Benoîte de Saporta

Université de Montpellier
Institut Montpelliérain Alexander Grothendieck
Case courrier 051
Place Eugène Bataillon
F-34095 Montpellier Cedex 5

born 31 July1977 in Metz, France
+ 33 4 67 14 35 72
Benoite.de-Saporta@umontpellier.fr
http://www.math.univ-montp2.fr/~saporta/
orcid.org/0000-0003-2509-1431

I am full professor (Professeure des Universités) in applied mathematics (CNU 26) at Université de Montpellier. I am a member of the team l'Probability and Statistics of Institut Montpelliérain Alexander Grothendieck (IMAG) and associate member of Inria team CQFD.

Contents

1 Positions and education

1.1 Positions

2014– **Full professor** at Université de Montpellier in applied mathematics, associate member of Inria team CQFD.

2006–2014 **Associate professor** at Université de Bordeaux in applied mathematics, vice-head of Inria team CQFD.

2005–2006 **Post doc** at Inria Sophia Antipolis Méditerranée, team OMEGA.

2004–2005 **Assistant professor** (half-time) at Université de Nantes.

2001–2004 **Teaching assistant** at Université de Rennes 1.

1997–2001 **Elève normalienne** at Ecole Normale Supérieure de Lyon.

1.2 Education

2013 **Habilitation à diriger des recherches**, Université Bordeaux 1.

Contributions à l'estimation et au contrôle de processus stochastiques.

Defended 3 July 2013, jury:

O.L.V. Costa	Reviewer	Universidade de São Paulo
J.-F. Delmas	Reviewer	Ecole Nationale des Ponts et Chaussées
A. Gégout-Petit	Member	Université Bordeaux Ségalen
F. Dufour	Member	Bordeaux INP
G. Pagès	Reviewer	Université Pierre et Marie Curie
D. Talay	President	Inria Sophia Antipolis Méditerranée

2001–2004 **PhD in Mathematics**, Université Rennes 1.

Etude de la solution stationnaire de l'équation $Y_{n+1} = a_n Y_n + b_n$ à coefficients aléatoires.

Defended 10 November 2004, jury:

P. Bougerol	Reviewer	Université Paris VI
C. Goldie	Reviewer	University of Sussex
Y. Guivarc'h	Member	Université Rennes 1
X. Guyon	Member	Université Paris I
E. Le Page	Member	Université Bretagne Sud
J. F. Yao	PhD Supervisor	Université Rennes 1

1997–2001 **Ecole Normale Supérieure de Lyon**

1997–2001 **Magistère de mathématiques et applications**, U. Lyon 1.

2000–2001 **DEA de mathématiques fondamentales et applications**, (master 2), specialty *Stochastic modeling and applications*, Université Rennes 1.

1999–2000 **Agrégation de mathématiques**, rank: 70/300.

1998–1999 **Maîtrise de mathématiques**, (master 1), Université Lyon 1.

1997–1998 **Licence de mathématiques**, (bachelor), Université Lyon 1.

1995–1997 Classes préparatoires (MPSI, MP*), Lycée Thiers, Marseille.

1995 Baccalauréat S, Lycée Honoré Daumier, Marseille.

2 Teaching

Since 2014, I am a full professor in applied mathematics at Université de Montpellier, I belong to the Mathematics Department of the Faculty of Sciences. I teach at licence and master levels.

Summary number of teaching hours (eq. TD) per year and per level

Year	Licence	Master	Total	Status
2016-2017	97.5	124	235.5	PR - 14h ETD for taking care of Biostatistics master
2015-2016	105	83	202	PR - 14h ETD for taking care of Biostatistics master
2014-2015	144.5	45	202.5	PR - 13h ETD for taking care of Biostatistics master
2013-2014	0	94	94	MCF - half leave of teaching paid by Inria
2012-2013	0	94	94	MCF - half leave of teaching paid by Inria
2011-2012	0	94	94	MCF - half leave of teaching paid by Inria
2010-2011	135	134	269	MCF
2009-2010	126	116,5	245,5	MCF
2008-2009	99	143,5	242,5	MCF
2007-2008	115	131,5	236,5	MCF
2006-2007	179,5	45	224,5	MCF
2004-2005	16	90	106	ATER à mi-temps
2003-2004	66	0	66	Monitrice
2002-2003	69	0	69	Monitrice
2001-2002	64	0	64	Monitrice

2014– Université de Montpellier

Full professor in applied mathematics et the Mathematics Department.

Teaching reductions

Head of M1 and M2 biostatistics	14h ETD	2015-2017
Head of M2 biostatistics	13h ETD	2014-2015

Courses abroad

M2 Statistics, Université de Monastir, Tunisia

Statistique des chaînes de Markov	18h C	2016-2017

Master 2 Mathematics

Specialty biostatistics

Modélisation en écologie	10h C	2016-2017
Processus de Markov	21h C	2014-2015

Preparing agrégation

Probabilités et statistique	9h C	2014-2015

Master 1 Mathematics

Specialty biostatistics and MIND

Processus Stochastiques	30h C + 30h TD	2015-2017
Projet M1	6h ETD	2016-2017
	8h ETD	2015-2016

Licence 3 Mathematics

Probabilités et Statistique	36h C + 39h TD	2014-2017
Projet L3	2h ETD	2015-2016
	8h ETD	2014-2015

Licence 2 Mathematics

Introduction aux logiciels scientifiques	6h TP	2016-2017
	15h TP	2014-2016
Probabilités et Statistique élémentaires	28.5h TD	2014-2015

2006–2014 Université de Bordeaux

Associate professor in applied mathematics at the Faculty of Economic Sciences and Management, half-time leave of teaching duties paid by Inria form 2012 to 2014.

Master 2 EBFI (Economy, bank, international finance)

Mathématiques pour la finance	10h C	2006-2010

Master 2 MIMSE (Mathematics, Statistics and Economic engineering)

Specialty 2 : Statistics and Reliability

Processus de Markov	10h C + 10h TD	2010-2014

Specialty 3 : Operation research and decision support

Finance en temps discret	10h C + 14h TD	2011-2014
	10h C + 10h TD	2009-2011
	5h C + 5h TD	2007-2009
Projet informatique	12h TD	2010-2011
		2008-2009

Specialty 4 : Economic engineering

Finance en temps continu	10h TD	2009-2014
	20h C	2007-2009

Master 1 MIMSE (Mathematics, Statistics and Economic engineering)

Specialty 2 : Statistics and Reliability

Chaînes de Markov	10h C + 14h TD	2007-2011

Specialty 4 : Economic engineering

Processus aléatoires en finance	20h C	2007-2014

All specialties

TER	3h TD	2010-2011
	7.5h TD	2009-2010
	15h TD	2007-2009

Master 1 Demography

Probabilité et statistique	20h C	2006-2007

Licence 3 Economics

MAGEFI : Magistère of economy an international finance

Mathématiques	30h C	2009-2011
	18h C	2008-2009
	20h C	2006-2007
Statistique	30h C	2010-2011

Specialty strategy

Mathématique	20h C et 15h TD	2010-2011
	15h TD	2007-2010

Licence 2 Economics and Management

Mathématiques	15h TD	2008-2010
	30h TD	2007-2008
	60h TD	2006-2007
Statistique	30h TD	2007-2008
	60h TD	2006-2007

Licence 1 Economics and Management

Mathématiques	12h TD	2008-2009
	20h C	2007-2008
	29.5h TD	2006-2007
Enseignante référente	51h TD	2009-2010
	30h TD	2008-2009

2005–2006 Université de Nantes

Half-time assistant professor in applied mathematics.

Master 1 Mathematics

Specialty Engineering

Probabilités appliquées	42h TD	2005-2006

Specialty Research

Probabilités	48h TD	2005-2006

Licence 3 Mathematics

Marches aléatoires	16h TD	2005-2006

2001–2004 Université de Rennes 1

Teaching assistant in applied mathematics

Licence 3 Mathematics

Probabilités pour le CAPES	12h TD	2002-2004

DEUG 2 MIASS

Algèbre	12h TD	2003-2004
	15h TD	2002-2003
Histoire des sciences	18h TD	2003-2004

DEUG 1

MIASS

Probabilités	24h TD	2001-2002

Biology

Probabilités et statistique	24h TD	2003-2004
	42h TD	2001-2003

3 Collective duties

• Editorial duties

I've been a reviewer for *Annales de l'IHP*, *Annals of Applied Probability*, *Applied Mathematical Finance*, *Electronic Communications in Probability*, *IMA Journal of Numerical Analysis*, *Journal of Multivariate Analysis*, *Journal of Scientific Computing*, *Mathematics of Computation*, *SIAM Journal on Control and Optimization*, *Statistical Inference for Stochastic Processes*, *Statistics & Probability letters*, *Stochastic Processes and their Applications*. From 2005 to 2009, I was a regular reviewer for *Mathematical Reviews*. In 2016, I reviewed a book (550p) for *Springer*.

• National elective duties

- Elected member of CNU 26 from 2011 to 2014.
- Elected member of the board of group MAS of SMAI from 2008 to 2014.

• Organization of conferences, sessions, seminars

- Member of the organizing committee of 48èmes Journées de Statistique 30 May to 3 June 2016, Montpellier. http://jds2016.sfds.asso.fr/
- Head of working group Probability at IMAG, 2015.
- Co-organization with Bertrand Cloez (Inra Montpellier) of a workshop of ANR Piece on Piecewise Deterministic Markov Processes, 18 to 21 May 2015, Saint Martin de Londres. http://wiki-math.univ-mlv.fr/pdmp/doku.php/events:pdmp2014
- Co-organization with Anne-Sophie Gosselin (U. Montpellier) of the pluridisciplinary workshop Donner des Elles à l'UM - Journée Femmes et Sciences de l'UM 26 march 2015, Université de Montpellier.
- Co-organization with Anne Gégout-Petit (U. Bordeaux) and Christian Paroissin (U. Pau) of a workshop SMAI maths-industrie on reliability 8 april 2013, Inria Bordeaux-Sud Ouest. http://smai.emath.fr/congres/journees/FIAB2013/
- Head of the seminar of team Probability and Statistics of IMB, Bordeaux from 2010 to 2014. http://www.math.u-bordeaux1.fr/imb/article76.html
- Member of the organizing committee of journées MAS 2010 and Jacques Neveu workshop, 31 august to 3 september 2010, Bordeaux. http://smai.emath.fr/documents/smai-mas/MAS/mas2010/
- Member of the organizing committee of 41èmes journées de Statistique, 25 to 29 may 2009, Bordeaux. http://www.sm.u-bordeaux2.fr/JDS2009/
- Co-organization with Christian Paroissin (U. Pau) of a joint workshop SMAI-IMdR (Institut pour la Maîtrise des Risques) on*Applied Mathematics and Reliability*, 6 february 2009, Pau. http://www.math.u-bordeaux1.fr/JMASF09/
- Organization of an invited session on auto-regressive processes et workshop MAS 2008, Rennes.

• Hiring committees

- President of hiring committee, PR26 position, Université de Montpellier, 2017.
- Member of hiring committee, PR61 position, Université de Technologie de Troyes, 2017.

- Member of hiring committee, MCF25-26 position, Université Grenoble Alpes, 2017.
- Member of hiring committee, PR26 position, Université de la Guyane, 2015.
- Member of hiring committee, MCF26 position, Université Montesquieu Bordeaux IV, 2012.
- Member of hiring committee, MCF 26 position et PRAG position in mathematics, Université Montesquieu Bordeaux IV, 2011.
- Member of specialist hiring committee 26, Université de Bordeaux 1, 2007-2008.

- PhD Juries
  - Member of the PhD jury of Alizée Geeraert, 6 june 2017, Université de Bordeaux.
  - President of the PhD jury of Van Hà Hoang, 28 november 2016, Université de Lille.
  - President of the PhD jury of Zeina Al Masri, 21 september 2016, Université de Pau et des Pays de l'Adour.
  - President of the PhD jury of Myriam Tami, 12 july 2016, Université de Montpellier.
  - Member of the PhD jury of Christophe Nivot, 19 may 2016, Université de Bordeaux.
  - Member of the PhD jury (reviewer) of Isabelle Charlier, 16-17 december 2015, Université Libre de Bruxelles and Université de Bordeaux.
  - President of the PhD jury of Adil Ahidar, 3 july 2015, Univ. Toulouse.
  - Member of the PhD jury of Coralie Fritsch, 24 november 2014, Univ. Montpellier 2.
  - Member of the PhD jury of Camille Baysse, 7 november 2013, Université Bordeaux 1.
  - Member of the PhD jury of Adrien Brandejsky, 2 juiy 2012, Université Bordeaux 1.
  - Member of the PhD jury of Karen Gonzalez, 3 december 2010, Université Bordeaux 1.

- Other reviewing activities
  - Reviewer of a submission for FWF (Austrian Science Fund) in 2016.
  - Reviewer of a submission for ANR program ASTRID in 2016.
  - Member of the ANR evaluation committee CES 40 Mathematics, Informatics, Communication Systems 2015.
  - Reviewer of a submission for ANR program Numerical Methods in 2013.

- Pedagogical duties
  - Head of M1 and M2 specialty biostatistics, Université de Montpellier since 2015.
  - Head of M2 specialty biostatistics, Université de Montpellier in 2014-2015.
  - Member of the board of Département de Mathématiques of Faculté des Sciences, Université de Montpellier since 2014.
  - Liaison of master MIMSE between Bordeaux 1 and Bordeaux IV and member of the master board from 2010 to 2012.

- Duties in Research organizations

  - Elected member of section 26 committe of Scientific Department MIPS, Université de Montpellier, since 2017.
  - Coordinator of EUR project MOSAIC, Université de Montpellier, 2017.
  - Elected member of the board of Doctoral School I2S, Montpellier since 2016.
  - Head of Generic Direction *Algorithme & computing* and memeber of the Pedagogic and Scientific Board of LabEx Numev since 2015.
  - Elected member of the board of IMAG Institut Montpelliérain Alexander Grothendieck since 2015.
  - Nominated member of the board of IMB Institut de Mathématiques de Bordeaux from 2013 to 2014.
  - Member of the editorial committee of SO News, internal (monthly) web-journal of Inria Bordeaux Sud Ouest from april 2011 to october 2012. http://sonews.bordeaux.inria.fr/
  - Member of the committee for *scientific animation* of Inria Bordeaux Sud-Ouest (attribution of funds to workshopss. Annual budget 10kEUR) from 2008 to 2014, president of the committee from 2011 to 2014.
  - Vice-head of Inria team CQFD from 2007 to 2014.

- Scientific dissemination

  - Talk for the workshop *Fille et Maths*, Université de Montpellier, april 2016.
  - Talk for the workshop MathsC2+, Université de Montpellier, october 2015.
  - Participation in a *speed mediation* event at Inria Bordeaux Sud-Ouest, 2013.
  - Dissemination talks to undergraduate students 2011-2012.
  - Workshop for *fête de la science*, 2009.
  - Member of the steering committee of enigmath, a free on-line mathematical quizz 2008-2009.

4 Research activities

Since 2014, I am a member of the Probability and Statistics team of Institut Montpelliérain Alexander Grothendieck (IMAG), and associate member of team CQFD of Inria Bordeaux Sud Ouest. From 2006 to 2014 I was a member of Institut de Mathématiques de Bordeaux (IMB) and vice-head of Inria team CQFD. My research activities deal with estimation and control for stochastic processes.

4.1 Research themes

My recent research is on numerical methods for the estimation and control of Markov processes (Piecewise deterministic Markov processes PDMPs, Markov Decision Processes MDPs and Markov jump linear systems MJLS).

Although PDMPs form a very general class of useful processes for many applications such as reliability or biology there are very few practical tools to make concrete calculations with these processes. However, in a modeling and application framework it is important to be able to build a model, but it is also crucial to be able to calculate performance indicators for this model and then optimize them. Our approach is therefore to propose such tools and apply them to problems of optimization of maintenance in partnership with industrialists or to problems of optimization derived from biology. The work carried out between 2007 and 2015 is published as a book [1]. I am also interested in other classes of Markov processes (MDP, MJLS) for related problems.

Numerical method for the control of PDMPs *Collaboration with*

- *Adrien Brandejsky (Inria CQFD) during his PhD (2009-2012),*
- *François Dufour (Bordeaux INP and Inria CQFD),*
- *Alizée Geeraert (Inria CQFD) during her PhD (2014-2017),*
- *Karen Gonzalez (Inria CQFD) during her PhD (2007-2010),*
- *Huilong Zhang (Université de Bordeaux and Inria CQFD).*

Piecewise deterministic Markov processes (PDMP) were introduced by Davis in the 80's as a general class of non-diffusion stochastic processes. They follow deterministic trajectories punctuated by random jumps. They can model numerous applications related to optimization, from queuing systems to maintenance optimization. Despite the wide variety of applications, very few practical numerical methods are dedicated to this class of processes.

During the PhD thesis of K. Gonzalez, we first developed a numerical method to solve optimal stopping problems for PDMPs. The aim is to find the best date to maximize the expectation of a performance functional of the process. We proposed an algorithm to approximated to optimal performance (value function) and gave a bound for its convergence rate. This algorithm is based on a discretization by quantization. This result is published in [19, 29, 45, 50]. In collaboration with Astrium and within ANR Fautocoes we implemented our algorithm on an example of preventive maintenance of a structure subject to corrosion. This work is published in [61, 15]. Another exemple involving more complicated combinatorial is published in [40, 12]. This approach was also used by C. Baysse during her PhD to study maintenance optimization problems for Thales [38, 58, 60] and led to a patent deposit [2].

With F. Dufour, we extended these results to the approximation of the value function of an impulse control problem. In this case, the controller must chose intervention times as ell as the type of intervention to be performed [44, 16]. A first step towards approximate optimal policies was obtained during A. Geeraert PhD [7].

With F. Dufour and A. Brandejsky, we also studied the optimal stopping problem under partial observations, where the process is observed though noise [11, 48].

Rupture detection for PDMP *Collaboration with Alice Cleynen (CNRS).*

In collaboration with A. Cleynen, I am now interested in general problem of rupture detection for PDMPs. This is a very difficult problem that we address through a simple special case when the process can only jump once. We propose a numerical method based on quantization and compare it to CUSUM and Kalman filtering when possible [46].

Numerical method for control of branching PDMPs *Collaboration with*

- *Bertrand Cloez (INRA),*
- *Maud Joubaud (U. Montpellier) during her PhD (2016-2019),*

The aim of the PhD thesis of M. Joubaud is to define a new class of measure-valued branching PDMPs in order to model the joint evolution of individuals in a population. Maud is presently comparing the optimal stopping problem for the whole population and for a marked individual. It is known that for branching processes, the properties of a marked individual yield many global properties of the genealogical tree. It would be interesting to know if this still hold for control problems.

Numerical methods for MDP *Collaboration with*

- *Tiffany Cherchi (U. Montpellier) during her PhD (2017-2020),*
- *François Dufour (Bordeaux INP and Inria CQFD),*
- *Christophe Nivot (Inria CQFD) during his PhD (2013–2016),*

We consider the optimal stopping problem for a Markov chain on a finite dimension space in a partial observation framework. Our goal is to construct a numerical approximation of the value function of the problem. In order to do this, we first translate the problem in the context of partially observed decisional Markov processes (POMDP), which makes it possible to reduce to a completely observed problem on a measurement space. Finally, we proposed a discretization scheme based on the quantification of an underlying probability law to obtain a finite-dimensional problem and a discretization of the resulting Markov chain to obtain a finite model which allows to make numerical calculations explicit. We prove the convergence of the approximate value function to the value function of the origin problem [6, 34].

We will follow up the investigation of this type of problem during the PhD thesis of Tiffany Cherchi.

Filtering for MJLS *Collaboration with Eduardo F. Costa (Univ. São Paulo, Brazil).*

A class of multi-model stochastic processes that lately has been receiving a great deal of attention is the so-called Markov jump linear systems (MJLS). In this case the motion of the process follows linear differential equations punctuated by exponential jump times. MJLS have a relatively simple structure that allows for many useful, strong properties. They feature flexibility enough to account for different types of behaviors, which is in part due to the versatile structure of the Markov chain that drives the system parameters. Probably the most important reason for the success of MJLS is that they provide good models for applications where some type of failure is involved, e.g. data loss between subsystems, with a booming field in web/internet based control. However, one problem faced when estimating the state parameter for MJLS is the pre-computation. Pre-computation refers to the computation of the relevant parameters of the filter and storage in the controller/computer memory prior to the system operation, which makes the implementation of the filter fast enough to couple with a wide range of applications.

Unfortunately, pre-computation is not viable for MJLS in continuous time, as it involves solving a Riccati differential equation that branches at every jump time of some underlying Markov chain. Our aim was to propose alternative filtering procedures that allow for pre-computations with a controlled error bound [35, 8, 33, 4].

Parameter estimation for BAR processes *Collaboration with*

- *Bernard Bercu (Université de Bordeaux),*
- *Bernard Delyon (Université de Rennes 1),*
- *Anne Gégout-Petit (Université de Lorraine),*
- *Nathalie Krell (Université de Rennes 1),*
- *Laurence Marsalle (Université Lille 1),*
- *Lydia Robert (AgroParisTech).*

Bifurcating autoregressive processes (BAR) are a generalization of autoregressive processes for tree structured data. They model cell division data. Some quantitative characteristics are measured (diameter, growth rate) on a population of cells issued from a single common ancestor, and the aim is to explain the link between the value of this characteristic for a mother cell and its two daughters', in an autoregressive framework. In the original BAR model, the sister cells have the same parameters. Recently, work on E; coli division suggested that the sister cells may inherit different characteristics from their mother, leading to asymmetric BAR models. With B. Bercu and A. Gégout-Petit we studied the sharp asymptotics of the asymmetric BAR model [20].

With A. Gégout-Petit and L. Marsalle we extended these results in the case when the full genealogical tree is not observed but has missing data with a probability depending on the genealogy. We tried our method on real E; coli data and designed a multiple tree estimation in order to improve the power of the asymmetry tests [49, 62, 9, 13, 18]. We also defined and studied a random parameter BAR model [10].

With N. Krell, B. Delyon and L. Robert we compared 2 different data sets from the literature: on on small full trees and one on long sparse trees to investigate asymmetry. [5].

Numercial methods for performance estimation of PDMP *Collaboration with*

- *Adrien Brandejsky (Inria CQFD) during his PhD (2009–2012),*
- *François Dufour (Bordeaux INP and Inria CQFD).*

Following our work on impulse control problems for PDMPs, we used a similar approach to estimate functionals of PDMPs and exit time distributions. this work is based on the discretization by quantization of the underlying discrete time Markov chain of the PDMP. It is applied to estimating the exit time distribution for a metallic structure subject to corrosion [17, 43, 55, 14].

Optimal portfolio allocation with transaction costs *Post-doc at Inria Sophia Antipolis in team OMEGA in 2005-2006, collaboration with*

- *Christophette Blanchet-Scalliet (Université de Nice),*
- *Rajna Gibson-Brandon (Université de Zurich),*
- *Denis Talay (Inria OMEGA),*
- *Etienne Tanré (Inria OMEGA).*

We consider a risky asset whose instantaneous rate of return takes two different values and changes from one to the other one at random times which are neither known, nor directly observable. We study the optimal allocation strategy of traders who, in the presence of cost of transactions, invest in this risky asset or in a non risky asset according to their belief on the current state of the instantaneous rate of return [30, 51, 52].

Tail of the stationary solution of Markov switching auto)-regressions *PhD thesis 2001 to 2004 at Institut de Recherche Mathématique de Rennes, supervisor Jian-Feng Yao (Université Rennes 1). Collaboration withYves Guivarc'h (Université Rennes 1) and Emile Le Page (Université Bretagne Sud)*

The linear autoregressive process (AR) in discrete time with random coefficients contains a large class of time series models that are very popular in statistics. Under weak assumptions, this process has a unique stationnary solution. The behaviour of its tail at infinity has been investigated by H. Kesten, E. LePage and C. Goldie when the coefficients are independent. This thesis extends their results in two directions. In a first part, we study the one-dimensionnal AR process with Markov switching introduced by J. D. Hamilton in econometrics. We get a similar result as in the independent case that can also be extended to continuous time processes. In a second part, we study the multidimensional model with independent coefficients. We extend the results mentionned above to a wider class of coefficients, namely a class with a property of irreducibility and proximality. Both parts make an intensive use of Renewal theory and Markovian operators [21, 22, 23, 24, 25, 26, 32, 53, 63, 64].

4.2 Supervision of PhD and Master theses

• Shared supervision (50%, with F. Dufour, Bordeaux INP) of the PhD thesis of Tiffany Cherchi, 2017-2020 (grant CIFRE Thales optronique, submitted).

Title *Automated optimal fleet management policy for airborne equipment.*

Abstract This project is concerned with the analysis and the study of the Markov Decision Processes (MDPs). It focuses on the modeling of a fleet of equipment with several levels of performance, which can be broken down or required for mission-oriented tasks. Thales wishes to put in place an optimized maintenance policy for the equipment to guarantee the availability of the equipment and the proper deployment of missions while minimizing maintenance costs. This problem can be seen as a fleet management problem. One of the main objectives will be to develop theoretical and numerical tools for the solution of such optimization problems.

• Shared supervision (50%, avec B. Cloez, INRA Montpellier) of the PhD thesis of Maud Joubaud, 2016-2019 (grant Ecole Doctorale and FEDER Prommece).

Title *Branching piecewise deterministic Markov processes, applications to cell division.*

Abstract The aim of the thesis is to study new models of branching PDMPs to model the dynamics of cell populations. We will pay particular attention to the simulation and optimization of these processes. Two examples will be privileged: the division of Escherichia coli related memory problems and asymmetry of the division, and chemostat models with possible applications to depollution.

• Shared supervision (50%, with F. Dufour, Bordeaux INP) of the PhD thesis of Alizée Geeraert, 2014-2017 (grant CIFRE Thales Optronique). From 2017, Alizée will be teaching at the military school of Brittany..

Title *Optimal control of piecewise deterministic Markov processes with application to maintenance.* Alizée sera à partir de septembre enseignante à l'école militaire de Bretagne.

Abstract The proposed research topic aims to study and analyze stochastic optimal control problems for PDMPs. This work we will focus on impulse control problems when the controller punctually intervenes on the process by moving it to a new point of the state space at a time

specified by the controller. Mathematically, this is to build an optimal control strategy defined by a sequence of time and stop points of the state space, inducing new jumps to the process in order to optimize function cost defined from a functional process. The main purpose of this thesis is to analyze this type of optimization problems in particular characterize the existence and shape policies? Epsilon-optimal and develop digital tools for the simulation of these strategies.

This work is published in [7].

• Shared supervision (50%, with F. Dufour, Bordeaux INP) of the PhD thesis of Christophe Nivot, 2013-2016 (grant Inria funded by Airbus Defence & Space and région Aquitaine). Christophe is a high school teacher since 2016.

Title *Modeling and simulation of an assembly line using MDPs.*

RAbstract This work deals with Markov Decision Processes (MDP). MDPs are a general family of controlled stochastic processes, which are suitable for the modeling of several sequential decision-making problems under uncertainty. They arise in many applications, such as engineering, computer science, telecommunications, finance, etc. The main aim of this work is to develop theoretical and numerical tools to solve such problems, by using dynamic or linear programming. Results are applied to the optimization of the assembly line of the new European launcher in collaboration with Airbus Defence & Space.

This work is published in [6, 34].

• Shared supervision (50%, with F. Dufour, Bordeaux INP) of the PhD thesis of Adrien Brandejsky, 2009-2012 (grant Inria ffunded by Astrium Space Transportation within ANR Fautocoes). since 2012 Adrien is financial risk analyst at Nomura, London.

Title *Numerical methods for piecewise deterministic Markov processes (PDMP).*

Abstract PDMP's have been introduced by M.H.A. Davis as a general class of non-diffusive stochastic models. PDMP's are hybrid Markov processes involving deterministic motion punctuated by random jumps. In this thesis, we develop numerical methods that are designed to fit PDMP's structure and that are based on the quantization of an underlying Markov chain. We deal with three issues : the approximation of expectations of functional of a PDMP, the approximation of the moments and of the distribution of an exit time and the partially observed optimal stopping problem. In the latter one, we also tackle the filtering of a PDMP and we establish the dynamic programming equation of the optimal stopping problem. We prove the convergence of all our methods (most of the time, we also obtain a bound for the speed of convergence) and illustrate them with numerical examples.

This work is published in [11, 14, 17, 43, 48].

• Shared supervision (50%, with F. Dufour, Bordeaux INP) of the PhD thesis of Karen Gonzalez, 2007-2010 (grant MENRT). Since 2011, Karen is a Safety engineer at Airbus Defence & Space.

Title *Contribution to the study of PDMPs*

Abstract In a first part, PDMPs are used to compute probabilities of top events for a case-study of dynamic reliability (the heated tank system) with two di erent methods : the rst one is based on the resolution of the differential system giving the physical evolution of the tank and the second uses the computation of the functional of a PDMP by a system of integro-differential equations. In the second part, we propose a numerical method to approximate the value function for the optimal stopping problem of a PDMP. Our approach is based on quantization of the postjump location and inter-arrival time of the Markov chain naturally embedded in the PDMP, and path-adapted time discretization grids. It allows us to derive bounds for the convergence rate of the algorithm and to provide a computable epsilon-optimal stopping time.

This work is published in [19, 29, 45, 50].

• Supervisor of M2 internship of Tiffany Cherchi (Université de Montpellier), march-july 2017 (funded by LabEx Numev).

Title *Simulation and optimization of bacteria populations.*

The aim of this internship is to simulate a stochastic model of growth of bacteria taking into account the fact that the law of division depends on the size of the bacterium and allowing an asymmetric division into two daughter cells. The simulator will then be used to solve an optimization problem consisting of stopping the experiment before the phenomenon of filamentation.

• Shared supervision (50%, withB. Cloez, INRA Montpellier) of M2 internship of Maud Joubaud (Université de Rennes), april-august 2016 (funded by INRA).

Title *Euler scheme for PDMPs.*

The aim of this internship is to propose new numerical algorithms to simulate PDMPs and their invariant law (when it exists), theoretically quantify the convergence of these algorithms and implement them to study their performance numerically. The work will be illustrated on examples from biology and reliability.

• Shared supervision (50%, with F. Dufour, Bordeaux INP) of M2 internship of Christophe Nivot (Université de Nice), march-september 2013 (funded by Airbus Defence & Space).

Title *Modeling and optimization of an assembly line.*

As part of an applied research partnership between Airbus Defense & Space and Inria, this internship consists of building a simplified mathematical model of the assembly line of the future European launcher in order to optimize it. One of the main objectives of this work was to identify and use theoretical and numerical tools for solving this optimization problem.

4.3 Participation in competitive academic research grants

USP-Cofecub Control of dynamical systems with jumps (2013–2014) and Inria associate team CDSS (2014-2016) *Principal investigators* : F. Dufour (Bordeaux INP and Inria), O. Costa (Univ. São Paulo) *Participants* : B. de Saporta, F. Dufour, P. Rouchon (France), E. Costa, O. Costa, P. Pereira da Silva (Brazil)

The main goals of this joint cooperation is to study the control of dynamic systems subject to stochastic jumps. In my topic, we focus on numerical methods for solving control and filtering problems related to Markov jump linear systems. This project allows a first cooperation between with Eduardo F. Costa (Univ. São Paulo à São Carlos, Brazil).

PROMMECE (2016-2019) *Principal investigator* : B. de Saporta (Univ. Montpellier), *Program* : Chercheur(se)s d'Avenir région Languedoc-Roussillon et FEDER, *Participants* : T. Cherchi (Univ. Montpellier), B. Cloez (INRA Montpellier), B. de Saporta (Univ. Montpellier), M. Joubaud (Univ. Montpellier), K. Milferstedt (INRA Narbonne), M. Ribatet (Univ. Montpellier), J-P. Steyer (INRA Narbonne).

The purpose of project PROMMECE is to study new mathematical models to describe the evolution of cell populations over time. Typically, these cells grow and divide into two daughter cells that will in turn grow and divide. Although cells descending from the same initial ancestor cell are genetically identical, there is a variability in measured quantities between cells (growth rate, concentration of a given protein, ...). It is therefore necessary to include randomness in models describing these phenomena. This project focuses on two main issues. The first one is to determine if there is asymmetry and memory in cell division. To do this, we will compare the existing deterministic models with new stochastic models to find experimental criteria for discriminating between models with and without memory. The second one concerns simulation and control of cell populations: how to dynamically adjust at best various parameters that influence cell growth (amount of nutrient, temperature, amount of biomass withdrawn ...) to achieve a predetermined goal such as optimizing the production of biogas.

ANR Piece (2013–2017) *Principal investigator* : F. Malrieu (Univ. Tours), *Program* : Jeunes chercheuses et jeunes chercheurs, *Participants* : J.-B. Bardet (Univ. Rouen), B. Cloez (Inra Montpellier), B. de Saporta (Univ. Montpellier), M. Doumic (INRIA Rocquencourt), N. Krell (Univ. Rennes 1), A. Genadot (Univ. Dauphine), D. Goreac (Univ. Paris-Est-Marne-La-Vallée), F. Malrieu (Univ. Tours), P. Robert (INRIA Rocquencourt), G. Wainrib (Univ. Paris 13), P.-A. Zitt (Univ. Paris-Est-Marne-la-Vallée). I am head of task 3 (simulation and estimation).

Piecewise Deterministic Markov Processes (PDMP) are non-diffusive stochastic processes which naturally appear in many areas of applications as communication networks, neuron activities, biological populations or reliability of complex systems. Their mathematical study has been intensively carried out in the past two decades but many challenging problems remain completely open. This project aims at federating a group of experts with different backgrounds (probability, statistics, analysis, partial derivative equations, modelling) in order to pool everyone's knowledge and create new tools to study PDMPs. The main lines of the project relate to estimation, simulation and asymptotic behaviors (long time, large populations, multi-scale problems) in the various contexts of application.

ANR Fautocoes (2009–2013) *Principal investigator* : F. Dufour (Bordeaux INP et Inria), *Program* : Arpege, *Participants* : R. Azaïs, A. Brandejsky, M. Colin, T. Colin, B. de Saporta, F. Dufour, A. Gégout-Petit (Inria CQFD et MC2), M. Puiggali, M. Touzet (Labo de Mécanique Physique, Univ. Bordeaux), F. Boyer, F. Hubert (Univ. Provence), C. Elegbede, M. Euzen (Astrium). I am head of task 3 (stochastic control).

Our aim is to use the framework of piecewise deterministic Markov processes (PDMPs) with an emphasis on probabilistic and deterministic numerical methods: to model complex physical systems and phenomena; to compute expectations of functionals of the process in order to evaluate the performance of the system; to develop theoretical and numerical control tools for PDMPs to optimize the performance and/or to maintain system function when a failure has occurred.

4.4 Participation in industrial research grants

Thales Optronique (2014–2017) *Participants* : B. de Saporta, F. Dufour, A. Geeraert (Inria), C. Baysse, D. Bihannic, M. Prenat (Thales Optronique).

Type of contract : PhD thesis of A. Geeraert (grant CIFRE) and research grant $45kEUR$.

We developed new powerful numerical methods to optimize the disponibility of Thales equipments. The aim is to go from a corrective maintenance to a predictive one. We propose a method that is both numerically efficient and mathematically sound to solve long term optimization problems with sequential decision making regarding the dates and types of intervention to be performed.

This work is published in [7].

Thales Optronique (2010-2013) *Participants* : C. Baysse, B. de Saporta, A. Gégout-Petit, J. Saracco (Inria), D. Bihannic, M. Prenat (Thales).

Type of contract : PhD thesis of C. Baysse (supervisors A. Gégout-Petit and J. Saracco) and research grant $45kEUR$.

The goal of the project is the optimization of the maintenance of a on board system with a HUMS (Health Unit Monitoring Systems). We have proposed a hidden Markov model to detect as soon as possible a possibly degraded state for an optronic equipment. The detection procedure is based on on-line recordings performed by the HUMS. We then proposed an optimal and dynamic maintenance policy, adapted to the state of the system and taking into account both random failures and those related to the degradation phenomenon, based on a PDMP model.

This work is published in [38, 60, 58] and lead to a patent [2].

Airbus Defence & Space (2013–2016) *Participants* : B. de Saporta, F. Dufour, C. Nivot (Inria), J. Behar, D. Berard-Bergery, C. Elegbede (Airbus DS).

Type of contract : M2 and PhD grant (with Région Aquitaine) of C. Nivot and research grant $45kEUR$.

The goal of this project is the optimization of the assembly line of the future European launcher, taking into account several kinds of economical and technical constraints. We have started with a simplified model with five components to be assembled in workshops liable to breakdowns. We have modeled the problem using the Markov Decision Processes (MDP) framework and built a simulator of the process in order to run an optimization procedure.

This work is published in [6, 34].

Astrium Space Transportation (2009-2013) *Participants* : A. Brandejsky, B. de Saporta, F. Dufour, H. Zhang (Inria), C. Elegbede (Astrium ST).

Type of contract : PhD grant of A. Brandejsky and research grant $45kEUR$ (within ANR Fautocoes).

We used Piecewise Deterministic Markov Processes (PDMPs) to model the randomness of the fatigue life of the material and the succession of the different loading regimes. This class of models allows us to input a propagation law adapted to the current regime of the propagation (usually called stage II and stage III in the literature) and also adapted to the current cycle (storage, transport, takeoff, etc.). The proposed approach allows us to make prediction about time of transition to the breaking regime. We proposed a new probabilistic approach to compute expectations of PDMPs based on quantization techniques. We have obtained general results to simulate a general functional of the PDMP. The same ideas have been used to compute approximations of the law and moments of exit times for general PDMPs. Astrium has provided an industrial example to test our numerical optimization tools on. It concerns a metallic structure subject to corrosion that is stored for potentially long times in different more or less stressing environments. We computed the service time of the structure, that is the law of the exit time for the corrosion level to reach a given threshold. We also proposed an optimized maintenance policy for this structure that is dynamic and adapted to the specific history of each structure.

This work is published in [15, 43, 61].

Astrium Space Transportation (2008–2009) *Participants* : R. Azaïs, B. de Saporta, F. Dufour, A. Gégout-Petit, H. Zhang (Inria), M. Touzet (I2M, Univ. Bordeaux), C. Elegbede (Astrium ST).

Type of contract : Yearly bibliographic contracts $15kEUR/year$.

The goal of this two-year project is to study random models for crack proagation. It lead to ANR Fautocoes.

DCNS (2010–2014) *Participants* : B. de Saporta, F. Dufour, H. Zhang (Inria), D. Laneuville, A. Nègre (DCNS).

Type of contract : Yearly contracts of industrial research $10kEUR/year$.

The increasing complexity of warfare submarine missions and crew reduction has led DCNS to study new tactical help functions for underwater combat management systems. In this context, the objective is to find optimal trajectories according to the current mission type by taking into account sensors, environment and surrounding targets. We modeled the problem as a Markov Decision Process first taking into account a single target vessel and allowing only to control the immersion of the submarine [69]. In 2011, we extended our previous results to multiple target vessels [68]. In 2012, we dealt with multiple target vessels and 3D control [67]. In 2013, we also coupled our code with the output of a tracking software to take more realistically into account the uncertainty on the position and speed of the targets [65].

This work is published in [3, 36, 42].

EDF (2010-2012) *Participants* : B. de Saporta, F. Dufour, H. Zhang (Inria), G. Deleuze (EDF), J.F. Aubry, G. Babykina, N. Brinzei, S. Medjaher (CRAN, Univ. Lorraine), A. Barros, C. Berenguer, A. Grall, Y. Langeron, D.N. Nguyen (Univ. Technologie Troyes).

Type of contract : Industrial research contract within GIS S3S (Supervision et Sûreté des systèmes complexes).

The objective of this project is develop new methodologies for studying the dynamic reliability of controlled systems used in the critical area of power generation and process industries. We worked on a benchmark of steam generator with four physical variables: feedwater flowrate , steam flow, narrow range water level and wide range water level. A PID controller is used to maintain the water level within limits of set-points. The system is composed of seven components: 1 passive system representing vapor transport system, 3 extraction pumps, 2 feeding turbopumps, and 1 waterflow regulation valve. We implemented a simulator of this hybrid process based on a PDMP model and computed failure probabilities for a typical 18-month scenario [66].

This work is published in [27, 28, 39, 59].

4.5 Awards

- Recipient of programme Chercheur(se)s d'Avenir de la Région Languedoc Roussillon, 2015.
- recipient of PES/PEDR since 2012 (competitive bonus).
- The paper *Optimal stopping for the predictive maintenance of a structure subject to corrosion* [15] was nominated *SAGE Best paper award 2012* for *Journal of Risk and Reliability*.
- Demi-délégation Inria (leave of half of teaching duty) in 2011-2012, 2012-2013 and 2013-2014.

4.6 Invitations

- International invitation
  - July 2017 : Invited talk and session at SIAM congress on control and its applications, Pittsburgh, USA.
  - December 2016 : Invited lecture at Université de Monastir, Tunisia by Leila Ben Abdelghani Bouraoui for a M2 course.
  - October 2016 : Invited talk et école CIMPA *Mathématiques pour la biologie*, Hammamet, Tunisia.
  - June 2016 : Invited 2 weeks at Universidade de São Paulo by E. F. Costa.
  - December 2015 : Invited to Université Libre de Bruxelles by D. Paindaveine for the PhD defense of Isabelle Charlier.
  - December 2015 : Invited 2 weeks at Universidade de São Paulo by E. F. Costa.
  - June 2015 : Invited talk at international Workshop international on Statistics within the *5èmes rencontres Sherbrooke-Montpellier*, Sherbrooke, Canada [54].
  - May-June 2015 : Invited 2 weeks at Universidade de São Paulo by E. F. Costa.
  - June 2014 : Invited talk (in invited session) at International Worshop on Applied Probability IWAP, Antalya, Turkey [47].
  - May-June 2014 : Invited 2 weeks at Universidade de São Paulo by E. F. Costa.

- Novembre 2013 : Invited talk at international Workshop *Hitting times and exit problems for stochastic models*, Dijon, France [55].
- May-June 2013 : Invited 2 weeks at Universidade de São Paulo by E. F. Costa
- April 2013 : Invited 1 week at Hong Kong University by J.-F. Yao.
- August 2012 : Invited talk (in invited session) at XIème colloque franco-roumain de mathématiques appliquées, Bucuresti, Romania [48].
- August 2011 : Invited talk (in invited session) at 18th IFAC World congress, Milano, Italy [44].
- July 2010 : Invited 1 week at Liverpool University by A. Piunovskiy, invited talk at workshop *Modern trends in controlled stochastic processes* [29, 56].
- March 2009 : Invited talk at international Workshop *Mathematical models for cell division*, IHP Paris, France [57].

- National invitations

  - June 2017 : Talk for deuxième journée Springboard, Montpellier
  - Feb. 2017 : Talk at Workshop Statistique pour les PDMP, Nancy
  - April 2016 : Talk for journée Fille et Maths, Université de Montpellier
  - Jan. 2016 : Talk for Journées modèles aléatoires pour l'écologie et l'évolution, SupAgro Montpellier
  - Oct. 2015 : Mini-course of interdisciplinary axis Modélisation Théorique et Computationnelle en Neurosciences et Sciences Cognitives, Université de Nice et Inria Sophia Antipolis http://mtc-nsc.unice.fr/video-Processus-markoviens.html
  - Oct. 2015 : Talk for Maths C2+ internship for high-school pupils, Université de Montpellier
  - March 2015 : Talk at Donner des Elles à l'UM – Journée Femmes et Sciences de l'UM, Montpellier
  - Jan. 2015 : Talk at Probabilités working group, IMAG, Montpellier
  - Jan. 2015 : Seminar Probabilité et Processus Stochastiques, IRMAR, Rennes 1
  - Oct. 2014 : Seminar of IMAG, Montpellier
  - March 2014 : Seminar of team Probabilités et Statistique, IMT, Toulouse.
  - Feb. 2014 : Seminar of team Probabilités et Statistique, IECL, Nancy.
  - Dec. 2013 : Seminar of team Statistique, Laboratoire de mathématiques d'Avignon, Avignon
  - Oct. 2013 : Seminar of team Probabilité et Statistique, I3M, Montpellier 2
  - Dec. 2012 : Seminar of team Probabilité et Processus Stochastiques, IRMAR, Rennes 1
  - Oct. 2012 : Seminar of team Probabilités et Statistique, LMB, Besançon
  - May 2011 : Seminar of team Mathématiques et Neurosciences, IHP, Paris.
  - March 2011 : Seminar of team Probabilités et Statistique, IECN, Nancy.

- Nov. 2010 : Seminar of team GTR22 of IMdR (Institut pour la Maîtrise des Risques), Bordeaux.
- Oct. 2010 : Seminar of team aléatoire EADS, Les Mureaux.
- March 2009 : Seminar of MAB, IMB, Bordeaux.
- Jan. 2009 : Seminar of team Statistique et Probabilité, Laboratoire Paul Painlevé, Lille 1.
- Aug. 2008 : Invited session on autoregressive Processes, Journées MAS 2008, Rennes.
- April 2007 : Seminar of team Monnaie Banque Finance, GREThA, Bordeaux 4.
- March 2007 : Seminar of team Probabilité et Processus Stochastiques, IRMAR, Rennes 1.
- Feb. 2007 : Seminar of team Prob-Stat-RO, IMB, Bordeaux 1.
- Oct. 2006 : Seminar of team Probabilités, Cergy-Pontoise.
- Oct. 2006 : Seminar of team Probabilités et Statistiques, U. Pau et des Pays de l'Adour.
- Sept. 2006 : Talk for Journées Bordeaux-Pau-Toulouse, Anglet.
- June 2006 : Seminar Bachelier, Paris.
- March 2006 : Seminar of team Probabilités et Mathématiques Financières, Evry.
- March 2006 : Seminar of team Probabilité et Théorie ergodique, Amiens.
- March 2006 : Seminar of team actuariat, Brest.
- March 2006 : Seminar of team Finance Dieudonné-OMEGA, Nice.
- Dec. 2005 : Seminar of team Probabilités et Statistique, IECN, Nancy.
- Oct. 2005 : Seminar of team OMEGA, Inria Sophia Antipolis.
- June 2005 : Seminar of team Mathématiques Appliquées, Nantes.
- March 2005 : Seminar of team Probabilités et Statistiques, Nice Sophia Antipolis.
- March 2005 : Seminar of Laboratoire de Statistique et Probabilité, Toulouse 3.
- March 2005 : Seminar of team Probabilité et Statistique, Lille 1.
- April 2004 : Seminar of team SAMOS, Paris 1.
- March 2003 : Seminar of team théorie ergodique, IRMAR, Rennes 1.
- May 2002 : Seminar of team Processus Stochastiques et Statistique, IRMAR, Rennes 1.

4.7 Publications

Book

[1] B. de Saporta, F. Dufour, and H. Zhang. *Numerical methods for simulation and optimization of piecewise deterministic Markov processes: application to reliability*. Mathematics and statistics series. Wiley-ISTE, 2015. hal-01249897.

Patent

[2] D. Bihannic, C. Baysse, B. de Saporta, F. Dufour, A. Gégout Petit, and J. Saracco. Procédé de maintenance d'un équipement. Demande de brevet : France WO2015091752, PCT/EP2014/078399, UE N°14814873.7-1958, Thales, Inria, 2014. hal-01096107.

Submitted papers in international peer-reviewed journals

[3] Huilong Zhang, Benoîte de Saporta, François Dufour, Dann Laneuville, and Adrien Nègre. Stochastic control of observer trajectories in bearings-only tracking with acoustic signal propagation optimization. Submitted, 2017, arXiv:1703.09924, hal-01498413.

Papers in international peer-reviewed journals

[4] E F. Costa and B. de Saporta. Linear minimum mean square filters for markov jump linear systems. *IEEE Trans on automatic control*, to appear, 2017. hal-01251334.

[5] B. Delyon, B. de Saporta, N. Krell, and L. Robert. Investigation of asymmetry in E. coli growth rate. *Case Studies In Business, Industry And Government Statistics*, to appear, 2017. hal-01201923.

[6] B. de Saporta, F. Dufour, C. Nivot. Partially observed optimal stopping problem for discrete-time Markov processes. *A Quarterly Journal of Operations Research*, to appear, 2017. hal-01274645.

[7] B. de Saporta, F. Dufour, A. Geeraert. Optimal strategies for impulse control of piecewise deterministic markov processes. *Automatica*, 77:219–229, 2017. hal-01294286.

[8] B. de Saporta and E.F. Costa. Approximate Kalman–Bucy filter for continuous-time semi-Markov jump linear systems. *IEEE Trans on automatic control*, 61(8):2035 – 2048, 2016. hal-01062618.

[9] B. de Saporta, A. Gégout Petit, and L. Marsalle. Statistical study of asymmetry in cell lineage data. *Computational Statistics & Data Analysis*, 69:15–39, 2014. hal-00702359.

[10] B. de Saporta, A. Gégout Petit, and L. Marsalle. Random coefficients bifurcating autoregressive processes. *ESAIM: Probability and Statistics*, 18:365–399, 2014. hal-00702357.

[11] A. Brandejsky, B. de Saporta, and F. Dufour. Optimal stopping for partially observed piecewise-deterministic Markov processes. *Stochastic Processes and their Applications*, 123(8):3201–3238, 2013. hal-00755052.

[12] B. de Saporta and H. Zhang. Predictive maintenance for the heated hold-up tank. *Reliability Engineering & System Safety*, 115:82–90, 2013. hal-00755056.

[13] B. de Saporta, A. Gégout Petit, and L. Marsalle. Asymmetry tests for bifurcating autoregressive processes with missing data. *Statistics & Probability Letters*, 82(7):1439–1444, 2012. hal-00662129.

[14] A. Brandejsky, B. de Saporta, and F. Dufour. Numerical method for expectations of piecewise-deterministic Markov processes. *CAMCoS*, 7(1):63–104, 2012. hal-00617816.

[15] B. de Saporta, F. Dufour, H. Zhang, and C. Elegbede. Optimal stopping for the predictive maintenance of a structure subject to corrosion. *Journal of Risk and Reliability*, 226(2):169–181, 2012. hal-00554759.

[16] B. de Saporta and F. Dufour. Numerical method for impulse control of piecewise deterministic Markov processes. *Automatica*, 48:779–793, 2012. hal-00541413.

[17] A. Brandejsky, B. de Saporta, and F. Dufour. Numerical methods for the exit time of a piecewise-deterministic Markov process. *Advances in Applied Probability*, 44(1):196–225, 2012. hal-00546339.

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[20] B. Bercu, B. de Saporta, and A. Gégout Petit. Asymptotic analysis for bifurcating autoregressive processes via a martingale approach. *Electronic Journal of Probability*, 14:2492–2526, 2009. hal-00293341.

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[26] B. de Saporta. Renewal Theorem for a system of renewal equations. *Annales de l'Institut Henri Poincaré*, 39(5):823–838, 2003. hal-00274872.

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[27] J.F. Aubry, G Babykina, N. Brinzei, S. Medjaher, A. Barros, Ch. Bérenguer, A. Grall, Y. Langeron, D.N. Nguyen, G. Deleuze, B. de Saporta, F. Dufour, and H. Zhang. Projet ApproDyn : approches de la fiabilité dynamique pour modéliser des systèmes critiques. In N. Matta, Y. Vandenboomgaerde, and J. Arlat, editors, *Supervision, surveillance et sûreté de fonctionnement des grands systèmes*, chapter 8, pages 181–222. Hermes Sciences - Lavoisier, 2012. hal-00740181.

[28] J.F. Aubry, G Babykina, N. Brinzei, S. Medjaher, A. Barros, Ch. Bérenguer, A. Grall, Y. Langeron, D.N. Nguyen, G. Deleuze, B. de Saporta, F. Dufour, and H. Zhang. The ApproDyn project: dynamic reliability approaches to modeling critical systems. In Y. Vandenboomgaerde N. Matta and J. Arlat, editors, *Supervision and Safety of Complex Systems*, pages 141–179. Wiley-ISTE, 2012. Chapter 8. hal-00762917.

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[30] C. Blanchet-Scalliet, R. Gibson Brandon, B. de Saporta, D. Talay, and E. Tanré. Viscosity solutions to optimal portfolio allocation problems in models with random time changes and transaction costs. In Hansjörg Albrecher, Wolfgang J. Runggaldier, and Walter Schachermayer, editors, *Advanced Financial Modelling*, volume 8 of *Radon Series on Computational and Applied Mathematics*. de Gruyter, 2009. hal-00594200.

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[33] EF. Costa and B. de Saporta. Precomputable kalman-based filter for markov jump linear systems. In *3rd International Conference on Control and Fault-Tolerant Systems*, pages 387–392, Barcelona, Spain, 2016. hal-01336597.

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