

## Curriculum Vitæ

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### Personnal Data

Born in Paris (France) April 21, 1955  
French citizen  
Married, three children

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### Positions

Since April 2004 :

Head of the research group ASPI at IRISA / INRIA Rennes.

From July 1998 to April 2004 :

Head of the research group SIGMA2 at IRISA / INRIA Rennes.

Since September 1993 :

Directeur de Recherche at IRISA / INRIA Rennes, research group SIGMA2.

From September 1991 to September 1993 :

Directeur de Recherche at INRIA Sophia Antipolis, research group MEFISTO.

From September 1983 to September 1991 :

Chargé de Recherche at INRIA Sophia Antipolis, research group MEFISTO.

From December 1981 to September 1983 :

Chargé de Recherche at INRIA Rocquencourt, research group THEOSYS.

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### Education

1981 Thèse de Docteur-Ingénieur, Université de Paris 9-Dauphine.  
(advisor Etienne Pardoux)

1979 DEA de Probabilités, Université de Paris 6.

1978 Ecole Centrale des Arts et Manufactures,  
option Mathématiques Appliquées.

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Academic year 2005/06 :

*Filtrage Bayésien Optimal et Approximation Particulaire,*  
École Nationale Supérieure des Techniques Avancées (ENSTA),  
cycle ingénieur 3ème année, filière Finance Quantitative.

Academic year 2004/05 and 2005/06 :

*Filtre de Kalman et Modèles de Markov Cachés,*  
Master Recherche STI, Université de Rennes 1.

Academic years 1994/95 to 2003/04 :

*Filtre de Kalman et Modèles de Markov Cachés,*  
DEA STIR (Signal, Télécommunications, Images, Radar), Université de Rennes 1,  
option Signal.

Academic year 1992/93 :

*Numerical Methods in Nonlinear Filtering,*  
Department of Mathematics, University of Southern California.

Academic year 1991/92 :

*Modèles Markoviens et Applications,*  
DESS Mathématiques de l'Ingénieur, Université de Provence.

Academic years 1989/90 to 1991/92 :

*Introduction au Filtrage Non Linéaire,*  
École Supérieure en Sciences Informatiques (ESSI), Université de Nice,  
option Télécommunications et Traitement Numérique du Signal.

Academic years 1983/84 to 1987/88 :

*Introduction aux Processus Stochastiques,*  
DESS Informatique et Sciences de l'Ingénieur, Université de Nice,  
option Automatique Industrielle et Robotique.

Nadia Oudjane, Université de Rennes 1, December 2000,  
Ingénieur de Recherche,  
Département OSIRIS (Optimisation, Simulation, Risque et Statistiques),  
Électricité de France R & D, Clamart.

Laurent Mevel, Université de Rennes 1, November 1997,  
Chargé de Recherche, INRIA Rennes.

Marc Joannides, Université de Provence, March 1997,  
Maître de Conférence, Département d'Informatique,  
Institut Universitaire de Technologie, Université de Montpellier 2.

Rivo Rakotozafy, Université de Provence, October 1993,  
Maître de Conférence, Département de Mathématiques,  
Université de Fianarantsoa (Madagascar).

Zhang Huilong, Université de Provence, March 1992,  
Maître de Conférence, Département de Mathématiques Appliquées,  
Université de Bordeaux 1.

Fall 1997 (one month) :

Department of Electrical and Electronic Engineering,  
University of Melbourne (Vikram Krishnamurthy)

Summer 1996 (two weeks) :

Department of Civil Engineering and Operations Research,  
Princeton University (René Carmona)

Spring 1993 (five months) :

Department of Mathematics, University of Southern California (Boris Rozovskii)

Spring 1992 (one month) :

Department of Systems Engineering,  
Australian National University (Matthew James)

Fall 1990 (two weeks) :

Centrum voor Wiskunde en Informatica (Jan van Schuppen)

Spring 1986 (three months) :

Systems Research Center, University of Maryland (John Baras)

Workshop on *Particle and Monte Carlo Methods*,  
Barcelona, July 24–25, 2004.

Journée de l'AS 67 (Méthodes Particulières), *Applications du Filtrage Particulaire*,  
Paris, December 3, 2003.

Journées thématiques du GdR ISIS, *Filtrage Particulaire*,  
Paris, December 2–3, 2002.

Workshop on *Stochastic Particle Methods in Nonlinear Filtering*,  
Rennes, June 9–10, 1998.

Workshop on *Statistical Inference for Stochastic Processes*,  
Rennes, April 24–26, 1997.

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Memberships

The Society for Industrial and Applied Mathematics (SIAM), from 1989 to 2002.

Société de Mathématiques Appliquées et Industrielles (SMAI), since 1990.

The Bernoulli Society, since 1992.

The Institute of Electrical and Electronics Engineers (IEEE), from 1995 to 2002.

The Institute of Mathematical Statistics (IMS), since 1996.

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Research Interests

- *Applications of interacting particle systems to statistics* : particle filter, Monte Carlo methods with interaction, risk analysis, simulation of rare events.
- *Statistics of partially observed processes* : small noise asymptotics of parameter estimates and tests for change–detection, long–time asymptotics of state and parameter estimates, recursive identification of hidden Markov models.
- *Nonlinear filtering equations for nonstandard models* : perfect (noise–free) observations, state–dependent observation noise, stochastic differential systems with algebraic constraints.

Rennes, 16th August 2005.

**Articles in Journals**

- [1] D. Brigo, B. Hanzon, F. Le Gland, A differential geometric approach to nonlinear filtering : the projection filter, *IEEE Transactions on Automatic Control AC-43*, 2, February 1998, pages 247–252.
- [2] D. Brigo, B. Hanzon, F. Le Gland, Approximate filtering by projection on the manifold of exponential densities, *Bernoulli* 5, 3, June 1999, pages 495–534.
- [3] F. Campillo, Y. A. Kutoyants, F. Le Gland, Small noise asymptotics of the GLR test for off–line change detection in misspecified diffusion processes, *Stochastics and Stochastics Reports* 70, 1–2, 2000, pages 109–129.
- [4] F. Campillo, F. Le Gland, MLE for partially observed diffusions : direct maximization vs. the EM algorithm, *Stochastic Processes and their Applications* 33, 2, 1989, pages 245–274.
- [5] P. Florchinger, F. Le Gland, Time discretization of the Zakai equation for diffusion processes observed in correlated noise, *Stochastics and Stochastics Reports* 35, 4, 1991, pages 233–256.
- [6] M. R. James, V. Krishnamurthy, F. Le Gland, Time discretization of continuous–time filters and smoothers for HMM parameter estimation, *IEEE Transactions on Information Theory IT-42*, 2, March 1996, pages 593–605.
- [7] M. R. James, F. Le Gland, Consistent parameter estimation for partially observed diffusions with small noise, *Applied Mathematics & Optimization* 32, 1, July/August 1995, pages 47–72.
- [8] M. Joannides, F. Le Gland, Small noise asymptotics of the Bayesian estimator in nonidentifiable models, *Statistical Inference for Stochastic Processes* 5, 1, 2002, pages 95–130.
- [9] F. Le Gland, L. Mevel, Basic properties of the projective product, with application to products of column–allowable nonnegative matrices, *Mathematics of Control, Signals, and Systems* 13, 1, 2000, pages 41–62.
- [10] F. Le Gland, L. Mevel, Exponential forgetting and geometric ergodicity in hidden Markov models, *Mathematics of Control, Signals, and Systems* 13, 1, 2000, pages 63–93.
- [11] F. Le Gland, N. Oudjane, A robustification approach to stability and to uniform particle approximation of nonlinear filters : the example of pseudo-mixing signals, *Stochastic Processes and their Applications* 106, 2, August 2003, pages 279–316.

- [12] F. Le Gland, N. Oudjane, Stability and uniform approximation of nonlinear filters using the Hilbert metric, and application to particle filters, *The Annals of Applied Probability* 14, 1, February 2004, pages 144–187.

### Articles in Contributed Volumes

- [13] A. Benveniste, F. Le Gland, E. Fabre, S. Haar, Distributed Hidden Markov Models, *in: Optimal Control and Partial Differential Equations. In honor of Alain Bensoussan on the occasion of his 60th birthday*, J.-L. Menaldi, E. Rofman, and A. Sulem, editors, IOS Press, Amsterdam, 2001, pages 211–220.
- [14] F. Campillo, F. Le Gland, E. Pardoux, Approximation of a stochastic ergodic control problem, *in: New Trends in Nonlinear Control Theory, Nantes 1988*, J. Descusse, M. Fliess, A. Isidori, and D. Leborgne, editors, *Lecture Notes in Control and Information Sciences*, 122, Springer–Verlag, Berlin, 1989, pages 379–395.
- [15] F. Cérou, F. Le Gland, N. J. Newton, Stochastic particle methods for linear tangent filtering equations, *in: Optimal Control and Partial Differential Equations. In honour of professor Alain Bensoussan's 60th birthday*, J.-L. Menaldi, E. Rofman, and A. Sulem, editors, IOS Press, Amsterdam, 2001, pages 231–240.
- [16] P. Florchinger, F. Le Gland, Time–discretization of the Zakai equation for diffusion processes observed in correlated noise, *in: Analysis and Optimization of Systems, Antibes 1990*, A. Bensoussan and J.-L. Lions, editors, *Lecture Notes in Control and Information Sciences*, 144, Springer–Verlag, Berlin, 1990, pages 228–237.
- [17] P. Florchinger, F. Le Gland, Particle approximation for first–order SPDE's, *in: Applied Stochastic Analysis, Rutgers University 1991*, I. Karatzas and D. L. Ocone, editors, *Lecture Notes in Control and Information Sciences*, 177, Springer–Verlag, Berlin, 1992, pages 121–133.
- [18] M. R. James, F. Le Gland, Identification of partially observed diffusions with small noise, *in: Applied Stochastic Analysis, Imperial College 1989*, M. H. A. Davis and R. J. Elliott, editors, *Stochastics Monographs*, 5, Gordon and Breach, New York, 1991, pages 561–568.
- [19] M. R. James, F. Le Gland, Numerical approximation for nonlinear filtering and finite–time observers, *in: Applied Stochastic Analysis, Rutgers University 1991*, I. Karatzas and D. L. Ocone, editors, *Lecture Notes in Control and Information Sciences*, 177, Springer–Verlag, Berlin, 1992, pages 159–175.
- [20] F. Le Gland, B. Wang, Asymptotic normality in partially observed diffusions with small noise : application to FDI, *in: Workshop on Stochastic Theory and Control, University of Kansas 2001. In honor of Tyrone E. Duncan on the occasion of his*

60th birthday, B. Pasik-Duncan, editors, *Lecture Notes in Control and Information Sciences*, 280, Springer-Verlag, Berlin, 2002, pages 267–282.

- [21] F. Le Gland, Nonlinear filtering equation and a problem of parametric estimation, *in: Stochastic Systems : The Mathematics of Filtering and Identification and Applications, Les Arcs 1980*, M. Hazewinkel and J. C. Willems, editors, *NATO ASI Series. Sub-Series C : Mathematical & Physical Sciences, C 78*, D. Reidel, Dordrecht, 1981, pages 613–620.
- [22] F. Le Gland, Application de l'équation du filtrage non-linéaire à un problème d'estimation paramétrique, *in: Outils et Modèles Mathématiques pour l'Automatique, l'Analyse de Systèmes et le Traitement du Signal (volume 3)*, I. D. Landau, editors, Editions du CNRS, Paris, 1983, pages 85–103.
- [23] F. Le Gland, Splitting-up approximation for SPDE's and SDE's with application to nonlinear filtering, *in: Stochastic Partial Differential Equations and Their Applications, Charlotte 1991*, B. L. Rozovskii and R. B. Sowers, editors, *Lecture Notes in Control and Information Sciences, 176*, Springer-Verlag, Berlin, 1992, pages 177–187.
- [24] C. Musso, N. Oudjane, F. Le Gland, Improving regularized particle filters, *in: Sequential Monte Carlo Methods in Practice*, A. Doucet, N. de Freitas, and N. Gordon, editors, *Statistics for Engineering and Information Science*, Springer-Verlag, New York, 2001, ch. 12, pages 247–271.

## Articles in Conference Proceedings

- [25] D. Brigo, B. Hanzon, F. Le Gland, A differential geometric approach to nonlinear filtering : the projection filter, *in: Proceedings of the 34th Conference on Decision and Control, New Orleans 1995*, IEEE-CSS, pages 4006–4011, December 1995.
- [26] D. Brigo, B. Hanzon, F. Le Gland, The exponential projection filter and the selection of the exponential family, *in: Proceedings of the 2nd Portuguese Conference on Automatic Control, Porto 1996*, APCA, pages 251–256, September 1996.
- [27] D. Brigo, F. Le Gland, A finite dimensional filter with exponential conditional density, *in: Proceedings of the 36th Conference on Decision and Control, San Diego 1997*, IEEE-CSS, pages 1643–1644, December 1997.
- [28] F. Campillo, H. Bernier, F. Cérou, F. Le Gland, R. Rakotozafy, Massively parallel computing for non-linear filtering, *in: Science on the Connection Machine System, Proceedings of the 2nd European CM Users Meeting, Meudon 1993*, J. M. Alimi, A. Serna, H. Scholl, editors, Thinking Machines Corporation, pages 81–91, Cambridge, MA, 1995.

- [29] F. Campillo, F. Le Gland, Application du filtrage non-linéaire en trajectographie passive, *in: 12ème Colloque sur le Traitement du Signal et des Images, Juan les Pins 1989*, GRETSI, pages 197–200, June 1989.
- [30] F. Campillo, F. Le Gland, Likelihood based statistics for partially observed diffusion processes, *in: Proceedings of the 1st European Control Conference, Grenoble 1991*, pages 2290–2295, July 1991.
- [31] F. Campillo, F. Le Gland, Threshold selection in the GLR test for change detection in partially observed diffusion processes, *in: Proceedings of the 2nd European Control Conference, Groningen 1993*, pages 134–138, July 1993.
- [32] N. Caylus, A. Guyader, F. Le Gland, N. Oudjane, Application du filtrage particulaire à l'inférence statistique des HMM, *in: Actes des 36èmes Journées de Statistique, Montpellier*, SFdS, May 2004.
- [33] N. Caylus, A. Guyader, F. Le Gland, Particle filters for partially observed Markov chains, *in: Proceedings of the Workshop on Statistical Signal Processing (SSP), Saint-Louis*, IEEE-SPS, September 2003. Paper WA2–5.
- [34] F. Cérou, P. Del Moral, F. Le Gland, P. Lezaud, Limit theorems for the multilevel splitting algorithm in the simulation of rare events, *in: Proceedings of the 2005 Winter Simulation Conference, Orlando 2005*, M. E. Kuhl, N. M. Steiger, F. B. Armstrong, J. A. Joines, editors, December 2005.
- [35] F. Cérou, F. Le Gland, Efficient particle filters for residual generation in partially observed SDE's, *in: Proceedings of the 39th Conference on Decision and Control, Sydney 2000*, IEEE-CSS, pages 1200–1205, December 2000.
- [36] G. Damy, M. Joannides, F. Le Gland, M. Prévosto, R. Rakotozafy, Integrated short term navigation of a towed underwater body, *in: Proceedings of OCEANS 94, Brest 1994, III*, IEEE-OES, pages 577–582, September 1994.
- [37] A. Gondel, F. Le Gland, Systematic numerical experiments in nonlinear filtering, with automatic FORTRAN code generation, *in: Proceedings of the 25th IEEE Conference on Decision and Control, Athens 1986*, IEEE-CSS, pages 638–642, December 1986.
- [38] A. Guyader, F. Le Gland, N. Oudjane, A particle implementation of the recursive MLE for partially observed diffusions, *in: Proceedings of the 13th Symposium on System Identification (SYSID), Rotterdam*, IFAC / IFORS, pages 1305–1310, August 2003.
- [39] M. R. James, V. Krishnamurthy, F. Le Gland, Time discretization of continuous time filters for HMM parameters estimation, *in: Proceedings of the 31st IEEE Conference on Decision and Control, Tucson 1992*, IEEE-CSS, pages 3305–3310, December 1992.

- [40] M. Joannides, F. Le Gland, Position estimation of a towed underwater body, *in: Proceedings of the 32nd IEEE Conference on Decision and Control, San Antonio 1993*, IEEE-CSS, pages 1548–1552, December 1993.
- [41] M. Joannides, F. Le Gland, Nonlinear filtering with perfect discrete time observations, *in: Proceedings of the 34th Conference on Decision and Control, New Orleans 1995*, IEEE-CSS, pages 4012–4017, December 1995.
- [42] M. Joannides, F. Le Gland, Small noise asymptotics of the Bayesian estimator in non-identifiable nonlinear regressions, *in: Proceedings of the 2nd Portuguese Conference on Automatic Control, Porto 1996*, APCA, pages 257–261, September 1996.
- [43] M. Joannides, F. Le Gland, Nonlinear filtering with continuous time perfect observations and noninformative quadratic variation, *in: Proceedings of the 36th Conference on Decision and Control, San Diego 1997*, IEEE-CSS, pages 1645–1650, December 1997.
- [44] M. Joannides, F. Le Gland, Small noise asymptotics of nonlinear filters with nonobservable limiting deterministic system, *in: Proceedings of the 36th Conference on Decision and Control, San Diego 1997*, IEEE-CSS, pages 1663–1668, December 1997.
- [45] V. Krishnamurthy, F. Le Gland, State and parameter estimation from boundary-crossings, *in: Proceedings of the 37th Conference on Decision and Control, Tampa 1998*, IEEE-CSS, pages 3954–3959, December 1998.
- [46] F. Le Gland, L. Mevel, Recursive identification of HMM's with observations in a finite set, *in: Proceedings of the 34th Conference on Decision and Control, New Orleans 1995*, IEEE-CSS, pages 216–221, December 1995.
- [47] F. Le Gland, L. Mevel, Asymptotic behaviour of the MLE in hidden Markov models, *in: Proceedings of the 4th European Control Conference, Bruxelles 1997*, July 1997. Paper FRA-F6.
- [48] F. Le Gland, L. Mevel, Exponential forgetting and geometric ergodicity in HMM's, *in: Proceedings of the 36th Conference on Decision and Control, San Diego 1997*, IEEE-CSS, pages 537–542, December 1997.
- [49] F. Le Gland, L. Mevel, Recursive identification in HMM's, *in: Proceedings of the 36th Conference on Decision and Control, San Diego 1997*, IEEE-CSS, pages 3468–3473, December 1997.
- [50] F. Le Gland, L. Mevel, Fault detection in HMM's : A local asymptotic approach, *in: Proceedings of the 39th Conference on Decision and Control, Sydney 2000*, IEEE-CSS, pages 4686–4690, December 2000.

- [51] F. Le Gland, C. Musso, N. Oudjane, An analysis of regularized interacting particle methods for nonlinear filtering, *in: Preprints of the 3rd IEEE European Workshop on Computer-Intensive Methods in Control and Data Processing, Prague 1998*, J. Rojíček, M. Valečkova, M. Kárný, K. Warwick, editors, pages 167–174, September 1998.
- [52] F. Le Gland, N. Oudjane, Stability and approximation of nonlinear filters using the Hilbert metric, and applications to particle filters, *in: Proceedings of the 39th Conference on Decision and Control, Sydney 2000*, IEEE-CSS, pages 1585–1590, December 2000.
- [53] F. Le Gland, N. Oudjane, A sequential algorithm that keeps the particle system alive, *in: Proceedings of the 13th European Signal Processing Conference, Antalya 2005*, EURASIP, September 2005.
- [54] F. Le Gland, Monte-Carlo methods in nonlinear filtering and importance sampling, *in: Proceedings of the 23rd IEEE Conference on Decision and Control, Las Vegas 1984*, IEEE-CSS, pages 31–32, December 1984.
- [55] F. Le Gland, Time discretization of nonlinear filtering equations, *in: Proceedings of the 28th IEEE Conference on Decision and Control, Tampa 1989*, IEEE-CSS, pages 2601–2606, December 1989.
- [56] F. Le Gland, Stability and approximation of nonlinear filters : an information theoretic approach, *in: Proceedings of the 38th Conference on Decision and Control, Phoenix 1999*, IEEE-CSS, pages 1889–1894, December 1999.
- [57] F. Le Gland, Filtrage particulaire, *in: 19ème Colloque sur le Traitement du Signal et des Images, Paris 2003, II*, GRETSI, pages 1–8, September 2003.

## Research and Technical Reports

- [58] D. Brigo, B. Hanzon, F. Le Gland, A differential geometric approach to nonlinear filtering : the projection filter, *Rapport de Recherche 2598*, INRIA, June 1995, <ftp://ftp.inria.fr/INRIA/publication/RR/RR-2598.ps.gz>.
- [59] D. Brigo, B. Hanzon, F. Le Gland, On the relationship between assumed density filters and projection filters, *Discussion Paper TI 7-96-18*, Tinbergen Institute, February 1996.
- [60] Z. Cai, F. Le Gland, H. Zhang, An adaptive local grid refinement method for nonlinear filtering, *Rapport de Recherche 2679*, INRIA, October 1995, <ftp://ftp.inria.fr/INRIA/publication/RR/RR-2679.ps.gz>.

- [61] F. Campillo, H. Bernier, F. Cérou, F. Le Gland, R. Rakotozafy, Parallélisme de données et filtrage non linéaire. Analyse de performance, *Rapport Technique 167*, INRIA, November 1994, <ftp://ftp.inria.fr/INRIA/publication/RT/RT-0167.ps.gz>.
- [62] F. Campillo, F. Cérou, F. Le Gland, R. Rakotozafy, Particle and cell approximations for nonlinear filtering, *Rapport de Recherche 2567*, INRIA, June 1995, <ftp://ftp.inria.fr/INRIA/publication/RR/RR-2567.ps.gz>.
- [63] F. Campillo, F. Le Gland, Y. A. Kutoyants, Asymptotics of the GLRT for the disorder problem in diffusion processes, *Rapport de Recherche 1735*, INRIA, July 1992, <ftp://ftp.inria.fr/INRIA/publication/RR/RR-1735.ps.gz>.
- [64] F. Campillo, F. Le Gland, MLE for partially observed diffusions : direct maximization vs. the EM algorithm, *Rapport de Recherche 884*, INRIA, August 1988.
- [65] F. Cérou, P. Del Moral, F. Le Gland, P. Lézaud, Genetic genealogical models in rare event analysis, *Publication du Laboratoire de Statistique et Probabilités*, Université Paul Sabatier, Toulouse, 2002.
- [66] F. Cérou, P. Del Moral, F. Le Gland, On genealogical trees and Feynman–Kac models in path space and random media, *Publication du Laboratoire de Statistique et Probabilités*, Université Paul Sabatier, Toulouse, 2002.
- [67] J. Fichou, F. Le Gland, L. Mevel, Particle–based methods for parameter estimation and tracking : Numerical experiments, *Publication Interne 1604*, IRISA, February 2004, <ftp://ftp.irisa.fr/techreports/2004/PI-1604.ps.gz>.
- [68] P. Florchinger, F. Le Gland, Time–discretization of the Zakai equation for diffusion processes observed in correlated noise, *Rapport de Recherche 1222*, INRIA, May 1990.
- [69] M. R. James, F. Le Gland, Consistent parameter estimation for partially observed diffusions with small noise, *Rapport de Recherche 1223*, INRIA, May 1990.
- [70] M. Joannides, F. Le Gland, Small noise asymptotics of the Bayesian estimator in nonidentifiable models, *Rapport de Recherche 3675*, INRIA, May 1999, <ftp://ftp.inria.fr/INRIA/publication/RR/RR-3675.ps.gz>.
- [71] Y. A. Kutoyants, F. Le Gland, R. Rakotozafy, Identification d’un système non–linéaire partiellement observé par la méthode de la distance minimale, *Rapport de Recherche 2125*, INRIA, December 1993, <ftp://ftp.inria.fr/INRIA/publication/RR/RR-2125.ps.gz>.
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- [73] F. Le Gland, N. Oudjane, Stability and uniform approximation of nonlinear filters using the Hilbert metric, and application to particle filters, *Rapport de Recherche 4215*, INRIA, June 2001, <ftp://ftp.inria.fr/INRIA/publication/publi-ps-gz/RR/RR-4215.ps.gz>.
- [74] F. Le Gland, N. Oudjane, A robustification approach to stability and to uniform particle approximation of nonlinear filters : the example of pseudo-mixing signals, *Rapport de Recherche 4431*, INRIA, March 2002, <ftp://ftp.inria.fr/INRIA/publication/publi-ps-gz/RR/RR-4431.ps.gz>.

## Theses

- [75] F. Le Gland, *Estimation de Paramètres dans les Processus Stochastiques, en Observation Incomplète — Applications à un Problème de Radio-Astronomie*, Thèse de Docteur-Ingénieur, Université de Paris IX-Dauphine, 1981.

Rennes, 16th August 2005.