

Daniel Dufresne, PhD

Montreal, Canada

dan@ozdaniel.com

SUMMARY

Current work and projects:

Consulting. Option pricing; statistics; investment modelling; Monte Carlo simulation; computing using Python and other languages.

Diagnostic of mental illnesses using brain imaging and deep learning. With F. Vázquez-Abad (Computer Science, City University of New York).

Part-time teaching. Financial mathematics, Python programming, machine learning, at the Dept of Mathematics and Statistics, University of Montreal.

Research project in financial modelling. Asian options.

Previous employment: Professor, Faculty of Business and Economics, University of Melbourne, Australia, 2003-2017.

Education: BSc (Mathematics), University of Montreal; PhD University of London. Fellow of the Society of Actuaries (FSA).

Job History

1981-82	Actuarial consulting work at The Wyatt Co. and Towers Perrin (Montreal, Canada).
1986-88	Assistant Professor, Dept. of Mathematics, Statistics and Actuarial Science, Laval University (Quebec City).
1988-1997	Assistant Professor, then Associate Professor, Dept. of Mathematics and Statistics, University of Montreal. Coordinator of Actuarial Studies program. Occasional lecturer at Concordia University.
1991	Course given at the University of Brussels (Belgium): Holder of the “Chaire de mathématiques actuarielles de l’Union professionnelle des entreprises d’assurance”.
1997	Lecturer at Université Louis Pasteur, Strasbourg, France.
1997-99	Senior Lecturer at the Centre for Actuarial Studies, University of Melbourne.
1999-2002	Professor at the Dept. of Mathematics and Statistics, University of Montreal.
2003-2017	Professor at the Centre for Actuarial Studies, University of Melbourne. Director of the Centre from 2009 to 2013. Program Director, Master of Actuarial Science and Master of Commerce (Actuarial Science).

Studies

1981	First degree in mathematics at the University of Montreal. Associate of the Society of Actuaries (ASA).
1986	PhD (Actuarial Science) at The City University (London, England), with Commonwealth Scholarship (UK) and Natural Sciences and Engineering Council Scholarship (Canada). Thesis wins Ellis Horwood Prize.
Professional designations	Fellow of the Society of Actuaries. Member of Bachelier Society (financial mathematics).

Recent Talks

“Stochastic Difference Equations and Properties of Hypergeometric Functions”, seminar, Department of Mathematics, University of Illinois, 31 January 2017.

“Some new formulas for the pricing of discrete and continuous average Asian options”, Mathematics of Risk Conference, Melbourne, Australia, 27 November 2017.

“Discounted Sums: A General Framework”, seminar, Department of Mathematics and Statistics, Concordia University, 10 February 2017.

“Gram-Charlier Processes and Option Pricing”, 9th World Congress of the Bachelier Finance Society, New York, 15-19 July 2016.

“Discounted Sums with Renewal Times”, invited lecture, Melbourne-Monash Probability Day, School of Mathematics and Statistics, University of Melbourne, 2 June 2016.

“Convergence of Gram-Charlier series”, Hunter College, City University of New York, Institute for Computer Simulation Stochastic Modeling and Optimization, 14 December 2015.

“Change of Dimension for Pricing Asian Options: Downsizing” Hunter College, City University of New York, Institute for Computer Simulation Stochastic Modeling and Optimization, 3 December 2015.

“Pricing Asian Options: Two New Techniques”. 59th Meeting of the Australian Mathematical Society, Flinders University, Adelaide, Australian Mathematical Society, 29 September 2015.

“Pricing Asian options: Convergence of Gram-Charlier Series”, ASTIN, AFIR-ERM and International Association of Consulting Actuaries (IACA) Colloquia, Sydney (Australia), 24 August 2015.

“Marc Yor’s Contribution to the Pricing of Asian Options”, invited lecture, Symposium In Memory de Marc Yor, Université Paris 7, Académie des Sciences de France, Société Mathématique de France, 4 June 2015.

“In Memory of Marc Yor”, invited lecture, 5th Ritsumeikan-Monash Symposium on Probability and Related Fields Monash University, Melbourne, Australia, 25 March 2015.

“Some Two-Dimensional Extensions of Bougerol’s Identity In Law for The Exponential Functional of Linear Brownian Motion”, 5th Monash-Ritsumeikan Symposium on Probability and Related Fields, Monash University, Melbourne, Australia, 25 March 2015.

Research Grants

1986-88	Research grant from Laval University.
1988 to 2003	Individual Research Grant from the Natural Sciences and Engineering Council of Canada (NSERC). Renewed every 3 years.
1989-90	Research grant from University of Montreal.
1990-93	Individual Research Grant from the Fonds FCAR (Canada).
1991	Research contract from Environnement Canada (ecology).
1991-93	Research grant from the Actuarial Education and Research Fund (AERF, Society of Actuaries): <i>Some Aspects of Financial Accounting Standards No. 87</i> .
1993-95	Research grant from AERF: <i>Actuarial Gains and Losses: A Martingale Approach</i> .
1996-98	Research grant from the Committee on Knowledge Extension and Research (CKER, Society of Actuaries), with J-P. Chateau, Rouen School of Management, France: <i>Valuation of Credit Line Commitments Subject to Credit Risk</i> .
1998	Australian Research Council Small Grant. Research grant from the Faculty of Commerce and Economics Research (University of Melbourne).
1999	Research grant from AXA. Research grant from the Institute of Actuaries of Australia: <i>On a General Class of Risk Models</i> . Research grant from AERF: <i>Actuarial and Financial Applications of Lévy Processes</i> .
2001-2003	Contracts from BP Canada (options on natural gas).
2003	Research grant from the Faculty of Commerce and Economics. Research Grant (University of Melbourne).
2004	Research grant from CKER: <i>The Distribution of the Sum of Lognormals</i> .
2007	Grant from FIRN (Financial Integrity Research Network) to bring Professor Marc Yor (France) to Australia in December 2007.
2009-2013	Australian Research Council Linkage Grant (with F. Vázquez-Abad, CUNY, industrial partner BHP Billiton, \$316,000): <i>Understanding Cycles in Mineral Commodity Prices, a Market Model with Uncertainty</i> .
2011-2015	Research grant from CKER (Society of Actuaries): <i>Gram-Charlier Distributions in Finance</i> .

Publications

Papers may be found at <http://ozdaniel.com/A/publications.html>

Google citation counts are available at:

https://scholar.google.com.au/citations?hl=&user=j_6qgPsAAAAJ

Dufresne, D. (1986). *The Dynamics of Pension Funding*. PhD thesis, School of Actuarial Science and Statistics, The City University, London (England).

Dufresne, D. (1986). Pension funding and random rates of return. In: *Insurance and Risk Theory*, M. Goovaerts, F. de Vylder, and J. Haezendonck (Editors), *Proceedings of the NATO Advanced Study Institute*, Maratea, Italy, 15-25 July, 1985.

Dufresne, D. (1988). Comparison of funding methods in a static environment. *Transactions of the Twenty-Third International Congress of Actuaries*, Helsinki, Finland, 1988 **2**: 99-114.

Dufresne, D. (1988). Moments of pension contributions and fund levels when rates of return are random. *Journal of the Institute of Actuaries* **115**: 535-544.

Dufresne, D. (1989). Stability of pension systems when rates of return are random. *Insurance: Mathematics and Economics* **8**: 71-76.

Dufresne, D. (1989). Weak convergence of random growth processes with applications to insurance. *Insurance: Mathematics and Economics* **8**: 187-201.

Dufresne, D. (1990). Fluctuations of pension contributions and fund levels. *Actuarial Research Clearing House* **1990.1**: 111-120.

Dufresne, D. (1990). The distribution of a perpetuity, with applications to risk theory and pension funding. *Scand. Actuarial J.* **1990**: 39-79.

Dufresne, D. (1991). Discussion of "Stochastic life contingencies with solvency considerations", by Edward Frees, *Transactions of the Society of Actuaries* **52**: 131-145.

Dufresne, D. (1992). Distributions of discounted values. *Actuarial Research Clearing House* **1992.1**: 11-24.

Dufresne, D. (1992). On discounting when rates of return are random. *Transactions of the Twenty-Fourth International Actuarial Congress*, Montreal, 1992, **1**: 27-44.

Dufresne, D. (1993). Current research on pension accounting. *Actuarial Research Clearing House* **1993.1**: 321-331.

Dufresne, D. (1993). *Some Aspects of Statement of Financial Accounting Standards No. 87*. Report of project sponsored by the Actuarial Education and Research Fund. Also appeared in *Actuarial Research Clearing House* **1993.2**: 1-130.

Dufresne, D. (1994). *Mathématiques des caisses de retraite* (Mathematics of Pension Funding). Éditions Supremum, Montreal. 200 pages.

Dufresne, D. (1995). *Actuarial Gains and Losses: A Martingale Approach*. Report on project sponsored by the Actuarial Education and Research Fund.

Dufresne, D. (1996). On the stochastic equation $L(X) = L[B(X + C)]$ and a property of gamma distributions. *Bernoulli* **2**: 287-291.

Dufresne, D. (1996). From compound interest to Asian options. *Quarterly Journal of the Institute of Actuaries of Australia* **2**: 2-17.

Dufresne, D. (1996). *Stochastic Calculus: A Tool for Finance*. 70 pages. Unpublished.

- Dufresne, D. (1997). Discussion of Z. Khorasanees paper "Deterministic modelling of defined contribution pension funds". *North American Actuarial Journal* **1**: 100-101.
- Alili, L., Dufresne, D., and Yor, M. (1997). Sur l'identité de Bougerol pour les fonctionnelles exponentielles du mouvement brownien avec drift. In: *Exponential Functionals and Principal Values Related to Brownian Motion. Part A : Exponential Functionals*, pp. 3-14. Biblioteca de la Revista Matematica Iberoamericana, Madrid.
- Boyle, P., Cox, S., Dufresne, D., Gerber, H., Mueller, H., Pederson, H., Pliska, S., Sherris, M., Shiu, E., and Tan, K.S. (1998). *Financial Economics: With Applications to Investments, Insurance and Pensions*. Actuarial Foundation, Chicago. 670 pages.
- Chateau, J.P., and Dufresne, D. (1998). Valuing the stochastic volatility put option of banks' credit line commitments. *Proceedings of the International Conference of Finance*, Association française de finance, Lille, France.
- Dufresne, D. (1998). Algebraic properties of beta and gamma distributions, and applications. *Advances in Applied Mathematics* **20**: 285-299.
- Vázquez-Abad, F., and Dufresne, D. (1998). Accelerated simulation for pricing Asian options. Invited paper, *Proceedings of the 1998 Winter Simulation Conference Proceedings* 1493-1500.
- Chateau, J.P., and Dufresne, D. (1998). Pricing the put option of bank credit commitments: A two-factor model of credit risk. Final report of CKER project, Society of Actuaries.
- Dufresne, D. (2000). Laguerre series for Asian and other options. *Mathematical Finance* **10**: 407-428.
- Bédard, D., and Dufresne, D. (2001). Pension funding with moving average rates of return. *Scand. Actuarial J.* **101**: 1-17.
- Dufresne, D. (2001). The integral of geometric Brownian motion. *Advances in Applied Probability* **33**: 223-241.
- Dufresne, D. (2001). Some thoughts on the pricing of insurance liabilities. *Magazine of the Actuarial Students' National Association* **2001**: 12-14.
- Dufresne, D. (2001). An affine property of the reciprocal Asian process. *Osaka Journal of Mathematics* **38**: 379-381.
- Dufresne, D. (2001). On a general class of risk models. *Australian Actuarial Journal* **7**: 755-791.
- Chateau, J.P., and Dufresne, D. (2002). Banks' regulatory capital requirement: Pricing the credit risk of short-term loan commitments. *Proceedings of the Regulation and Deregulation of Financial Markets Conference*, Principality of Liechtenstein, June 2002.
- Chateau, J.P., and Dufresne, D. (2002). The stochastic-volatility American put option of banks' credit line commitments. *International Review of Financial Analysis* **107**: 159-181.
- Dufresne, D. (2003). The integral of the square-root process. Working paper.
- Dufresne, D. (2004). The lognormal approximation in financial and other computations. *Advances in Applied Probability* **36**: 747-773.

- Dufresne, D. (2005). Bessel processes and Asian options. In: *Numerical Methods in Finance*, H. Ben-Ameur and M. Breton (Editors.), Kluwer Academic Publisher.
- Dufresne, D. (2005). Two notes in financial mathematics. *Actuarial Research Clearing House* **2005.2**.
- Dufresne, D. (2007). Fitting combinations of exponentials to probability distributions. *Applied Stochastic Models in Business and Industry* **23**: 23-48.
- Dufresne, D. (2007). Stochastic life annuities. *North American Actuarial Journal* **11**: 136-157.
- Dufresne, D. (2008). *The Distribution of Realized Volatility in Stochastic Volatility Models*. Course notes presented at the Barcelona Financial Engineering Seminar, Centra de Recerca Matemàtica, Barcelone, 2008. 63 pages.
- Dufresne, D. (2008). Sums of lognormals. *Actuarial Research Clearing House* **2009.1**.
- Dufresne, D. (2008). Discounted claims in a renewal risk model. *Actuarial Research Clearing House* **2009.1**.
- Dufresne, D., Garrido, J., and Morales, M. (2009). Fourier inversion formulas in option pricing and insurance. *Methodology and Computing in Applied Probability* **11**:359-383.
- Dufresne, (2010). Beta products with complex parameters. *Communications in Statistics - Theory and Methods* **39**: 837-854.
- Dufresne, D. (2010). G distributions and the beta-gamma algebra. *Electronic Journal of Probability* **15**: 2163-2199.
- Dufresne, D. (2010). Stochastic volatility and option pricing. *Risks and Rewards* **55**:28-31.
- Dufresne, D., and Yor, M. (2011). A two-dimensional extension of Bougerol's identity in law for the exponential functional of Brownian motion. Centre for Actuarial Studies Research Papers no.222. 15 pages.
- Chin, S., and Dufresne, D. (2012). A general formula for option prices in a stochastic volatility model. *Applied Mathematical Finance* **19**(4): 313-340.
- Bertoin, J., Dufresne, D., and Yor, M. (2013). Some two-dimensional extensions of Bougerol's identity in law for the exponential functional of linear Brownian motion. *Revista Matemática Iberoamericana* **29**(4): 1307-1324.
- Dufresne, D., and Vázquez-Abad, F. (2013). Cobweb theorems with production lags and price forecasting. *Economics: The Open-Access, Open-Assessment E-Journal*, **7** **2013-23**.
<http://dx.doi.org/10.5018/economics-ejournal.ja.2013-23>.
- Dufresne, D., Vázquez-Abad, F.J., and Chin, S. (2014). Change of measure for the square root process. *Proceedings of the 2014 Winter Simulation Conference*. A. Tolk, S. D. Diallo, I. O. Ryzhov, L. Yilmaz, S. Buckley, and J. A. Miller, eds, Savannah, Georgia, December 2014: 465-475.
- Dufresne, D., and Li, H. (2016). Pricing Asian options: Convergence of Gram-Charlier series. 20 pages. *Actuarial Research Clearing House* **2016.2**. Available at:
<https://www.soa.org/Library/Proceedings/Arch/2016/arch-2016-iss2.aspx>

Dufresne, D. (2016). *Introduction to Probability and Stochastic Calculus*. Aimed at business or actuarial students, as background for derivative pricing. Unpublished.

Chateau, J.-P., and Dufresne, D. (2017). Gram-Charlier processes and applications to option pricing. *Journal of Probability and Statistics*, vol. 2017, Article ID 8690491. <https://www.hindawi.com/journals/jps/2017/8690491/>.

Dufresne, D., Ho, T.L., and Leung, J. (2017). Speeding up the QE algorithm for the Heston stochastic volatility model (with Python code). In preparation.

Dufresne, D., and Vázquez-Abad, F. (2017). Downsizing, upsizing for Asian options. In preparation.

Dufresne, D., Novikov, A, and Vostrikova, L. (2018). New results on functionals of Brownian motion and fractional Brownian motion. In preparation.

Dufresne, D., and Zhang, Z. (2018). Discounted sums with renewal times. Submitted for publication.

Vázquez-Abad, F., Flynn, T., and Dufresne, D. (2018). Dynamic mollifiers to deal with discontinuities in machine learning. In preparation.

Books

The first part of *Mathématiques des caisses de retraite* (1994) is a description of financial and actuarial valuation methods for pension liabilities, presented in a modern fashion. The second part gives a martingale interpretation of gains and losses; the latter arise in practice in Canada and the US. The third part deals with asset-liability modelling. The book is aimed at undergraduate and graduate students.

The collective work *Financial Economics: With Applications to Investments, Insurance and Pensions* (1998) was commissioned by the Actuarial Foundation (affiliated to the Society of Actuaries). It covers financial markets and derivatives, interest rate risk and immunization, no-arbitrage pricing, equilibrium pricing, term structure of interest rates, optimal portfolios.