CURRICULUM VITAE

Peter A. Forsyth

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EDUCATION:

1977-79	Ph.D. University of Western Ontario London, Ontario, Canada
1975-77	M.Sc. Australian National University Canberra, Australia
1971-75	B.Sc. University of Western Ontario London, Ontario, Canada

EXPERIENCE:

2016 - present	Distinguished Professor Emeritus Cheriton School of Computer Science, University of Waterloo, Waterloo, Ontario, Canada.
1993 - 2016	Professor Cheriton School of Computer Science, University of Waterloo
2009 - 2011	Associate Director (Computing and Infrastructure) Cheriton School of Computer Science University of Waterloo
2006 - 2008	Scientific Director Institute for Quantitative Finance and Insurance University of Waterloo
2002 - 2005	Associate (Vice) Director Cheriton School of Computer Science University of Waterloo

1995 - 1998	Director Institute for Computer Research University of Waterloo
1991 - 1993	Associate Chair (Graduate Studies) Department of Computer Science University of Waterloo
1987 - 1993	Associate Professor Department of Computer Science, University of Waterloo
1985 - 1987	President Dynamic Reservoir Systems, Calgary, Alberta, Canada.
1979 - 1985	Senior Simulation Scientist (and other positions) Computer Modelling Group, Calgary, Alberta, Canada.

Recent Awards

Brockett-Shapiro Actuarial Journal Award (2021) Co-winner (with K. Vetzal and G. Westmacott) of the Brockett-Shapiro Actuarial Journal award (2021) for the most valuable contribution to risk and insurance. This award, sponsored by the American Risk and Insurance Association (ARIA), recognizes the paper *"Management of Portfolio Depletion Risk through Optimal Life Cycle Asset Allocation,"* published in the North American Actuarial Journal in 2019.

Chris Daykin Award (2025) Co-winner (with K. Vetzal and G. Westmacott) of the Chris Daykin Award (2025), for the best pension-related paper published in the 2024 ASTIN Bulletin – The Journal of the IAA. This award, sponsored by the International Association of Actuaries, Pension Benefits and Social Security Section (PBSS) recognizes the paper *"Optimal performance of a tontine overlay subject to withdrawal constraints,"* published in the ASTIN Bulletin in 2024.

Research Interests

Computational finance, numerical methods for optimal stochastic control, sparse matrix algorithms, nonlinear partial integro-differential equations.

Short Courses Taught

- Real options and finance: optimal stochastic control formulation and solution techniques. Seven hours of lectures, co-taught with Margaret Insley. Coruna, Spain, 2015.
- Numerical methods for Hamilton Jacobi Bellman equations in finance. This research level mini-course (eight hours of lectures) has been given in Singapore (2009), the Netherlands (2010), Vienna (2012), Coruna (Spain, 2012), Singapore (2013), Amsterdam (2015).

- Numerical PDE methods for path dependent options. Two day short course, combines lectures and Matlab exercises. Co-taught with Ken Vetzal. This course has been given in New York City (2001, 2003, 2004, 2005), Tokyo (2001), Toronto (2002), Ithaca, NY (2001, 2002) and Waterloo (2006, 2007, 2009, 2010).

- Convertible bonds: pricing theory and algorithms. One day short course, lectures and software demonstrations. Co-taught with Ken Vetzal, Elie Ayache. Given in New York City (2003), Paris (2004).

Commercially Developed Software

Dynamic Reservoir Simulator (developed with P.H. Sammon, A. Behie). Black oil reservoir simulation model for primary production, waterflooding, and coning. Duke Energy currently supports and markets this software. This package has been purchased by over thirty petroleum companies.

IMEX (developed with A. Behie, P.H. Sammon). Adaptive implicit black oil model. This code continues to be marketed and supported by the Computer Modelling Group, Calgary. Over 200 licenses sold.

Licensed Software Developed at Waterloo

WATSIT (developed with J. Kightley, S. Clift, E. D'Azevedo). Iterative sparse matrix solution package. This library has been purchased by such organizations as: HydroGeoLogic Inc. (Herndon, VA), Westinghouse Hanford (Richland, WA), Boeing (Seattle), Los Alamos National Laboratory, Lawrence Berkeley National Laboratory, Sandia National Laboratory, Phillips Petroleum (Bartlesville), TRW Safety Systems (Los Vegas), Desert Research Institute (Los Vegas), and Atomic Energy of Canada (Pinawa). This software has also been distributed to a number of academic sites.

PCG5 This sparse iterative solver is embedded in simulation software (Visual Modflow, Modflow Surfact) developed by HydroGeoLogic Inc (Herndon, VA). Since 2005, about 300 licenses have been sold.

Consulting Experience

Research related consulting for such organizations as: Aquanty Inc. (Waterloo), TGINet/Cornell (Tokyo), SunLife of Canada, NOVA Corporation (Calgary), the Electric Power Research Institute (Mountain View, CA), Smithville Bedrock Remediation Corporation (Smithville Ont.), Los Alamos National Laboratory, Phillips Petroleum (Bartlesville), US Environmental Protection Agency, Oak Ridge National Laboratory, Lawrence Berkeley National Laboratory, NASA ICASE (Langley, VA), and HydroGeoLogic (Herndon, VA).

Editorial Boards

- Journal of Computational Finance (Editor-in-Chief, 2008-2013, Associate Editor, 2003-2008, 2013-2023)

- Applied Mathematical Finance (Associate Editor, 2004-2023)
- Encyclopedia of Quantitative Finance (section co-editor (with D. Lamberton), PDEs and Numerical Methods, 2007-2008).
- Applied Numerical Mathematics (guest co-editor, special issue on Iterative Methods, 2008).
- Advances Water Resources (Associate Editor, 1998-2001)

Recent Research Service

- Member, organizing committee, SIAM Conference on Financial Mathematics and Engineering, Austin, 2016.
- Member, MITACS Research Management Committee (2008-11).
- Scientific Director, Institute for Quantitative Finance and Insurance (Waterloo, now WATRISQ, 2006-2008).
- Member of organizing committee, Fields Institute numerical analysis year (2001-2002).
- NSF Panel member (*Computational Mathematics* (2001)).
- Grant selection committee member, CITO, *Modelling and simulation*, 1998-2000.
- Director, Institute for Computer Research (Waterloo, 1995-1998). Organized over twenty-five short courses with industrial participants; also coordinated Waterloo submissions to ORDCF and CFI related to Bell Canada University Laboratory research initiative (total funding received from Bell, ORDCF and CFI in excess of $20 million over three years).
- Workshops, Conferences Co-organized
  - Conference on Computational Methods in Finance, University of Waterloo, July, 2007
  - Workshop on Real Options in Telecommunications, University of Waterloo, May 2003
  - Workshop on Computational Methods and Applications in Finance, Fields Institute, University of Toronto, February 2002

Graduate Student Supervision

PhD

C. Ni (2024, co-supervisor Y. Li)
P. van Staden (2020, Queensland, principal supervisor D.M. Dang)
K. Ma (2015)
S.T. Tse (2012, co-supervisor J. Wan)
Y. Huang (2011)
J. Wang (2010)
Z. Chen (2008)
A. Belanger (2008, co-supervisor G. Labahn)
S. Kennedy (2007, co-supervisor G. Labahn)
S. Clift (2007)
Y. d'Halluin (2004)
H. Windcliff (2003)
D. Pooley (2003)
R. Zvan (2000, co-supervisor K. Vetzal)
A. Unger (1995, co-supervisor E. Sudicky)

MMath

Zeyu Zhang (2025, co-supervisor Y. Li)
Yuan Liu (2025, co-supervisor Y. Li)
Q. Cao (2025, co-supervisor Y. Li)
M. Chen (2023, co-supervisor Y. Li)
M. Shirazi (2023, co-supervisor Y. Li)
Y. Guo (2020, co-supervisor Y. Li)
B. Na (2020, co-supervisor Y. Li)
B. Xu (2018, co-supervisor G. Labahn)
C. Shan (2014, co-supervisor G. Labahn)
J. Lippa (2013, co-supervisor G. Labahn)
A. Asare (2013, co-supervisor G. Labahn)
P. Azimzadeh (2013)
H. Su (2013, co-supervisor G. Labahn)
M. Ma (2013, co-supervisor G. Labahn)
X. Peng (2013)
Z. Wang (2012, co-supervisor G. Labahn)
X. Guan (2012)
C. Morley (2011, co-supervisor G. Labahn)
J. Babbin (2011, co-supervisor G. Labahn)
D. Fagnan (2011, co-supervisor G. Labahn)
Y. Sohrabi (2011)
W. Xiao (2010)
D. Saraph (2010, co-supervisor G. Labahn)
B. Wang (2010)
J. Aquan-Asee (2009, co-supervisor G. Labahn)
M. Yu (2007)
J. Kraus (2007, TU Munich, co-supervisors, Zagst, Grau)
L. Xiao (2006, co-supervisor, K. Vetzal)
J. Wang (2005)
P. Lizak (2004)
A. Grau (2003)
C. Cheng (2002)
M.C. Lam (2002)
W. Morland (2001)
H. Windcliff (2000)
Y. d'Halliun (2000, co-supervisor G. Labahn)
M. Fitzgerald(1999)
D. Pooley(1999, co-supervisor R.B. Simpson)
L. Wang (1998)
T. Zvi (1998)
E. Carr (1997)
S. Friedman (1996)
H. Li (1996)
R. Zvan (1996)
B.Y. Shao (1994)
S. Clift (1993)
Y. Qian (1993)
J. Dickinson (1993)
P. Chin (1991, co-supervisor W.L. Seward)
M.C. Kropinski (1990)
F.W. Letniowski (1989)
T. Natalisa (1988)
W.S. Nugroho (1988)

Students Currently Supervised

Sadman Khan (joint with Li) (MMath)
Boris Leung (joint with Li) (MMath)

PhD Examining Committees

K. Andersson (Mathematics, Utrecht) 2023.
J. Zhang (Statistics) 2018.
N. Leung(CS, Toronto) 2017.
F. Cong (Mathematics, Delft) 2016.
B. Kimmel (CS) 2016.
A. Rajabi (CS) 2016.
S. Amarala (CS) 2015.
O. Ardakanian (CS) 2015.
M. Ruijter (Mathematics, Delft) 2015.
K. Zhou (Systems Engineering, CUHK) 2014.
A. Tayal (CS) 2014.
K. Miller (Applied Mathematics) 2012.
J. Witte (Mathematics, Oxford) 2012.
H.T. Hwang (Earth Sciences) 2012.
V. Surkov (CS, Toronto) 2009.
A. Rohani (ECE) 2006.
H. Li (Mathematics, Calgary) 2006.
R. Maji (Earth Sciences) 2005.
M. Steigleider (CS) 2005.
M. Ayatollah (ECE) 2004.
K. Lau (Computer Science, UHKST) 2004.
A. Borji (ECE) 2004.
W. Annable (Earth Sciences) 2003.
Y. Wang (ECE) 2000.
V. Van (ECE) 1999.
J. VanderKwaak (Earth Sciences) 1999.
P. Zwart (Mechanical Engineering) 1999.
J. Grad (Applied Mathematics) 1997.
K. MacQuarrie (Earth Sciences) 1997.
L. Zhang (Earth Sciences) 1997.
I. Murray (Applied Math) 1994.
M. Ibaraki (Earth Sciences) 1994.
C. Mendoza (Earth Sciences) 1992.
R. Heywood (Mechanical Engineering) 1992.
R. Therrien (Earth Sciences) 1992.
A. Bajor (Chem. Eng.,Toronto) 1990.
S. Ormiston (Mechanical Engineering) 1990.
W. Drennan (Applied Mathematics) 1988.
E. Fraga (CS) 1988.

Administrative Duties

Member, Business at Waterloo Committee (2016)
Member, School Advisory Commitee on Appointments (2015-2016)
Member, Director Search Committee, School of Accounting and Finance (2015)
Member, UW Pension and Benefits Committee (2014-2016)
Member, UW Registered Pension Plan Investment Commitee (2014-2016)
Member, Faculty Association Academic Freedom and Tenure Committee (2012-2016)
Member, School Advisory Commitee on Appointments (2011-2012)
Member, CS Graduate Committee (2011-14)
Member, University Senate (2010-2012)
Member, University Committee on Information Systems and Technology (2009-10).
Chairman, CS Computing Facility Committee (2009-2011).
Member, Engineering Faculty Promotion and Tenure Committee (2007-08).
Scientific Director, Institute for Quantitative Finance and Insurance (2006-2008).

Associate Director, Computing and Financial Management Program (2005-2008).
Member, School of Computer Science Promotion and Tenure Committee (2005-07, 2009-10).
Member, School of Computer Science Director Selection Committee (2005).
Member, Dean of Mathematics Selection Committee (2004-2005).
Member, University Senate (2004-2007).
Associate Director, School of Computer Science (2002-2005).
Member, External Relations Committee (2002-2005).
Member, CS Computing Facility Committee (2002-2005).
Member, CS Budget Committee (2002-2005).
Member, Science Faculty Promotion and Tenure Committee (2001-2002).
Member, Computer Science Governance Committee (2001).
Member, Eyton Chair selection Committee (2000-2001).
Member, Mathematics Faculty Promotion and Tenure Committee (1998-2001)
Member, Graduate Committee (CS) (1997-2002)
Member, Engineering Faculty Promotion and Tenure Committee, (1996-97)
Member, Chair selection Committee (CS), (1996-1997).
Member, Promotion and Tenure Committee(CS) (1995-97)
Director, Institute for Computer Research (1995-98)
Associate Chairman, Graduate Studies (1991 - 1993)
Chairman, Graduate Committee (CS) (1991 - 1993)
Member, Promotion and Tenure Committee (CS) (1991 - 1992)
Member, Graduate Committee (CS) (1990-91)
Chairman, PhD Comprehensive Committee (1989-90)
Member, PhD Comprehensive Committee (1988-89)
Member, Curriculum Committee, (1987-90)
Member, Graduate Committee (Applied Mathematics) (1987-90)

Research Grants

2017-2023 NSERC Discovery grant. $43,000/year.

2016-2018 Global Risk Institute. A multi-period mean-variance approach to risk and return in climate change policy. $60,000 per year (with M. Insley (PI)).

2013-2016 Global Risk Institute. Long-horizon and longevity risks in insurance. $188,000 per year (with K.S. Tan (PI), T. Coleman, M. Hardy, J. Li).

2012-2015 NSERC Collaborative Research and Development (CRD). Matching for Scotiabank grant. $38,000 per year (co-PI with G. Labahn).

2011-2014 Scotiabank. Implied Volatility Surfaces, Local Volatility Models and Low Dimensional Hedging Strategies for Arithmetic and Geometric Baskets. $25,000/year (co-PI with G. Labahn).

2010-2015 NSERC Discovery grant. $40,000/year. (Deferred to end in 2017).

2009-2012 Credit Suisse Research Grant $70,200/year (co-PI with Y. Li and A. Heunis).

2008-2011 Tata Consultancy Services Research Grant. $25,000/year (co-PI with G. Labahn).

2006-2011 Morgan Stanley Equity Market Microstructure Research Grant. $20,000/year.

2005-2010 NSERC Discovery grant. $64,000/year.

2003-2005 ITO33, Paris. Numerical methods for jump diffusion and jump volatility models, $23,000/year (co-PI with K. Vetzal).

2001-2005 NSERC Discovery grant. $57,000/year.

2000-2003 Bell Canada University Labs. Computational Finance: Real options, telecommunications, and corporate finance $135,000/year (co-PI) (with K. Vetzal(co-PI), P. Boyle, G. Labahn, K.S. Tan).

1999-2002 NSERC Strategic, Royal Bank. Computational Finance: algorithms for option pricing and hedging. $128,000/year (PI) (with K. Vetzal, P. Boyle, G. Labahn).

1998-2001 NSERC Strategic. New computational approaches for modelling surface water-groundwater systems. $131,000/year (with E. Sudicky (PI), E. Frind, N. Kouwen, D. Rudolph, R. Soulis, J. Sykes, H. Whiteley).

1998-2000 CITO. Computational support for modelling in Engineering & Finance.$50,000 /year (with W.P. Tang, R.B. Simpson, A. George, P. Boyle, K. Vetzal).

1997-2001 NSERC operating grant. $45,000/year.

1996-98 Smithville Environmental Restoration Project, ITRC and WCGR. Simulation of DNAPL contaminants in fractured rock. $60,000/year (with E. Sudicky).

1995-1998 US EPA. Simulation of groundwater flow at the Smithville site. $80,000/year (with E. Sudicky (PI), K. Novakowski).

1995-1998 Information Technology Research Center. Research into numerical solution of partial differential equations. $75,000/year (with A. George, R. Simpson, W.P. Tang).

1995 Haley and Aldrich (Boston), Gartner-Lee (Markham), Waterloo Center for Groundwater Research. Simulation and video animation of NAPL extraction methods. $29,000 (with E. Sudicky).

1995 Solvents in Groundwater Consortium. Simulation of vacuum extraction methods for VOC's. $20,000 (with E. Sudicky).

1994 Waterloo Center for Groundwater Research. Visualization of DNAPL contamination. $13,600 (with E. Sudicky).

1994 NSERC Equipment Grant. Video recording equipment for scientific visualization. $42,000 (with R.H. Bartels).

1993 Solvents in Groundwater Consortium. Three dimensional simulation of NAPL contamination. $19,000 (with E. Sudicky).

1993-1995 Information Technology Research Center. Research into numerical solution of partial differential equations. $40,000/year (with R. Simpson, W.P. Tang).

1993-1997 NSERC operating grant. $28,000/year.

1990-1993 NSERC operating grant. $25,000/year.

1988-1990 NSERC operating grant. $23,000/year.

1988-1992 Information Technology Research Center. Research into numerical solution of partial differential equations. $80,000/year (with R. Simpson, W.P. Tang, W.L. Seward).

1985 Energy Mines and Resources. Development of new software technology for reservoir simulation. $80,000 (with A. Behie, P. Sammon).

List of Research Contributions - Peter A. Forsyth

Refereed Journal Publications

1. P. van Staden, P. A. Forsyth and Y. Li, *"Smart leverage? Rethinking the role of leveraged exchange traded funds in constructing portfolios to beat a benchmark."* (to appear in Quantitative Finance, 2026, 39 pages.)

2. P. A. Forsyth and Y. Li, *"Risk Measures for DC Pension Plan Decumulation,"* (to appear in the North American Actuarial Journal, 2026, 42 pages.)

3. M. Chen, M. Shirazi, P. A. Forsyth and Y. Li, *"Machine learning and Hamilton-Jacobi-Bellman equation for optimal decumulation: a comparison study,"* Journal of Computational Finance (29:1) 2025 77-118.

4. C. Ni, Y. Li and P. A. Forsyth, *"Optimal Multi-period Leverage-Constrained Portfolios: a Neural Network Approach,"* Journal of Economic Dynamics and Control 177 (2025) 105127.

5. P. M. van Staden, P. A. Forsyth and Y. Li, *"A global-in-time neural network approach to dynamic portfolio optimization,"* Applied Mathematical Finance 31:3 (2024) 131-163.

6. C. Ni, Y. Li and P. A. Forsyth, *"Neural network approach to portfolio optimization with leverage constraints: a case study on high inflation investment,"* Quantitative Finance 24:6 (2024) 753-777.

7. P. A. Forsyth, K. R. Vetzal and G. Westmacott, *" Optimal performance of a tontine overlay subject to withdrawal constraints,"* ASTIN Bulletin 54 (2024) 94-128.

8. P. M. van Staden, P. A. Forsyth and Y. Li, *"Across-time risk-aware strategies for outperforming a benchmark,"* European Journal of Operational Research 313:2 (2024) 776-800.

9. P. A. Forsyth, P. van Staden, Y. Li, *"Beating a constant weight benchmark: easier done than said,"* International Journal of Theoretical and Applied Finance 26:4-5 (2023) paper 2350011 (electronic) 1-24.

10. P. van Stadan, P. A. Forsyth, Y. Li, *"Beating a benchmark: dynamic programming may not be the right numerical approach,"* SIAM Journal on Financial Mathematics 14:2 (2023) 407-451.

11. P. A. Forsyth and K. R. Vetzal, *"Multi-period Mean Expected-Shortfall Strategies: Cut your losses and ride your gains,"* Applied Mathematical Finance 29:5 (2022) 402-438.

12. C. Ni, Y. Li, P. A. Forsyth, R. Carroll, *"Optimal asset allocation for outperforming a stochastic benchmark target,"* Quantitative Finance 22:9 (2022) 1595-1626.

13. P. A. Forsyth, *"A stochastic control approach to defined contribution plan decumulation: the nastiest, hardest problem in finance,"* North American Actuarial Journal 26:2 (2022) 227-251.

14. P. A. Forsyth, *"Short term decumulation strategies for underspending retirees,"* Insurance: Mathematics and Economics 102 (2022) 56-74.

15. M. Insley, T. Snoddon, P.A. Forsyth, *"Strategic interactions and uncertainty in decisions to curb greenhouse gas emissions,"* Frontiers of Economics in China 16:2 (2021) 214-262.

16. P. A. Forsyth, K. Vetzal, G. Westmacott, *"Optimal control of the decumulation of a retirement portfolio with variable spending and dynamic asset allocation,"* ASTIN Bulletin 51:3 (2021) 905-938.

17. P. M. van Staden, Duy-Minh Dang, P. A. Forsyth, *"Practical investment consequences of the scalarization parameter formulation in dynamic mean-variance portfolio optimization,"* International Journal of Theoretical and Applied Finance 24:5 (2021) Article 2150029, 1-49.

18. P. M. van Staden, Duy-Minh Dang, P. A. Forsyth, *"On the distribution of terminal wealth under dynamic mean-variance optimal investment strategies,"* SIAM Journal on Financial Mathematics 12 (2021) 774-792.

19. P. A. Forsyth, *"Two stage decumulation strategies for DC plan investors,"* International Journal for Theoretical and Applied Finance, 24:1 (2021) Article 2150007, 1-31.

20. P. M. van Staden, Duy-Minh Dang, P. A. Forsyth, *"The surprising robustness of dynamic Mean-Variance portfolio optimization to model misspecification errors,"* European Journal of Operational Research 289:2 (2021) 774-792.

21. P. A. Forsyth, K. R. Vetzal, G. Westmacott, *"Optimal asset allocation for DC pension decumulation with a variable spending rule,"* ASTIN Bulletin 50:2 (2020) 419-447.

22. P. A. Forsyth, *"Optimal dynamic asset allocation for DC plan accumulation/decumulation: Ambition-CVAR,"* Insurance: Mathematics and Economics 93 (2020) 230-245.

23. P. A.. Forsyth, *"Multi-period mean-CVAR asset allocation: is it advantageous to be time consistent?"* SIAM Journal on Financial Mathematics 11:2 (2020) 358-384.

24. M. Insley, P.A. Forsyth, *"Climate Games: Who's on first? What's on second?"* l'Actualite Economique 95:2-3 (2019) 287-322.

25. P. M. van Staden, D-M Dang and P.A. Forsyth, *"Mean-quadratic variation portfolio optimization: A desirable alternative to time-consistent mean-variance optimization?"* SIAM Journal on Financial Mathematics 10:3 (2019) 815-856.

26. P.A. Forsyth, K.R. Vetzal and G. Westmacott, *"Management of portfolio depletion risk through optimal life cycle asset allocation,"* North American Actuarial Journal 23:3 (2019) 447-468.

27. P.A. Forsyth and K.R. Vetzal, *"Optimal asset allocation for retirement savings: deterministic vs. time consistent adaptive strategies,"* Applied Mathematical Finance 26:1 (2019) 1-37.

28. Y. Li and P.A. Forsyth, *"A data driven Neural Network approach to optimal asset allocation for target based defined contribution pension plans,"* Insurance: Mathematics and Economics 86 (2019) 189-204.

29. P.A. Forsyth, G. Labahn, *"ϵ-Monotone Fourier methods for optimal stochastic control in finance,"* Journal of Computational Finance 22:4 (2019) 25-71.

30. P. van Staden, D-M. Dang and P.A. Forsyth, *"Time-consistent mean-variance portfolio optimization: a numerical impulse control approach,"* Insurance: Mathematics and Economics 83 (2018) 9-28.

31. K.L. Miller, S.J. Berg, J.H. Davison, E.A. Sudicky, P.A. Forsyth, *"Efficient uncertainty quantification in fully-integrated surface and subsurface hydrologic simulations,"* Advances in Water Resources 111 (2018) 381-394.

32. P.A. Forsyth and K.R. Vetzal *"Dynamic mean variance asset allocation: tests for robustness,"* International Journal of Financial Engineering 4:2 (2017) 1750021 (electronic).

33. P.A. Forsyth and K.R. Vetzal, *"Robust asset allocation for long-term target-based investing,"* International Journal of Theoretical and Applied Finance 20:3 (2017) 1750017 (electronic).

34. K. Ma, P.A. Forsyth *"An unconditionally monotone numerical scheme for the two factor uncertain volatility model,"* IMA Journal of Numerical Analysis 37 (2017) 905-944.

35. D.M. Dang, P.A. Forsyth, K.R. Vetzal, *"The 4% strategy revisited: A pre-commitment optimal mean-variance approach to wealth management,"* Quantitative Finance 17 (2017) 335-351.

36. P. Azimzadeh, P.A. Forsyth, *"Weakly chained matrices and impulse control,"* SIAM Journal on Numerical Analysis 54 (2016) 1341-1364.

37. C. Reisinger, P.A. Forsyth, *"Piecewise constant policy approximations to Hamilton-Jacobi-Bellman equations,"* Applied Numerical Mathematics 103 (2016) 27-47.

38. K. Ma, P.A. Forsyth, *"Numerical solution of the Hamilton-Jacobi-Bellman formulation for continuous time mean variance asset allocation under stochastic volatility,"* Journal of Computational Finance 20:1 (2016) 1-37.

39. D.M. Dang, P.A. Forsyth, Y. Li, *"Convergence of the embedded mean-variance optimal points with discrete sampling,"* Numerische Mathematik 132 (2016) 271-302.

40. D.M. Dang, P.A. Forsyth, *"Better than pre-commitment mean-variance portfolio allocation strategies: a semi-self-financing Hamilton-Jacobi-Bellman equation approach,"* European Journal of Operational Research 250 (2016) 827-841.

41. P. Azimzadeh, P.A. Forsyth, *"The existence of optimal bang-bang controls for GMxB contracts,"* SIAM Journal on Financial Mathematics 6 (2015) 117-139.

42. H.-T. Hwang, Y.-J. Park, E.A. Sudicky, P.A. Forsyth *" A parallel computational framework to solve flow and transport in integrated surface-subsurface hydrologic systems,"* Environmental Modelling and Software 61 (2014) 39-58.

43. P.A. Forsyth, K.R. Vetzal *"An optimal stochastic control framework for determining the cost of hedging of variable annuities,"* Journal of Economic Dynamics and Control 44 (2014) 29-53.

44. S.T. Tse, P.A. Forsyth, Y. Li, *"Preservation of scalarization optimal points in the embedding technique for continuous time mean variance optimization,"* SIAM Journal on Control and Optimization 52 (2014) 1527-1546.

45. D.M. Dang, P.A. Forsyth *"Continuous time mean-variance optimal portfolio allocation under jump diffusion: a numerical impulse control approach,"* Numerical Methods for Partial Differential Equations 30 (2014) 664-698.

46. J. Babbin, P.A. Forsyth, G. Labahn, *"A comparison of iterated optimal stopping and local policy iteration for American options under regime switching,"* Journal of Scientific Computing 58 (2014) 409-430.

47. S.T. Tse, P.A. Forsyth, J.S. Kennedy, H. Windcliff, *"Comparison between the mean variance optimal and mean quadratic variation optimal trading strategies,"* Applied Mathematical Finance 20 (2013) 415-449.

48. Y. Huang, P.A. Forsyth, G. Labahn, *"Inexact arithmetic considerations for direct control and penalty methods: American options under jump diffusion,"* Applied Numerical Mathematics 72 (2013) 33-51.

49. P.A. Forsyth, J.S. Kennedy, S.T. Tse, H. Windcliff, *"Optimal trade execution: a mean quadratic variation approach,"* Journal of Economic Dynamics and Control 36 (2012) 1971-1991.

50. Y. Huang, P.A. Forsyth, G. Labahn, *"Combined fixed point and policy iteration for HJB equations in finance,"* SIAM Journal on Numerical Analysis 50 (2012) 1849-1860.

51. Y. Huang, P.A. Forsyth, G. Labahn, *"Iterative methods for the solution of a singular control formulation of a GMWB pricing problem,"* Numerische Mathematik 122 (2012) 133-167.

52. J. Wang and P.A. Forsyth, *"Comparison of mean variance like strategies for optimal asset Allocation problems."* International Journal of Theoretical and Applied Finance 15:2 (2012) (33 pages: DOI: 10.1142/S0219024912500148).

53. I. Huang and P.A. Forsyth, *"Analysis of a penalty method for pricing a Guaranteed Minimum Withdrawal Benefit (GMWB)."* IMA Journal on Numerical Analysis 32 (2012) 320-351.

54. Y. Huang, P.A. Forsyth, G. Labahn, *"Methods for American options under regime switching,"* SIAM Journal on Scientific Computing 33 (2011) 2144-2168.

55. P.A. Forsyth, *"A Hamilton Jacobi Bellman approach to optimal trade execution."* Applied Numerical Mathematics 61 (2011) 241-265.

56. J. Wang and P.A. Forsyth, *"Continuous time mean variance asset allocation: a time consistent strategy."* European Journal of Operational Research 209 (2011) 184-201.

57. Z. Chen, P.A. Forsyth *"Implications of a regime-switching model on natural gas storage valuation and optimal operation,"* Quantitative Finance 10 (2010) 159-176.

58. J. Wang, P.A. Forsyth. *"Numerical solution of the Hamilton Jacobi Bellman Formulation for continuous time mean variance asset allocation."* Journal of Economic Dynamics and Control 34 (2010) 207-230.

59. A. C. Belanger, P.A. Forsyth, G. Labahn, *"Valuing the guaranteed minimum death benefit clause with partial withdrawals,"* Applied Mathematical Finance 16 (2009) 451-496.

60. J.S. Kennedy, P.A. Forsyth, K.R. Vetzal, *"Dynamic hedging under jump diffusion with transaction costs,"* Operations Research 57 (2009) 541-559.

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