanding Paper Award for the paper titled “Optimal Steering of a Linear Stochastic System to a Final Probability Distribution, Part I”
- Member of the MTNS Steering Committee, 2016-.
- Alexander von Humboldt Foundation fellowship, F.R.G. (Oct.83-Jun.84, Aug.90-Jan.91, Summer 91, Summer 92, Summer 95, Summer 97, Summer 2012).
- 1999-2002 Vice-President Scientific Committee for area “Ingegneria dell’Informazione”.
- 1997-2005 President Committee for English Test for area “Ingegneria dell’Informazione”.
- N.A.T.O. Senior fellowship (Sept. 1986).
- N.A.T.O. postdoctoral fellowship (Fall 1982).
- Three C.N.R. fellowships to visit abroad (1977-1979, Spring1982, Spring 1986)
- C.N.R. fellowship for graduates (1974-1975).
- C.N.R. fellowship for undergraduates (Spring 1974).
- Member of Scientific Council of LADSEB-CNR (1982-1986).

Research and Grants:

- July 1986-2000 LADSEB-CNR, Padova, Italy, Research Associate.
- Mar 80-Jun.86 LADSEB-CNR, Padova, Italy, Staff Member.
- 1981-1983 Principal Investigator CNR-NSF bilateral project “Stochastic variational methods in systems theory”
- 1984-1986 Principal Investigator Italy-Sweden bilateral project “Approximation and interpolation of stochastic dynamical systems”
- 1989-1991 Principal Investigator Italy-Germany European Economic Community Contract Nr.SC1*/0126-C(AM).
- 1993-1994 Principal investigator of C.N.R. Italy-Germany Bilateral Research Project on “Matrix Riccati Equations and Linear Stochastic Systems”
- 2000-2002 principal investigator of the University of Padova Research Grant on “Control of Quantum systems”
- participant in MIUR-PRIN Italian grant Identification and Control of Industrial Systems
- principal investigator of the 2008 GNAMPA-INDAM grant Teoria del Controllo per Sistemi Quantistici
- participant in the 2009-2010 University of Padova research grant “Schroedinger Bridges for Quantum Channels: A New Approach to Information Encoding and Control Design”, CPDA080209/08

Research and Grants (continued):

- participant in the 2010-2013 QFUTURE "Communication at the Quantum Limit" strategic research project of the University of Padova
- participant in the Department of Information Engineering research project QUIN-TET
- participant in the 2011-12 University of Padova research grant "Aspetti analitici e geometrico-differenziali nella Teoria del Controllo Non Lineare, con applicazioni alla Meccanica", CPDA103522
- participant in the 2015-16 University of Padova research grant CPDA140897 "New challenges in reciprocal processes, Schroedinger bridges, optimal transport and their respective geometries with applications to control engineering problems for classical and quantum systems."

Other employment:

March 1979- Feb. 1980 Italian Army (drafted)

Colloquia and seminars:

- Jan.-Feb. 2017 Cambridge University, Department of Engineering, Cambridge, UK (4 lectures)
- Sept. 2015, Cambridge University, Department of Engineering, Cambridge, UK.
- April 2015, NYUAB, Abu Dhabi.
- March 2015 Università di Padova, Department of Information Engineering.
- Feb 2015 Courant Institute of Mathematical Sciences, NYU.

Colloquia and seminars (continued):

- October 2014 Cambridge University, Department of Engineering, Cambridge, UK.
- June 2014 Instituto Superior Técnico, Universidade Técnica de Lisboa, , Portugal.
- April 2014 Courant Institute of Mathematical Sciences, NYU (colloquium).
- April 2014 L.I.D.S.-M.I.T., Cambridge, Mass., U.S.A.
- Feb. 2014 Courant Institute of Mathematical Sciences, NYU
- July 2012 Universitaet Heidelberg, Institut fuer Angewandte Mathematik, Germany.
- Oct. 2011 University of Tokyo, Dept. of Information Physics and Computing, Graduate School of Information Science and Technology.
- Sept. 2011, Nagoya University, Dept. of Aerospace Engineering.
- Aug. 2005 PHYSCON Conf. S. Petersburg (keynote speaker)
- June 2003 Scuola Normale Superiore, Pisa, Italy (2 conf.)
- Mar. 2003 Mittag-Leffler Institute, Stockholm, Sweden
- Nov. 2000 Uni-Würzburg, Mathematisches Institut, Würzburg, Germany
- Feb. 2000 L.I.D.S.-M.I.T., Cambridge, Mass.
- Nov. 1999 Politecnico di Milano, Dipartimento di Matematica, Milano.
- Feb. 1998 Universidad Carlos III, Escuela Politecnica Superior, Madrid, Spain
- Aug. 1997 Uni-Würzburg, Mathematisches Institut, Würzburg, Germany

Colloquia and seminars (continued):

- Jul. 1996 Uni-Würzburg, Mathematisches Institut, Würzburg, Germany
- Dec 1994 University of California at Davis, Department of Mathematics.
- Oct. 1994 University of California at Davis, Institute of Theoretical Dynamics.
- April 1994 Royal Institute of Technology, Dept. of Mathematics, Stockholm, Sweden.
- Nov.1992 Université de Montréal, Centre de la Recherche en Mathematiques, Montréal, Canada.
- Oct. 1992 S.I.S.S.A., Trieste.
- Oct.1992 Università di Padova, Dipartimento di Elettronica e Informatica (2 conf.).
- April 1991 S.I.S.S.A., Trieste.
- Jan.1991 Royal Institute of Technology, Dept. of Mathematics, Stockholm, Sweden.
- Oct.1990 Center for Mathematics and Computer Science, Amsterdam, The Netherlands.
- Jul. 1990 Universität Würzburg, Mathematisches Institut, Würzburg, F.R.G.
- Jul. 1990 McGill University, Dept. of Electrical Engineering, Montréal, Canada.
- May 1990 Universität Linz, Institut für Mathematik, Linz, Austria.
- Nov.1989 Università di Roma "La Sapienza", Dipartimento di Fisica.

Colloquia and seminars (continued):

- Oct. 1988 Università di Padova, Dipartimento di Elettronica e Informatica
- April 1988 Università di Roma "La Sapienza", Dipartimento di Fisica.
- Sept. 1987 Università di Padova, Dipartimento di Elettronica e Informatica.
- Nov. 1986 University of California, Dept. of Mathematics, Davis, California.
- Spring, Fall 1986 Arizona State University, Dept. of Math., Tempe, AZ (6 conf.).
- Oct. 1984 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden.
- May 1984 Technical Univ. at Eindhoven, Dept. of Math., Eindhoven, The Netherlands.
- May 1984 Stichting Mathematisch Centrum, Amsterdam, The Netherlands (2 conf.).
- Nov. 1983 Royal Inst. of Technology, Dept. of Mathematics, Stockholm, Sweden (2 conf.).
- June 1983 Universität Hamburg, Institut für Mathematische Stochastik, F.R.G.
- March 1983 Université de Paris-Dauphine, CEREMADE, France.
- Dec. 1982 Stichting Mathematisch Centrum, Amsterdam, The Netherlands.
- Fall 1982 Rijksuniversiteit Groningen, Mathematisch Instituut, Groningen, The Netherlands (6 conf.).
- June 1982 Scuola Normale Superiore, Pisa, Italy.

Colloquia and seminars (continued):

- May 1982 Universidad Nacional Autonoma de Mexico, I.I.M.A.S., Mexico City.
- May 1982 Centro de Investigacion en Matematicas, A.C., Guanajuato, Mexico.
- Spring 1982 Florida State University, Dept. of Stat., Tallahassee, Florida (7 conf.).
- Nov. 1981 Université de Nice, Laboratoire de signaux et systemes, Nice, France.
- June 1981 Universidade Tecnica de Lisboa, Centro de analise e processamento de sinais, Lisboa, Portugal (2 conf.).
- May 1981 McGill University, Dept. of Electr. Eng., Montreal, Canada.
- April 1981 Florida State University, Dept. of Stat., Tallahassee, Florida.
- June 1980 University of Kentucky, Dept. of Math., Lexington, Kentucky.
- Nov. 1979 Università della Calabria, Dipartimento di Sistemi (2 conf.).
- Feb. 1979 Università di Roma, Istituto Matematico (2 conf.).
- Nov. 1978 M.I.T., Dept. of Electrical Engineering, Cambridge, Mass.

Reviewer:

- SIAM J. on Control and Optimization
- IEEE Transactions Aut.Contr.
- Automatica
- Systems and Control Letters
- IEEE Transactions Inf.Theory
- Journal of Mathematical Physics
- Journal of Physics A
- Foundations of Physics
- IEEE Signal Processing Letters
- Math.Progr.Study
- Journal of Mathematical Systems, Estimation, and Control
- IEEE Transactions on Signal Processing
- Physica Scripta
- Annalen der Physik
- “ad hoc” reviewer for the National Science Foundation.

Teaching:

- Department of Mathematics, University of Kentucky:
Introductory Finite Mathematics (Fall 1977, Spring 1981).
Vector Calculus (Spring 1981).
- Dipartimento di Statistica, Università di Padova:
Markov Chains (Spring 1984).
Probability Theory (Spring 1985).
- Department of Mathematics, Arizona State University:
Elementary Differential Equations (Spring, Fall 1986).
- College of Engineering, Università di Padova:
Mathematical Methods of Information Engineering, Spring 2017
Signals and Systems, Fall 2002-Spring 2013, Spring 2015, Spring 2016
Automatic Control (Spring 1987, Spring 1989-Spring 2002).
Filtering and Identification Theory (Spring 1987, Spring 1988).
Brownian Motion and Noise in Physical Devices, Fall 2000, Fall 2013 (Ph.D. course).
Selected Topics in Optimization, Fall 2001, Spring 2004, Spring 2006 (Ph.D. course).
Applied Functional Analysis, Spring 2003 (Ph.D. course).
- Introduction to Probabilistic Models, Scuola Galileiana di Studi Superiori, Università di Padova, Spring 2007-Spring 2013
- Escuela Politecnica Superior, Universidad Carlos III de Madrid, Spain
Brownian Motion and Noise in Physical Devices, Spring 2002 (Ph.D. course).
- Math. Department, University of Padova, Mathematical Statistics, 2014-2016

Teaching (continued):

- Directed several “laurea” theses at the Dept. of Electrical Engineering, Department of Mathematics and Department of Statistics of the University of Padova.
- Supervised research of a CNR postgraduate fellow (P. Dai Pra) at LADSEB-CNR during 1987-1988.
- Supervised or co-supervised eight Ph.D. students (A. Ferrante, D. D’Alessandro, F. Ticozzi, F. Ramponi, F. Carli, N. Sahasrabudhe, M. Zorzi, C. Masiero).

Lecture Notes

- M. Pavon and S. Pinzoni, *Lezioni di Controlli Automatici con esercizi svolti*, Terza Edizione, Libreria Progetto, Padova, 1997.
- M. Pavon, *Lectures on Discrete Probabilistic Models*, 2013, available at http://www.math.unipd.it/~pavon/Site/Teaching_files/notes.pdf.

PUBLICATIONS

Journal Papers

- [1] F. Badawi, A.Lindquist and M.Pavon, A stochastic realization approach to the smoothing problem, *IEEE Trans. Aut. Control* **AC-24** (1979), 878-888.
- [2] M.Pavon, Stochastic realization and invariant directions of the matrix Riccati equation, *SIAM J. Control and Optimiz.* **18** (1980), 155-180.
- [3] M.Pavon and R.Wets, The duality between estimation and control from a variational viewpoint: the discrete time case, *Mathematical Programming Study* **18** (1982), 1-11.
- [4] M.Pavon, The conjugate process in stochastic realization theory, *Mathematical Programming Study* **18** (1982), 12-26.
- [5] M.Pavon, New results on the interpolation problem for continuous time stationary increments processes, *SIAM J. Control and Optimiz.* **22** (1984), 133-142.
- [6] A.Lindquist and M.Pavon, On the structure of state-space models for discrete-time stochastic vector processes, *IEEE Trans. Aut.Control* **AC-29** (1984), 418-432.
- [7] M.Pavon, Canonical correlations of past inputs and future outputs for linear stochastic systems, *Systems and Control Letters* **4** (1984), 209-215.
- [8] M.Pavon, Optimal interpolation for linear stochastic systems, *SIAM J.Control and Optimiz.* **22** (1984), 618-629.
- [9] A.Gombani and M.Pavon, On the Hankel-norm approximation of linear stochastic systems, *Systems and Control Letters* **5** (1985), 283-288.

Journal Papers (continued):

- [10] A.Gombani and M.Pavon, On approximate recursive prediction of stationary stochastic processes, *Stochastics* **17** (1986), 125-143.
- [11] M.Pavon, Critical Ornstein-Uhlenbeck processes, *Appl. Math. and Optimiz.* **14** (1986), 265-276.
- [12] P.E.Crouch and M.Pavon, On the existence of solutions of the Riccati differential equation, *Systems and Control Letters* **9** (1987), 203-206.
- [13] T.Taylor and M.Pavon, A solution of the nonlinear stochastic realization problem, *Systems and Control Letters* **11** (1988), 117-121.
- [14] M.Pavon, Stochastic control and nonequilibrium thermodynamical systems, *Appl. Math. and Optimiz.* **19** (1989), 187-202.
- [15] T.Taylor and M.Pavon, On the nonlinear stochastic realization problem, *Stochastics* **26** (1989), 65-79.
- [16] P.Dai Pra and M.Pavon, Variational path-integral representations for the density of a diffusion process, *Stochastics* **26** (1989), 205-226.
- [17] D.B.Hernandez and M.Pavon, Equilibrium description of a particle system in a heat bath, *Acta Applicandae Mathematicae* **14** (1989), 239-256.
- [18] A.Gombani and M.Pavon, A general Hankel-norm approximation scheme for linear recursive filtering, *Automatica* **26** (1990), 103-112.
- [19] A.Cavazzana and M.Pavon, Principal component analysis for multivariate stochastic processes, *Stochastics and Stochastics Reports* **30** (1990), 151-162.

Journal Papers (continued):

- [20] H.Wimmer and M.Pavon, A comparison theorem for Riccati difference equations, *Systems and Control Letters* **19** (1992), 233-239.
- [21] P.Kosmol and M.Pavon, Lagrange approach to the optimal control of diffusions, *Acta Applicandae Mathematicae* **32** (1993), 101-122.
- [22] A.Ferrante, G.Michaletzky and M.Pavon, Parametrization of all minimal square spectral factors, *Systems and Control Letters* **21** (1993), 249-254.
- [23] P.Kosmol and M.Pavon, Lagrange Lemma and the optimal control of diffusions II : nonlinear Lagrange functionals, *Systems and Control Letters* **24** (1995), 215-221.
- [24] M. Pavon, Hamilton's principle in stochastic mechanics, *Journal of Mathematical Physics* **36** (1995), 6774-6800.
- [25] M. Pavon, A new formulation of stochastic mechanics, *Physics Letters A* **209** (1995), 143-149, Erratum 211 (1996), 383.
- [26] M. Pavon, Lagrangian dynamics for classical, Brownian and quantum mechanical particles, *Journal of Mathematical Physics* **37** (1996), 3375-3388.
- [27] M.Pavon and D. D'Alessandro, Families of solutions of matrix Riccati equations, *SIAM J. on Control and Optimization* **35** (1997), 194-204.
- [28] D. D'Alessandro and M. Pavon, On the nonnegative definite solutions of the discrete time algebraic Riccati equation, *J. Math. Systems, Estimation and Control*, accepted for publication and never published.

Journal Papers (continued):

- [29] A. Ferrante and M. Pavon, The Algebraic Riccati Inequality: Parametrization of Solutions, Tightest Local Frames and Generalized Feedback Matrices, *Linear Algebra and its Applications* **292** (1999), 187-206.
- [30] M. Pavon, Derivation of the wavefunction collapse in the context of Nelson's stochastic mechanics, *Journal of Mathematical Physics* **40** (1999), 5565-5577.
- [31] M. Pavon, Stochastic mechanics and the Feynman integral, *Journal of Mathematical Physics*, **41** (2000), 6060-6078.
- [32] P.Kosmol and M.Pavon, Solving optimal control problems by means of general Lagrange functionals, *Automatica* **37** (2001), 907-913.
- [33] A. Ferrante, M. Pavon and S. Pinzoni, Asymmetric algebraic Riccati equation: A homeomorphic parametrization of the set of solutions, *Linear Algebra and its Applications*, **329** (2001), 137-156.
- [34] M. Pavon, On the stochastic mechanics of the free relativistic particle, *Journal of Mathematical Physics*, **42** (2001), 4846-4856.
- [35] M. Pavon and H. Wimmer, Suboptimal Markovian smoothing estimates based on continuous curves of solutions of the Algebraic Riccati Equation, *Automatica*, **38** (2002), 1017-1025.
- [36] Alessandro Beghi, Augusto Ferrante and Michele Pavon, How to steer a quantum system over a Schrödinger bridge, *Quantum Information Processing*, **1** (2002), 183-206.

Journal Papers (continued):

- [37] Augusto Ferrante, Michele Pavon and Stefano Pinzoni, On the relation between additive and multiplicative decompositions of rational matrix functions, *Int. J. on Control*, **76** (2003), 366-385.
- [38] M. Pavon, A footnote to Nelson's interpretation of the two-slit experiment, *Int. J. Modern Phys. B.*, **18** (2004), 745-753.
- [39] F. Ticozzi, A. Ferrante and M. Pavon, Robust Steering of n-level Quantum Systems, *IEEE Trans. Aut. Control*, **49**, (2004), 1742- 1745.
- [40] M. Pavon, Hamilton-Jacobi equations for nonholonomic dynamics, *J. Math. Phys.* **46**, 032902, doi:10.1063/1.1858441 (2005).
- [41] M. Pavon and A. Ferrante, On the Georgiou-Lindquist approach to constrained Kullback-Leibler approximation of spectral densities, *IEEE Trans. Aut. Control*, **51**, (2006), 639- 644.
- [42] M. Pavon and F. Ticozzi, On entropy production for controlled Markovian evolution, *J. Math. Phys.*, **47**, 06330, doi:10.1063/1.2207716 (2006).
- [43] A. Ferrante, M. Pavon and F. Ramponi, Hellinger Versus Kullback-Leibler Multivariable Spectrum Approximation, *IEEE Trans. Aut. Control*, **53**, Issue 4, May 2008, 954 - 967.
- [44] F. Ramponi, A. Ferrante and M. Pavon, A globally convergent matricial algorithm for multivariate spectral estimation, *IEEE Trans. Aut. Control*, **54**, Issue 10, October 2009, 2376-2388.

Journal Papers (continued):

- [45] F. Ramponi, A. Ferrante and M. Pavon, On the well-posedness of multivariate spectrum approximation and convergence of high-resolution spectral estimators, March 2009, *Systems and Control Letters*, **59**, (2010), 167-172.
- [46] F. Ticozzi and M. Pavon, On Time-reversal and space-time harmonic processes for Markovian quantum channels, Preprint April 2009, *Quantum Information Processing*, **9**, (2010), 551-574. Preprint arXiv:quant-ph/0811.0929v2
- [47] M. Pavon and F. Ticozzi, Discrete-time classical and quantum Markovian evolutions: Maximum entropy problems on path space, *J. Math. Phys.*, **51**, 042104-042125 (2010) doi:10.1063/1.3372725. Preprint arXiv:math-ph/0811.0933v2
- [48] A. Ferrante and M. Pavon, Matrix Completion *à la* Dempster by the Principle of Parsimony, preprint arXiv:1006.5385, *IEEE Trans. Information Theory*, **57**, Issue 6, June 2011, 3925-3931.
- [49] F. Carli, A. Ferrante, M. Pavon, and G. Picci, A Maximum Entropy solution of the Covariance Extension Problem for Reciprocal Processes, arXiv:math-ph/1101.4849, *IEEE Trans. Aut. Control*, **56**, Issue 9, September 2011, 1999-2012.
- [50] A. Ferrante, M. Pavon and M. Zorzi, A maximum entropy enhancement for a family of high-resolution spectral estimators, *IEEE Trans. Aut. Control*, **57**, Issue 2, Feb. 2012, 318-329.
- [51] A. Ferrante, C. Masiero and M. Pavon, Time and spectral domain relative entropy: A new approach to multivariate spectral estimation, *IEEE Trans. Aut. Control*, **57**, Issue 10, 2561-2575, 2012.

Journal Papers (continued):

- [52] P. Dai Pra, M. Pavon, N. Sahasrabudhe, A maximum entropy approach to the realizability of spin correlation matrices, *Entropy*, **15**, June 2013, 2448-2463.
- [53] M. Pavon and A. Ferrante, On the geometry of maximum entropy problems, *SIAM Review*, **55-3**, 2013, 415-439, preprint arXiv: math/1112.5529v3 [math.OC].
- [54] P. Dai Pra, M. Pavon, N. Sahasrabudhe, A note on the geometric interpretation of Bell's inequalities, preprint arXiv: quantum-ph/1301.4823v3, *Letters in Mathematical Physics*, **103-11**, 2013, 1165-1170.
- [55] F. Carli, A. Ferrante, M. Pavon, and G. Picci, An Efficient Algorithm for Maximum-Entropy Extension of Block-Circulant Covariance Matrices, Feb. 2013 arXiv:math-ph/1107.2465, *Linear Algebra and its Applications*, **439**, 2013, 2309-2329.
- [56] A. Ferrante, N. Laurenti, C. Masiero, M. Pavon and S. Tomasin, On the Achievable Error Region of Physical Layer Authentication Techniques over Rayleigh Fading Channels, April 2014 arXiv:1303.0707v2, *IEEE Transactions on Information Forensics & Security*, **10**, Issue 5, 941-952, 2015.
- [57] T. T. Georgiou and M. Pavon, Positive contraction mappings for classical and quantum Schrödinger systems, May 2014, arXiv:1405.6650v2, *J. Math. Phys.*, **56**, 033301 (2015); doi: 10.1063/1.4915289.
- [58] Y. Chen, T.T. Georgiou and M. Pavon, "Optimal steering of a linear stochastic system to a final probability distribution, Part I" Aug. 2014, arXiv :1408.2222v1, *IEEE Trans. Aut. Control*, **61**, Issue 5, 1158-1169, 2016.

Journal Papers (continued):

- [59] Y. Chen, T.T. Georgiou and M. Pavon, “Optimal steering of a linear stochastic system to a final probability distribution, Part II” Oct. 2014, arXiv :1410.3447v1, *IEEE Trans. Aut. Control*, **61**, Issue 5, 1170-1180, 2016.
- [60] Y. Chen, T.T. Georgiou and M. Pavon, “Fast cooling for a system of stochastic oscillators” Nov. 2014, arXiv :1411.1323v2, *J. Math. Phys.*, **56**, n.11, 113302, 2015.
- [61] Y. Chen, T.T. Georgiou and M. Pavon, “On the relation between optimal transport and Schrödinger bridges: A stochastic control viewpoint” Dec. 2014, arXiv :1412.4430v1, *J. Optim. Theory and Applic.*, **169** (2), 671-691, 2016. (published online 2015, DOI 10.1007/s10957-015-0803-z).
- [62] Y. Chen, T.T. Georgiou and M. Pavon, “Optimal transport over a linear dynamical system”, Feb. 2015, arXiv:1502.01265v1, *IEEE Trans. Aut. Control*, **62**, n. 5, 2137-2152, 2017.
- [63] Y. Chen, T.T. Georgiou and M. Pavon, Entropic and displacement interpolation: a computational approach using the Hilbert metric, arXiv:1506.04255v1, *SIAM Journal on Applied Mathematics*, **76** (6), 2375-2396, 2016.
- [64] Y. Chen, T.T. Georgiou, M. Pavon and A. Tannenbaum, Robust transport over networks, March 2016, arXiv:1603.08129v1, *IEEE Trans. Aut. Control*, **62**, n.9, 4675-4682, 2017.
- [65] Y. Chen, T.T. Georgiou and M. Pavon, “Optimal steering of a linear stochastic system to a final probability distribution, Part III” Aug. 2016, arXiv :1608.03622v1, *IEEE Trans. Aut. Control*, Oct. 2018.
- [66] Y. Chen, T.T. Georgiou, M. Pavon and A. Tannenbaum, Efficient-robust routing for single commodity network flows, arXiv: 1701.07625v2, *IEEE Trans. Aut. Control*, to appear.
- [67] G. Conforti and M. Pavon, Extremal curves in Wasserstein space, ArXiv e-prints, arXiv: 1712.02257, *J. Math. Physics*, **59**, n. 6, 063502, 2018.

Journal Papers (continued):

- [68] M. Pavon, A variational derivation of a class of BFGS-like methods, ArXiv e-prints, arXiv: 1712.00680v2, *Optimization*, to appear.
- [69] Y. Chen, T.T. Georgiou and M. Pavon, Steering the distribution of agents in mean-field and cooperative games, ArXiv e-prints, arXiv: 1712.03578, *J. Optim. Theory and Applic.*, to appear.
- [70] Y. Chen, T.T. Georgiou, M. Pavon and A. Tannenbaum, Relaxed Schrödinger bridges and robust network routing, ArXiv e-prints, arXiv: 1801.07852.
- [71] M. Essid and M. Pavon, Traversing the Schrödinger Bridge strait: Robert Fortet's marvelous proof redux, ArXiv e-prints, arXiv: 1805.02695.
- [72] M. Pavon, E. G. Tabak and G. Trigila, The data-driven Schrödinger bridge, ArXiv e-prints, arXiv: 1806.01364. .

Book and Conference Papers:

- [73] M.Pavon, Constant directions and singular stochastic realization: the scalar case, Proc. 1st Colloque AFCET-SMF de Mathematiques Appliquees t.I , Ecole Polytechnique, Palaiseau, France, Sept. 1978.
- [74] F.Badawi, A.Lindquist and M.Pavon, On the Mayne-Fraser smoothing formula and stochastic realization theory for nonstationary linear stochastic systems, Proc.18 IEEE CDC Conf.,Fort Lauderdale, Florida, Dec.1979, 505-510A.
- [75] M.Pavon and R.Wets, A stochastic variational approach to the duality between estimation and control: discrete time, in Analysis and Optimisation of Stochastic Systems ,M.H.A.Davis et.al. Eds., Academic Press, London, 1980.
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