Curriculum Vitae

Dr Brahim Mezerdi
King Fahd University of Petroleum and Minerals
Algerian Academy of Sciences and Technology

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1 Personal Data

- Name: Brahim *MEZERDI*
- Date and Place of Birth: June *19, 1960, Mchouneche (W. Biskra), Algeria.*
- Nationality: *Algerian.*
- Marital Status: *Married , 4 children*
- Address: *King Fahd University of Petroleum and Minerals, Dept of mathematics and Statistics, Dhahran, KSA*
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- Langages written and spoken: *Tamazight, Arabic, French, English.*

2 Academic Positions

- 2019 to present, Visiting Associate Professor, King Fahd University of Petroleum and Minerals, KSA.
- 2002 - 2019, Full Professor, University of Biskra, 2002-2018.
- 1997 - 2002, Associate Professor, University of Biskra.
- 1991 to 1997, Assistant Professor in charge of courses ,University of Biskra.
- 1987 to 1991, Assistant Professor, University of Biskra.
- 1986 to 1987, Postdoc, Research Assistant, Imperial College of Sciences and Technology, London, UK.

3 Research positions

- Director of the Laboratory of Applied Mathematics, University of Biskra, from 2001 to 2012.
- Chairman of the probability and stochastic processes team, Laboratory of Applied Mathematics, University of Biskra, from 2001 to 2018.

- Chairman of several research projects in mathematics since 1994.
- Research Assistant (Postdoctor), Department of Electrical Engineering, Imperial College of Sciences and Technology, London, Great Britain, from 1986 to 1987.

4 Education

- **State Doctorate (**Doctorat d'état es-sciences) in Mathematics, University of Constantine, 1996 (Supervisor: **Prof. Nicole El-Karoui, University of Paris VI**).

  Title: *Contributions to the study of stochastic differential equations and optimal control.*

  Jury: *D. Aissani (Béjaia), N. El Karoui (Paris VI), R. Bennacer (Batna), A. Aissani (Blida), B. Ksir (Constantine).*

- **PhD (**Doctorat de $3^{\grave{e}me}$ cycle) in Mathematics, Option: Probability, Pierre and Marie Curie University, Paris VI, France, (1983-1986). (Supervisor: **Prof. Nicole El-Karoui, University of Paris VI**).

  Title: *Contribution to the optimality necessary condition for a system governed by a stochastic differential equation with a non smooth drift*

  Jury: *J. Neveu (President) (Paris VI), N. El Karoui (Paris VI and ENS Fontenay), J Jacod (Paris VI), E. Pardoux (Univ. Provence, Marseille), G. Mazziotto (Telecom Paris Tech)*

- **Master** (DEA, Diplôme d'études approfondies**)** in Mathematics, Option: Probability, Pierre et Marie Curie University, Paris VI, France, 1982/1983, Supervisor Prof. D. Revuz.
- **Bachelor** (Diplôme d'études supérieures) in Mathematics, Major: Probability and Statistics, University of Algiers (USTHB),1978-1982.
- **Baccaluréat** , Mathematics Series, High School Larbi Ben M'hidi, Biskra, 1978.

5 Research Fields

- Theory of stochastic processes
- Stochastic differential equations
- Backward Stochastic differential equations
- Stochastic optimal control
- Optimal control of mean-field systems and games
- Applications to mathematical finance

6 Scientific Awards

- Maurice Audin Prize of Mathematics, *Institut Henri Poincaré and French Academy of science, Paris* 2005.
- Prize of the *National Agency for academic research, Algiers 2006.*
- Founding member of the *Algerian Academy of Sciences and Technology, June 2015.*
- President of the *Mathematics section*, Algerian Academy of Sciences and Technology*, 2016 to 2023.*

7 Administrative responsabilities

- Vice-Rector of the Biskra University in charge of International Cooperation, 2009-2018.
- Vice-Rector of the Biskra University in charge of the post-graduate studies and scientific research, 2002 - 2009.
- Vice-Rector of the Biskra University in charge of undergraduate studies, 1992-1993.
- President of the scientific council of the mathematics department, 2000-2006.

8 Visiting faculty positions

- Toulon University (France), June 1-30 1991, April 1-30 1992, June 1-30 1998 and June1-30, 2000.
- Le Mans University (France), 1-30 May, 2002.
- Royal Institute of Technology, Stockholm (Sweden), for 01 month for the years 2002, 2003, 2004, 2005, 2007.
- Toulon University (France), for the periods: December 2002, June 2005, June 2009, June 2011 and June 2013.
- Valenciennes University (France) for the periods: April 2011, June 2012 and June 2014.
- Freibourg University (Germany), May 2013.
- Marrakech University (Morroco) for the periods: Décember 2011, September 2012, May 2015.
- Cadiz University (Spain), September 2017.

9 International Cooperation

- Chair of the scientific project :Accord PICS 444 (CNRS, France/DEF, Algeria), with Prof. E. Pardoux, Laboratoire d'Analyse, Topologie et Probabilités, Université de Provence (France), 2002-2004.
- Chair of the project MENA Swedish Algerian Research Partnership Program (348-2002-6874) with Prof. B. Djehiche, Division of Mathematical Statistics, Royal Institute of Tehnology (KTH), Stockholm (Suède), 2003-2005.
- Chair of the project, French Algerian Partnership Program Accord Tassili 07 MDU 705, with prof. K. Bahlali, CPT-USTV, Toulon University (France), 2007-2010.
- Member of the European project FP7: "International Training Network ITN "*Deteministic and Stochastic control*", 2009 - 2012.
- Chair of the project, French Algerian Partnership Program, Accord Tassili 13 MDU 887 "*Equations différentielles stochastiques et contrôle optimal*", with K. Bahlali, Toulon University, 2013-2016.
- Coordinator with Prof. E. Eberlein (Freibourg, Germany) and Prof. Y. Ouknine (Marrakech, Morroco) of the Network : Financial Mathematics (DAAD, Germany), 2013-2015.
- Member of the International Euro-Maghreb Laboratory of Mathematics and their Intercations, LEM2I (CNRS) since 2009.

10 Supervision Activities

10.1 PhD theses supervised and defended (13)

- Seid Bahlali (1961-2010), Batna univesity, 2002. *Existence et principe du maximum pour les problèmes de contrôle relaxés.*
- Boubakeur Labed, 2006. *Equations différentielles rétrogrades et équations aux dérivées partielles semi-linéaires.*
- Farid Chighoub, 2009. *Contrôle optimal des équations différentielles stochastiques*
- Nabil Khelfallah, 2011. *Contrôle des équations différentielles stochastiques progressives rétrogrades*
- Badreddine Mansouri, 2011. *Sur certaine propriétés des équations différentielles stochastiques doublement rétrogrades.*
- Lazhar Tamer, 2012. *Contrôle stochastique des diffusions avec sauts*

- Boulakhrass Gherbal, 2011. *Sur certains aspects des équations différentielles stochastiques rétrogrades et leur contrôle optimal.*
- Mokhtar Hafayed, 2010. *Gradients généralisés et contrôle stochastique*
- Nacira Agram, 2013. *Contrôle optimal stochastique à horizon infini*
- Samia Yakhlef, 2015. *Application du calcul de Malliavin aux problèmes de contrôle singulier*
- Rafika Gatt, 2016. *Equations différentielles stochastiques rétrogrades et application au contrôle optimal.*
- Hanane Bengherbal, 2017. *Quelques contributions aux problèmes de contrôle stochastique de diffusion avec sauts.*
- Saloua Labed, 2017. *Calcul Stochastique et Optimisation Dynamique des Processus Aléatoires*

10.2 Magister theses supervised and defended (13)

- Bahlali Seid (1961-2010), Batna University, 1998. *Contrôle optimal des diffusions par des processus à valeurs mesures.*
- Zerarka Khedidja Soraya, Annaba University, 2002. *Equations diffétrentielles stochastiques rétrogrades et application au contrôle optimal*
- Yakhlef Samia, 2003. *Solutions faibles des équations différentielles stochastiques rétrogrades*
- Labed Saloua, 2005. *Mesures Martingales et Application au Contrôle Stochastique*
- Chighoub Farid, 2005. *Sur l'équation de Hamilton Bellmann Jacobi en contrôle optimal stochastique*
- Khelfallah Nabil, 2005. *Propriétés des équations différentielles stochastiques rétrogrades et leur contrôle*
- Djenaihi Youcef, Annaba University, 2008. *Quelques proriétés du contrôle déterministe et stochastique.*
- Didi Abdelouahab, 2008. *Théorèmes Limites et Stabilité des Equations Différentielles Stochastiques*
- Bougherara Saliha, 2005. *Principe du maximum pour les problèmes de contrôle stochastique*
- Lakhdari Imad, 2010. *Equations différentielles stochastiques rétrogrades et applications au contrôle optimal*

- Hafiane Naouel, 2010. *Existence et conditions nécessaires d'optimalité pour une équation différentielle stochastique.*
- Redjil Amel, 2010. *Approche variationnelle du principe de Pontriagin stochastique*
- Zouzou Akila, 2007. *Principe variationnel d'Ekeland et application au contrôle stochastique et déterministe*

11 Organisation of seminars and workshops

- Principal Organiser (with B. Djehiche, KTH Stockholm) of the "First International Workshop on Probability and Stochastic Analysis", Biskra December 6-8, 2003.
- Principal Organiser (with B. Djehiche, KTH Stockholm and K. Bahlali, Univ. Toulon, France) of the "Second International Workshop on Probability and Stochastic Analysis", Biskra December 11-16, 2004.
- Principal Organiser (with B. Djehiche, KTH Stockholm) of the "Third International Workshop on Probability and Stochastic Analysis", Biskra December 17-19, 2005.
- Co-organisater of the "journées de statistique appliquée, Biskra, February 26-28, 2005."
- Co-organiser of the conference "Equations aux dérivées partielles non linéaires", Tipaza Mai 2005.
- Principal Organiser (with B. Djehiche, KTH Stockholm) of the "IVth International Workshop on Probability and Stochastic Analysis", Biskra December 16-18, 2006.
- Member of the scientific committee of the French-Maghreb conference in Mathematics (Convergence franc-maghrébines), Nice (France), January 26- 28, 2007.
- Principal Organiser (with B. Djehiche, KTH Stockholm) of the "Vth International Workshop on Probability and Stochastic Analysis", Biskra December , 2008.
- Co-organiser of the first conference of the Laboratoire euro-maghrébin LEM2I, Tipaza, June 2010.
- Organiser of the winter school in probability and statistics, Biskra, January 2017.

12 Teaching activities and courses taught in recent years

At KFUPM, KSA, since 2019

- MATH 515, Stochastic processes
- MATH 562, Fundamentals of option pricing.
- MATH 208, Differential equations and linear Algebra.
- MATH 201, Calculus III, 2020/2021 at KFUPM
- MATH 341, Advanced Calculus, 2019/2020 at KFUPM
- MATH 102, Calculus II, 2018/2019 at KFUPM

At Biskra University, Algeria

- Stochastic processes and stochastic integration, PhD course, 2016 - 2018
- Stochastic calculus and Applications, Master 2 Probability & Statistics 2014 - 2018.
- General theory of stochastic processes, Master 2, Probability & Statistics 2011-2014
- Brownian motion and stochastic integrals, Magister in Applied Mathematics, 2010 - 2011.
- Brownian motion and martingales, Magister in Applied Mathematics, 2009 - 2010.
- Advanced course in probability (BSc in Mathematics, 4th year)
- Measure and integration (BSc in Mathematics, 3rd year)
- Probability and Mathematical Statistics (Second year for engineers in hydraulics)
- Mathematical Statistics, Master in civil engineering.
- Probability and Mathematical Statistics, Master in Hydraulics.
- Topology and metric spaces (BSc in Mathematics, 2nd year)
- Probability theory (D.E.S. in Mathematics, third)
- Linear Algebra (1st year exact science).

13 Curriculum Development

- Designer and Coordinator of the *Professional Master in Mathematical Finance* 2021/2022, KFUPM.
- Coordinator of the MSc Program: *Random Models and Applications, 2001-2005.*
- Coordinator of the MSc Program: *Applied Mathematics, 2006-2009.*
- Coordinator of the PhD program: *Probability and Statistics (2010-2012)*

14 Industrial collaboration

- Collaboration with the business school and the department of systems engineering, in designing the *Professional Master in Mathematical Finance*, KFUPM, 2021/2022.
- I was member of a joint team (KFUPM and ARAMCO), whose objective was to build a project related to problems in optimization of oil exploration.
- I was involved in designing the program for the engineer degree in Statistics, 2005 - 2010, Biskra University. The program has been suggested by a joint committee between the university and the economic sector.
- As a vice rector in charge of cooperation at Biskra university, I was involved in many projects with the industrial sector, mainly to allow students to get internships, and facilitate relationship of our research units with many companies acting in our region in the domains of Energy, Agriculture and Cement plants. In this framework, I have organized three joint workshops with the industrial and economic sectors around the region of Biskra (Algeria).

15 Other duties

- Vice President of the Algerian Mathematical Society from 2009 to 2012.
- Member of the National permanent Sectorial Committe (2010-2013) (main evaluation institution of scientific research in Algeria).
- Member of the National Evaluation Commission of Scientific projects, CNEPRU (2003-2010)
- Member of the National Evaluation Commitee of the National Research Projects (PNR) (2010-2012).
- Jury member of several PhD theses in Algeria, Senegal, Morroco, Ivory cost, Tunisia and France.

- Member of several scientific committees of international as well as national conferences in applied mathematics.
- Member of the selection committee for the Maurice Audin prize of Mathematics (2006-2015).
- Member of the selection commitee for the prize of the best thesis defended by a Tunisian Women (2016).

16 Refereeing and Editing Activities

- Associate Editor of the Journal "Arabian Journal of Mathematics", Springer-Verlage, 2024.
- Associate Editor of the Journal Afrika Statistika *(Journal of the African Society of Probability and Statistics).*
- Associate Editor of the Journal of the Algerian Mathematical Society.
- Referee for many international journals such as:

SIAM J. Control Optim., Systems and control Letters, IEEE Transactions on Automatic Control, Non linear Analysis, Non linear Analysis (Hybrid systems), Stochastic Proc. Appl., Stochastic Analysis, Automatica, Stochastic Models, Electronic J. Diff. Equ., Appl. Math. Comput., J. Math. Anal. Appl., Mathematical Engineering Problems, J. Non linear Science and Appl....

17 Some recent research grants

- Principal Investogator: Project SB201017, *The maximum principle in optimal control of stochastic differential equations, 2021-2022, 95,897 SAR, KFUPM, KSA.*
- Principal Investogator: Project SR 181019, *McKean-Vlasov stochastic differential equations and their optimal control, 2019-2020, 56,106 SAR, KFUPM , KSA.*
- Principal Investogator: Project C00L03UN070120140030, Contrôle des systèmes stochastiques et applications, 2014 - 2017, Biskra University, Algeria.
- Principal Investogator: Project B01420130091, Analyse Stochastique et Contrôle Optimal, 2014 - 2017, Biskra University, Algeria;

18 Publications in International Peer-Reviewed Journals

42) *The Relaxed Stochastic Maximum Principle in Singular Optimal Control of Jump Diffusions.* Bulletin of the Malaysian Mathematical Science Society, Vol. 47 (2024), Paper 34.

41) *On the well-posedness of coupled forward-backward stochastic differential equations driven by Teugels martingales.* Math. Methods Appl. Sci. 43 (2020), no. 17, 10296–10318 (with D. Guerdouh, and N. Khelfallah).

40) *Stability of McKean-Vlasov stochastic differential equations and applications.* Stoch. Dyn. 20 (2020), no. 1, 2050007, 19 pp (with K. Bahlali and M.A. Mezerdi)

39) *On the relaxed mean-field stochastic control problem,* Stoch. Dyn. 18 (2018), no. 3, 1850024, 20 pp. (with K. Bahlali and M. Mezerdi).

38) *Existence of an Optimal Control for a coupled FBSDE with a non degenerate diffusion coefficient.* Stochastics 90 (2018), no. 6, 861–875 (with. K. Bahlali, O. Mtiraoui).

36) *The maximum principle in optimal control of systems driven by martingale measures.* J. Afr. Stat. 12 (2017), No. 1, 1095–1116. (with S. Labed).

35) *The relaxed stochastic maximum principle in optimal control of diffusions with controlled jumps,* **J**. Afr. Stat. Vol. 12, No 2, (2017), 1287-1312. (with H. Ben Gherbal).

34) *Existence and optimality conditions for relaxed mean-field stochastic control problems.* Systems Control Lett. 102 (2017), 1–8. (With K. Bahlali and M. Mezerdi).

33) *On Optimal Control of Forward Backward Stochastic Differential Equations.* Afrika Mat. 28 (2017), no. 7-8, 1075–1092.(with F. Baghery, N. Khelfallah et I. Turpin).

33) *The stochastic maximum principle for mixed regular-singular control problems via Malliavin calculus.* Afrika Matematika, 27 (2016), no. 3-4, 409–426. (with S. Yakhlef).

32) *Near-optimality conditions in stochastic control of linear fully coupled FBSDEs.* Afrika Mat., Vol. 27 (2016), no. 3-4, 327–343**.** (with N. Khelfallah).

31) *Existence of optimal controls for systems governed by mean-field stochastic differential equations,* Afrika Stat., Vol. 9, No 1 (2014), 627-645. (with K. Bahlali et M. Mezerdi).

30) *Fully Coupled Forward Backward Stochastic Differential Equations Driven by Lévy Processes and Application to Differential Games.* Rand. Operators and Stoch. Equations, Vol. 22 (2014), No 3, 151-161**.** (with F. Baghery, N. Khelfallah and I. Turpin).

29) *The relationship between the stochastic maximum principle and the dynamic programming in singular control of jump diffusions.* **I**nt. J. Stoch. Anal. 2014, Art. ID 201491, 17 pp., (with F. Chighoub).

28) *A stochastic maximum principle in mean field optimal control problems for jump diffusions.* Arab J. Math. Sc., Vol. 2013, 223-241 (with F. Chighoub),.

27) *Optimality conditions for partial information stochastic control problems driven by Lévy processes.* Systems and Control Letters 61, (2012), 1079-1084 (with K. Bahlali, N. Khelfallah),.

26) *Near optimality conditions in stochastic control of jump diffusion processes.* Systems & Control Letters, 60, (2011) 907-916. (with F. Chighoub).

25) *On the relationship between the dynamic programming and the maximum principle in singular control*, Stochastics, Vol. 84 (2012), no. 2-3, 233–249. (with F. Chighoub, K. Bahlali).

24) *Existence of optimal solutions in the control of FBSDEs,* Systems & Control Letters, Vol. 60, Nr. 5 (2011) , p. 344-349 (With K. Bahlali, B. Gherbal).

23) *Existence and optimality conditions in the control of linear FBSDEs,* Rand. Operat. Stoch. Equ., Vol. 18 (2010),185-197 (with K. Bahlali, B. Gherbal).

22) *The stochastic maximum principle in optimal control of degenerate diffusions with non-smooth coefficients*, Rand. Operators and Stochastic Equations, Vol. 17 (2009), Issue 1, Pages 37–54, (with F. Chighoub, B. Djehiche).

21) Optimality necessary conditions in singular stochastic control problems with nonsmooth data, J. of Math. Analysis and Appl., Volume 355, Issue 2, 15 July 2009, Pages 479-494. (with K. Bahlali, F. Chighoub, B. Djehiche).

20) *Necessary and sufficient conditions for near optimality in the control of FBSDEs,* Systems and Control Letters,Vol. 58 (2009,) 857-864., (With K. Bahlali, N. Khelfallah).

19) *On Yamada-Watanabe theorem and weak solutions for FBSDE.* Rand. Operators and Stoch. Equ. , Vol. 15 (2007), No 3, 271-285, (with K.Bahlali , M. N'zi and Y. Ouknine).

18) *A general stochastic maximum principle for degenerate SDE with Lipschitz coefficients,* Applied Math. and Optim., Vol. 56 (2007), 364-378, (with K. Bahlali & B. Djehiche).

17) *On the maximum principle in singular relaxed control problems,* SIAM J. Control and Optim., Vol. 46 (2007), No 2, 427-444, (with S. Bahlali & B. Djehiche).

16) *Approximation and Necessary optimality conditions in relaxed control problems.* J. Appl. Math. Stoch. Anal., Volume 2006 (2006), Article ID 72762, 23 pages, (with S. Bahlali et B. Djehiche).

15) *A general stochastic maximum principle for singular control problems,* Elect. J. of Probab., Vol. 10 (2005), Paper no 30, 988-1004, (with S. Bahlali).

14) *Backward Stochastic Differential Equations with two Re‡ecting Barriers and Quadratic Growth Coefficient.* Stoch. Proc. and Appl. 115 (2005), no 7, 1107-1129, (with K.Bahlali & S. Hamadene).

13) *Prevalence of Backward stochastic differential equations with unique solutions.* Jour. of Appl. Math. and Stoch. Anal.(2004), no 2, 123-136, (with K.Bahlali & Y. Ouknine).

12) *A Haussmann-Clarke-Ocone formula for functionals of diffusion processes with Lipschitz coefficients,* Jour. of Appl. Math. and Stoch. Anal., Vol. 15, N 4, 371-383 (2002), (with K. Bahlali and Y. Ouknine).

11) *Necessary conditions for optimality in relaxed stochastic control problems.* Stochastics and Stoch. Reports, Vol. 73 (3-4), 201-218 (2002), (with S. Bahlali).

10) *Some properties of stochastic differential equations driven by semi-martingales.* Rand. Oper. and Stoch. Equ., Vol. 9, No 1, 1-12 , 2001, (with K. Bahlali).

9) *Some generic properties of backward stochastic differential equations.* Monte-Carlo Methods and Applications, Vol. 7, No 1 (2001), (with K. Bahlali & Y. Ouknine).

8) *Approximation in stochastic optimal control of diffusion processes.* Random Operat. and Stoch. Equ. Vol. 8, No 4, pp. 1-8 (2000), (with S. Bahlali).

7) *On weak limits of a sequence of Ito processes.* Maghreb Math. Review, vol.4, n01, (1995).

6) *Pathwise uniqueness and approximation of stochastic differential equations.* Sém. de proba., vol.XXXII, 1998, Edit. J. Azema, M.Yor, P.A Meyer, Lect. Notes in Math.1651, Springer Verlag, (with K.Bahlali, Y. Ouknine).

5) *The maximum principle for optimal control of diffusions with non smooth coefficients.* Stochastics and Stoch. Reports, vol.57, 1996, pp. 303-316, (with K.Bahlali,Y. Ouknine),.

4) *Some generic properties of stochastic differential equations.* Stochastics & Stoch. Reports, Vol. 57, pp. 235-245, 1996, (with K.Bahlali,Y. Ouknine).

3) *Some Lp local estimates related to the solution of a stochastic differential equation and application to stochastic flows.* Random Oper. and Stoch. Equ, Vol.4, no 1 , pp.9-18, 1996, (with K. Bahlali).

2) *On the derivability with respect to the initial condition of the solution of a stochastic differential equation with Lipschitz coefficients.* Maghreb Math.Rev., Vol.2, n 01, pp. 73-86 (1993), (with K. Bahlali).

1) *Necessary conditions for optimality for a diffusion with a non smooth drift.* Stochastics, Vol.24, pp. 305-326.(1988).

19 Papers submitted for publication

43) On optimal control of coupled mean-field forward-backward stochastic equations, 2023 (with K. Bahlali and B. Mansouri)

44) On the maximum principle for relaxed control problems of non linear stochastic systems, 2023, (with M. Mezerdi).

45) The relaxed second order maximum principle in stochastic control of jump diffusions, 2023 (with H. Bengherbal)

46) Weak solutions to Coupled Quadratic FBSDEs and Sobolev Solutions to their Related PDEs, 2023

(with A. Elouaflin and K. Bahlali, S. Mouchtabih).

20 Talks and conferences

20.1 Some recent invited and plenary lectures

- On Some Recent Resulats in Optimal Control of McKean-Vlasov Stochastic Differential equations, ICOMAA2022), May11-14 2022, Yildiz Technical University,Turkey.
- Necessary and Sufficient Conditions for Optimality in Singular Control of Stochastic Differential Equations. International Conference on Mathematical of Finance, MFOA' 2019, Bejaia October, 28-29, 2019.
- Optimality conditions in Singular Control of SDEs. Inter. Conf. on Math., "An Istanbul Meeting for World Mathematicians" 3-5 July 2019, Istanbul, Turkey
- *Existence and optimality conditions in stochastic mean-field optimal control.* Conference in honor of Nicole El Karoui, Paris 22-24 May, 2019.
- *On optimal control of stochastic mean-field systems.* Journées en l'honneur de Prof. Youcef Atik, E.N.S. Kouba, Algiers, July 3rd, 2017.
- *Stochastic mean-field games and optimal control.* Winter School, Biskra, January 22-25, 2017
- *Some aspects of singular control.* Journées en l'honneur de Brahim Boufoussi, Marrakech Avril 2014.
- *An overview of optimal stochastic control*, Ecole CIMPA, Tlemcen Avril 2014.
- *Necessary and sufficient conditions in stochastic control*, WIMAM 3, Guelma, September 2014.
- *Optimal control of mean-field stochastic diffrential equations.* Journées de Maths Appliquées, ENSA Marrakech, June 2015.
- *Mean-field stochastic control problems.* International Conference on Stochastic Analysis and Applications Hammamet, Tunisia, October 19-23, 2015.
- *Existence and Maximum principle for Mean field stochastic control problems.* Colloque du LEM2I, Hammamet, Tunisia, Avril 28-May 1, 2016.
- *Existence and Maximum principle for Mean field stochastic control problems.* Workshop on applied Mathematics, Academie Tunisienne des Sciences des Lettres et des Arts, Beit El Hikma, 1-2 Février 2016.
- *Necessary and sufficient conditions for optimality in singular control*, 3ème Congrès du LEM2I, Rabat, Maroc, 12 - 15 Février, 2013.

- *Travaux de S. Bahlali en contrôle stochastique,* Workshop Proba.Stat., à la mémoire de S. Bahlali, Biskra, Algeria, January 29-30 , 2013.
- *On optimal control of mean-field systems*, ICRAPAM 2017, Kusadasi - Aydin, TURKEY, May 11-15 , 2017.
- *Stochastic Mean-field games and control.* Doctoriales Nationales de Mathématiques, ENS de Constantine, October 28-31, 2017.
- *On optimal control of stochastic mean-field systems.* Opening lecture of the conference of the Algerian Mathematical Society, November 2016.
- *On some aspects of singular control.* RAMA VII, Batna, Algeria, October 24-26, 2010.
- *Dynamic programming and the maximum principlein singular stochastic control*, 1er congrès du LEM2I, Tipaza, 19-22 Juin 2010.
- *On some aspects of singular control.* RAMA VII, Batna, Algeria, October 24-26, 2010.
- *Dynamic programming and the maximum principle in singular stochastic control*, 1er congrès du LEM2I, Tipaza, 19-22 Juin 2010.
- *Optimal Control of Systems Driven by Forward Backward Stochastic Differential Equations.* Journées M.A. Moussaoui, Alger, 12-14 Mai, 2012.
- *Optimal Control Forward Backward Stochastic Differential Equations.* Workshop "Stochastic Analysis and Applications", Ksar Kaissar El Kelaa Mgouna (Morroco), April 9 - 14, 2012.
- *Forward backward SDEs and optimal control.* RAMA 8, Algiers, November 26-29, 2012.
- *Existence and Maximum principle in the control of FBSDEs,* TAMTAM 09, Kenitra (Morroco), May 5-8, 2009, invited lecture.
- *Existence and optimality necassary conditions in stochastic control of FBSDEs.* Workshop : Finance and Insurance, Jena (Germany), March 16-19, 2009.
- *An existence result in the control of non linear FBSDE*, Vth International Workshop in Probability and Stochastic Analysis, Biskra, December 16-18, 2008.
- *Necessary and sufficient conditions for optimality in singular control*, 3ème Congrès du LEM2I, Rabat, Maroc, 12 - 15 Février, 2013.
- *On some aspects of singular control*, International Conference on Stochastic Analysis and Applications, Hammamet (Tunisia), October 11 – 16, 2009.

- *On some aspects of singular control of stochastic differential equations*, Séminaire international sur les Systèmes dynamiques et contrôle, Oum El Bouaghi, November, 07-10, 2009.

- *On some aspects of stochastic control*, Colloque international sur les EDP et leurs applications, Guelma, 5-7 Novembre 2007.

- *On some aspects of stochastic control*, Stochastic and Potential Analysis, Hammamaet (Tunisia) March 26-29, 2007

- *Singular control of stochastic differential equations*, Journées de mathématiques franco-algériennes, Constantine, November, 27-29, 2005.

20.2 Talks in International Seminars and Conferences

- On the derivability with respect to the initial condition of the solution of a stochastic differential equation with lipschitz coefficients. *Journées inter-universitaires d'Analyse convexe et probabilités, Marrakech 28-29 Janvier 1993.*

- Sur le flôt d'une équation différentielle stochastique dand $\mathbf{R}^d$ à coefficients non lipschitziens. *Journées inter-universitaires d'Analyse convexe et probabilités, Marrakech 28-29 Janvier 1993 .*

- Some generic properties of stochastic differential equations. *Workshop on stochastic processes, Academica Sinica, Beijing -China, 26-29 September 1994.*

- Pathwise uniqueness and approximation of solutions of stochastic differential equations . *$2^{èmes}$ journées maghrébines de Math.Appl., Bizerte-Tunisie, 1-5 Novembre 1994.*

- The maximum principle for optimal control of stochastic differential equations with non smooth coefficients. *2^{nd} International conference on differential equations, Marrakech June 16-20, 1995.*

- Stochastic differential equations with Sobolev space valued coefficients. *2^{nd} International conference on differential equations, Marrakech June 16-20, 1995.*

- A general maximum principle in stochastic optimal control of diffusion processes *.$5^{ème}$ Colloque maghrébin sur les modèles numériques de l'ingénieur, Rabat -Maroc, 21-23 Novembre 1995.*

- On the Haussmann Clarke representation formula for functionals of diffusion processes, *Conference internationale sur les maths appliquées et les sciences de l'ingénieur, Casablanca, 14-16 Novembre 1996.*

- The Pontriagin's maximum principle in optimal control of stochastic differential equations. 35^{th} scientific week, Alep Syria, 2-7 November 1996.

- *Representation of functionals of diffusion processes as stochastic integrals.* 1ère rencontre sur l'analyse mathématique et ses applications. M'sila 3-5 Mai 1997.

- *An integral representation formula and application to stochastic control.* $6^{ème}$ Colloque maghrébin sur les modèles numériques de l'ingénieur, 24-26 Novembre 1998, Tunis.

- *Approximation in relaxed stochastic optimal control problems.* $2^{ème}$ conférence internationale sur les mathématiques et application aux sciences de l'ingénieur, 27-28 Octobre 1998, Casablanca.

- *On the relaxed maximum principle in optimal control of stochastic differential equations.* $3^{ème}$ conférence internationale sur les mathématiques et application aux sciences de l'ingénieur (CIMASI 2000), 26-28 Octobre 2000, Casablanca.

- *Generic properties for backward stochastic differential equations.* Probability and its applications, Edit. D. Talay, Monte Carlo 3-5 July 2000.

- *On the maximum principle in stochastic control.* Ecole CIMPA, UNESCO "Approche probabiliste des équations aux dérivées partielles", Marrakech, Avril 2000.

- *On the maximum principle in optimal control of SDE driven by martingale measures.* Journées de Probabilités, Marrakech 12-13 Avril 2001.

- *On the stochastic maximum principle in optimal control of SDE driven by martingale measures.* Inter. Conf. Stoch. Anal. Appl., Hammamet, Tunisia, 22-27 October 2001.

- On the stochastic maximum principle in relaxed optimal control problems. *24th European meeting of Statisticians, Prague 19-23 August 2002.*

- On weak solutions of BSDE. *First International Workshop on Probability and Stochastic Analysis", Biskra December 6-8, 2003.*

- On the Haussmann Clarke Ocone formula for diffusion processes.*First International Workshop on Probability and Stochastic Analysis", Biskra December 6-8, 2004.*

- Approximation and Optimality necessary conditions in relaxed control problems, *Second International Workshop on Probability and Stochastic Analysis", Biskra December 11-16, 2004.*

- Optimality necessary conditions in singular control. *Third International Workshop on Probability and Stochastic Analysis", Biskra December 17-19„ 2005.*

- On the relaxed maximum principle of SDE. *Third Colloquium on Mathematics and Computer Science, Wien, Austria, September 13-17, 2004*

- Maximum principle in stochastic control. *CIMPA School "Modelisation of financial markets", Irbid, Jordan, September, 2005.*
- Lecture on Stochastic Control, CIMPA School Stochastic Methods in Mathematical finance, Marrakech, April 2007.
- Existence and necessary conditions for optimality in the control of FBSDEs, 2ème Rencontre des Mathematiciens Algériens, Alger, May 10-11, 2009.
- Sur la couverture des options en finance mathématique. Workshop on Applied Mathematics, Guelma, 25-26 November 2011.
- Existence and necessary conditions in the control of FBSDEs. Journée de Mathématiques: Seid Bahlali, Biskra, January 31, 2012.
- Dynamic programming and the maximum principle in stochastic singular control. 3rd Conference SM2A, Marrakech, Maroc, September 10-13, 2012.
- Sur la couverture des options en finance mathématique. Séminaire IMATH, Univ. Toulon, Juin2011.

20.3 Some talks in National Seminars and Conferences

- On the stable convergence of a sequence of Ito semi - martingales. *1^{er} congrés national de mathématiques, Tizi-ouzou ,21-23 Novembre 1994.*
- On Ekeland variational principle in optimal control of stochastic differential equations. *Conférence maghrébine sur les équations différentielles Annaba 18-20 Décembre 1994.*
- Approximation of stochastic differential equations, *Conférence maghrébine sur les équations différentielles, Annaba 18-20 Décembre 1994.*
- *Representation of functionals of diffusion processes as stochastic integrals.* 1ère rencontre sur l'analyse mathématique et ses applications. M'sila 3-5 Mai 1997.
- *An approximation result in stochastic control.* $2^{èmes}$ Journées de statistique appliquée. Université d'Alger 30 Novembre-03 Décembre1997.
- *Generic properties of stochastic differential equations.* $2^{èmes}$ Journées de statistique appliquée. Université d'Alger 30 Novembre-03 Décembre1997.
- *A stability property in relaxed stochastic optimal control problems.* Congrès national de mathématiques, Annaba 17-19 Mai 1999.
- *On the stochastic maximum principle for diffusions controlled by measure valued processes.* Congrès national de mathématiques, Annaba 17-19 Mai 1999.

- *Estimation L^p-locale des distributions de semi-martingales. Application aux EDS.* $2^{ème}$ rencontre nationale des mathématiciens algériens. Alger Mai 2000.
- *On the Haussmann Clarke formula for diffusion processes.* $2^{ème}$ rencontre nationale des mathématiciens algériens. Alger Mai 2000.
- *A strong approximation property in relaxed stochastic control problems.* $2^{ème}$ rencontre nationale des mathématiciens algériens. Alger Mai 2000.
- *Necessary conditions in relaxed stochastic control problems.* 4ème Conf. Magh. sur les Equ. diff., Sétif 24-26 Octobre 2000.

20.4 Some invited talks in weekly seminars and courses

- An Overview of Optimal Control of Mean-Field Stochastic Differential equations, Polytechnic Univ. Med VI, Morocco, June 7, 2022.
- *On the relaxed stochastic maximum principle for mean-field control problems,* Seminar at BTU Cottbus-Seftenberg, Germany, Feb. 3rd, 2021.
- *An Overview of Mean Fied Games and Mean-Field Optimal Control*, Seminar at the Algerian Academy of Science and Technology, Algiers June 5th, 2021.
- *Survey of Stochastic differential equations and stochastic control*, Seminar of the Dept of Maths KFUPM, January 23, 2019.
- *Stochastic control and mean-field games.* Seminar of the Dept of Maths KFUPM, January 30, 2019.
- *Optimal control of stochastic differntial equations.* In KFUPM-IAU Workshop, April 25, 2019.
- *A survey of stochastic control. Seminar at Cadiz university, Spain, September 2017.*
- *A maximum principle in relaxed stochastic control problems. Royal Institute of Technology, Division of Mathematical Statistics, Stockholm (Sweden), May 27th, 2002.*
- *Principe du maximum pour les problèmes de controle stochastique relaxé. Université of Le Mans (France), May 12, 2002.*
- *Conditions nécessaires d'optimalité pour des problèmes de contrôle relaxé, CPT, Marseille, June, 15, 2005.*
- *Series of Lectures on stochastic control*, University of Tlemcen, February 2005.
- *Lectures on SDE and stochastic control.* Ecole Normale Supérieure, Algiers, February 2006.

21 Main research results and perspectives

My research is mainly focused on three areas: the Itô stochastic differential equations, backward stochastic differential equations and stochastic optimal control.

I) Ito stochastic differential equations (SDE)

SDEs were introduced by K. Itô in the 40s, to build the paths associated with Markov processes associated with elliptic operators. To do so, he invented the stochastic calculus that bears his name, to give meaning to stochastic differential equations, whose solutions are of Markov processes. Thus, he gave a probabilistic alternative to Kolmogorov method based on partial differential equations that bear his name. It is well known that under Lipschitz assumptions on the coefficients, a SDE has a unique solution, stable with respect to initial conditions and coefficients. In [6], under the assumption of pathwise uniqueness and continuity of the coefficients, we proved that the solution remains stable with respect to the coefficients and the initial conditions, in the space of continuous functions and as well as in Hölder space. Furthermore, we have shown in [4] that the set of coefficients for which existence, uniqueness and stability of the solution hold, is of second category in the sense of Baire.

II) **Backward stochastic differential equations (BSDE)**

The BSDEs were introduced for the first time by J.M. Bismut in 1973, in the stochastic control framework. More precisely, he proved that the adjoint process intervening in the Pontriagin maximum principle, satisfies a linear BSDEs. The nonlinear case with Lipschitz coefficients was treated by Pardoux and Peng in 1990. Since then, this theory has proved very useful in financial mathematics and semi-linear and quasi-linear PDEs. In [14], we showed the existence of minimal and maximal solutions for reflected BSDEs with two barriers and with quadratic growth in z, satisfying the Mokobodski hypothesis on the barriers. Moreover, in [19], we have shown a result of existence of weak solutions using the Girsanov theorem.

III) Stochastic Control

This is an essential part of my work and turn around the stochastic maximum principle and its variants. One of the problems I was interested in, is to demonstrate this principle, under weaker conditions on the coefficients. In [1] and in my PhD thesis, I proved a maximum principle in the case where the drift is only Lipschitz, using the generalized Clarke gradients. More precisely, the adjoint process is built on a wider space, with a probability measure whose support is given by the generalized gradient of the drift.This result can be interpreted as the stochastic counterpart of the differential inclusion in deterministic control. We proposed in [18], a probabilistic method to treat the case of Lipschitz coefficients, based on derivatives in the sense of distributions and on Bouleau and Hirsch flow theorem. The other issue on which I worked relates to relaxed controls. These are measure valued processes, for which we know under certain assumptions, the existence of an optimal solution. In [11], we proved the necessary optimality conditions in the case of a controlled drift. This result was extended in [16], to the case where all coefficients are controlled, using martingale measures. Singular control problems has been an important part of

my research in recent years. These problems arise naturally, when looking at the consumption-investment problems with transaction cost. In particular, we have shown a maximum principle in the case where only the drift is controlled by a random measure [17], in the case where all coefficients are controlled in [15] generalizing the result of Peng and finally if the coefficients are less regular in [21]. We explored in [25,29] the link between the maximum principle and the Bellmann principle. This result states that the adjoint process is given by the gradient of the value function along the optimal trajectory.

IV) Perspectives

I plan to continue working on the theme of stochastic control, for mean field systems. These systems are particularly involved in game theory, when we are dealing with a large number of players. The state equations are obtained by approximation and where the drift and the diffusion coefficient depend not only on the process itself but also its probability distribution. This theory was invented by PL Lions and JM Lasry in 2006, to solve the problem of existence of a Nash equilibrium, if the number of players is large enough. We have already existence results of optimal relaxed controls as well as optimality necessary conditions for relaxed controls in [31, 35, 40]. The following questions will be investigated in the near future.

- *Dynamic programming for control problems driven by stochastic McKean-Vlasov equations and their application to mean-field games.*
- *Application of mean field systems to financial problems with many small investors.*
- *Maximum principle for mixed regular singular mean-field control problems and application to consumption investment problems in finance.*
- *Properties of Mc Kean-Vlasov stochastic differntial equations such as existence, uniqueness, stability, genericity.*
- *Maximum principle for mean-field control problems with non smooth coefficients.*
- *Backward stochastic differential equations and application to the recursive utility* problems in economics.