Quanling Deng

Curriculum Vitae

Computational Science, School of Computing
Australian National University
Canberra, ACT, Australia
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Employment

Feb. 2022 - **Lecturer**, *School of Computing*, Australian National University, Canberra, ACT, Australia

Mar. 2020 - Jan. 2022 **Van Vleck Visiting Assistant Professor**, *Department of Mathematics*, University of Wisconsin-Madison, Madison, WI, USA

Feb. 2018 - Mar. 2020 **Affiliated Member**, *Institute for Geoscience Research (TIGeR)*, Curtin University, Perth, WA, Australia

July 2017 - Mar. 2020 **Affiliated Member**, *Curtin Institute for Computation (CIC)*, Curtin University, Perth, WA, Australia

Oct. 2016 - Mar. 2020 **Research Associate**, *Department of Applied Geology*, Curtin University, Perth, WA, Australia

Aug. 2011 - May 2016 **Research/Teaching Assistant**, *Department of Mathematics*, University of Wyoming, Laramie, WY, USA

Education

Aug. 2011 - May 2016 **Ph. D. in Mathematics**, *University of Wyoming*, Laramie, WY, USA
Thesis: Local conservation on continuous Galerkin finite element methods with applications
Advisor: Prof. Victor Ginting

Aug. 2007 - June 2011 **B. S. in Mathematics and Applied Mathematics**, *Hebei University of Technology*, Tianjin, China
Thesis: An optimum seeking method and its applications
Advisor: Prof. Xinwei Liu

Research Interests

- **Mathematical modeling and simulation**: fluid flow through poroelastic media, ocean and atmosphere dynamics, sea ice floe dynamics.
- **Scientific computing** and **numerical analysis**: parallel computing, preconditioners, post-processing, PDE numerical solvers such as FDM, FVM, FEM, IGA, DG, HHO, Runge–Kutta methods, and generalized-α methods, operator splitting schemes, dispersion and spectral analysis, a priori and a posteriori error analysis.
- **Uncertainty quantification** and **data assimilation**: stochastic models, Kalman filters, Ornstein-Uhlenbeck process, Monte Carlo methods.

Publications

[32] **Q. Deng***, Isogeometric Analysis of Bound States of a Quantum Three-Body Problem in 1D, *International Conference on Computational Science*, accepted (2022).

[31] J. Zhang, **Q. Deng**, X. Li. A generalized isogeometric analysis of elliptic eigenvalue and source problems with an interface, *Journal of Computational and Applied Mathematics*, **407** (2022), 114053.

[30] T. Aryeni, **Q. Deng**, V. Ginting, On the Application of Stable Generalized Finite Element Method for Quasilinear Elliptic Two-Point BVP, *Journal of Scientific Computing*, **90** (2022), 1–38.

[29] **Q. Deng***, A. Ern, SoftFEM: revisiting the spectral finite element approximation of elliptic operators, *Computers and Mathematics with Applications*, **101** (2021), 119–133.

[28] **Q. Deng***, V. Calo, A boundary penalization technique to remove outliers from isogeometric analysis on tensor-product meshes, *Computer Methods in Applied Mechanics and Engineering*, **383** (2021), 113907.

[27] **Q. Deng***, Analytical solutions to some generalized and polynomial eigenvalue problems, *Special Matrices*, **9** (2021), 240–256.

[26] **Q. Deng***, V. Calo, Outlier removal for isogeometric spectral approximation with the optimally-blended quadratures, *International Conference on Computational Science*, (2021), 315–328.

[25] P. Behnoudfar, **Q. Deng**, V. Calo, Higher-order generalized-α methods for hyperbolic problems, *Computer Methods in Applied Mechanics and Engineering*, **378** (2021), 113725.

[24] P. Behnoudfar, **Q. Deng**, V. Calo, Split generalized-α method: A linear-cost solver for multi-dimensional second-order hyperbolic systems, *Computer Methods in Applied Mechanics and Engineering*, **376** (2021), 113656.

[23] V. Calo, M. Łoś, **Q. Deng**, I. Muga, M. Paszyński. Isogeometric Residual Minimization Method (iGRM) with direction splitting preconditioner for stationary advection-dominated diffusion problems, *Computer Methods in Applied Mechanics and Engineering*, **373** (2021), 113214.

[22] P. Behnoudfar, **Q. Deng**, V. Calo, High-order generalized-alpha method, *Applications in Engineering Science*, **4** (2020), 100021.

[21] **Q. Deng***, V. Calo. Higher order stable generalized finite element method for the elliptic eigenvalue problem with an interface in 1D, *Journal of Computational and Applied Mathematics*, **368** (2020), 112558.

[20] P. Behnoudfar, V. Calo, **Q. Deng***, P. Minev. A variationally separable splitting for the generalized-α method for parabolic equations, *International Journal for Numerical Methods in Engineering*, **121(5)** (2020), 828-841.

[19] M. Bartoň, V. Puzyrev, **Q. Deng**, V. Calo. Efficient mass and stiffness matrix assembly via weighted Gaussian quadrature rules for B-splines, *Journal of Computational and Applied Mathematics*, *371* (2020), 112626.

[18] V. Calo, **Q. Deng***, S. Rojas, A. Romkes. Residual minimization for isogeometric analysis in reduced and mixed forms. *Procedia Computer Science*, (2019), 463–476.

[17] **Q. Deng***, V. Ginting, B. McCaskill. Construction of locally conservative fluxes for high order continuous Galerkin finite element methods, *Journal of Computational and Applied Mathematics*, **359** (2019), 166–181.

[16] V. Calo, **Q. Deng***, V. Puzyrev. Dispersion optimized quadratures for isogeometric analysis, *Journal of Computational and Applied Mathematics*, **355** (2019), 283-300.

[15] V. Calo, M. Cicuttin, **Q. Deng***, A. Ern. Spectral approximation of elliptic operators by the Hybrid High-Order method, *Mathematics of Computation*, **88** (2018), 1559–1586.

[14] **Q. Deng***, V. Puzyrev, V. Calo. Optimal spectral approximation of $2n$-order differential operators by mixed isogeometric analysis, *Computer Methods in Applied Mechanics and Engineering*, **343** (2018), 297–313.

[13] **Q. Deng***, V. Calo. Dispersion-minimized mass for isogeometric analysis, *Computer Methods in Applied Mechanics and Engineering*, **341** (2018), 71–92.

[12] **Q. Deng***, V. Puzyrev, V. Calo. Isogeometric spectral approximation for elliptic differential operators, *Journal of Computational Science*, (2018).

[11] V. Puzyrev, **Q. Deng**, V. Calo. Spectral approximation properties of isogeometric analysis with variable continuity, *Computer Methods in Applied Mechanics and Engineering*, **334** (2018), 22–39.

[10] **Q. Deng***, M. Bartoň, V. Puzyrev, V. Calo. Dispersion-minimizing quadrature rules for C^1 quadratic isogeometric analysis, *Computer Methods in Applied Mechanics and Engineering*, **328** (2018), 554–564.

[9] M. Bartoň, V. Calo, **Q. Deng***, V. Puzyrev. Generalization of the Pythagorean eigenvalue error theorem and its application to isogeometric analysis, *Numerical methods for PDEs. Springer*, 2018, 147–170.

[8] **Q. Deng***, V. Ginting. Locally conservative continuous Galerkin finite element method for pressure equation in two-phase flow model in subsurfaces, *Journal of Scientific Computing*, **74** (3), 2018, 1264–1285.

[7] Q. Zou, L. Guo, **Q. Deng**. High order continuous local-conserving flux and finite-volume-like finite element solutions for elliptic equations, *SIAM Journal on Numerical Analysis*, **55** (6), 2017, 2666–2686.

[6] V. Puzyrev, **Q. Deng**, V. Calo. Dispersion-optimized quadrature rules for isogeometric analysis: modified inner products, their dispersion properties, and optimally blended schemes, *Computer Methods in Applied Mechanics and Engineering*, **320** (2017), 421–443.

[5] **Q. Deng**, V. Ginting, B. McCaskill, P. Torsu. A locally conservative stabilized continuous Galerkin finite element method for two-phase flow in poroelastic subsurfaces, *Journal of Computational Physics*, **347** (2017), 78–98.

[4] V. Calo, **Q. Deng***, V. Puzyrev. Quadrature blending for isogeometric analysis. *Procedia Computer Science*, **108** (2017), 798–807.

[3] **Q. Deng***. Local conservation on continuous Galerkin finite element methods with applications, *ProQuest Dissertations Publishing*, 2016.

[2] L. Bush, **Q. Deng***, V. Ginting. A locally conservative stress recovery technique for continuous Galerkin FEM in linear elasticity, *Computer Methods in Applied Mechanics and Engineering*, **286** (2015), 354–372.

[1] **Q. Deng***, V. Ginting. Construction of locally conservative fluxes for the SUPG method, *Numerical Methods for Partial Differential Equations*, **31** (6), 2015, 1971–1994.

Preprints

[4] C. Attanayake, S.H. Chou, **Q. Deng**, Higher-Order SGFEM for One-Dimensional Interface Elliptic Problems with Discontinuous Solutions, arXiv preprint, arXiv: 2204.07665 (2022).

[3] **Q. Deng***, P. Behnoudfar, V. Calo, A boundary-penalized isogeometric analysis for second-order hyperbolic equations, arXiv preprint, arXiv:2203.12373 (2022).

[2] N. Chen, **Q. Deng***, S.N. Stechmann, Lagrangian Data Assimilation and Uncertainty Quantification for Sea Ice Floes with an Efficient Physics-Constrained Superfloe Parameterization, arXiv preprint, arXiv:2105.13569 (2021).

[1] P. Behnoudfar, **Q. Deng**, V. Calo, Higher-order generalized-α methods for parabolic problems, arXiv preprint, arXiv:2102.05910 (2021).

Invited Talks

Aug. 2022 **Mathematics and Computational Sciences Seminar**, *Mathematical Sciences Institute, Australian National University, Australia*
Title: "*SoftFEM for spectral approximation of an second-order elliptic operator*"

April. 2022 **Colloquium Series**, *Department of Mathematics and Statistics, Bowling Green State University, USA*
Title: "*Soft finite element method for spectral approximation*"

July 2021 **Minisymposium "Mathematics and Data Science for Physical Modeling and Prediction of Sea Ice" at the 2021 SIAM Annual Meeting**, *Online*
Title: "*Lagrangian Data Assimilation and Uncertainty Quantification for Sea Ice Floes with Efficient Superfloe Parameterization*"

May 2021 **Young Scholars Frontier Forum**, *Online, Nanjing University, Nanjing, China*
Title: "*SoftFEM: a new approach for spectral approximation of elliptic operators*"

Mar. 2021 **Computational and Applied Mathematics Seminar**, *Online, University of Wyoming, USA*
Title: "*SoftFEM: revisiting the spectral finite element approximation of elliptic operators*"

Feb. 2021 **Applied and Computational Mathematics Seminar**, *Online, University of Wisconsin-Madison, USA*
Title: "*SoftFEM, isogeometric analysis, and hybrid high-order method for spectral approximations*"

July 2019 **Minisymposium "Variational Stabilization, Structure- and Positivity-Preserving Techniques for Complex Flows" at the US National Congress on Computational Mechanics**, *Austin, Texas, USA*
Title: "*High-order generalized-α methods*"

June 2019 **Serena seminar**, *INRIA, Paris, France*
Title: "*High-order generalized-α methods and splitting schemes*"

May 2019 **Computer science seminar**, *AGH University of Science and Technology, Kraków, Poland*
Title: "*High-order generalized-α methods and splitting schemes*"

April 2019 **Mathematics seminar**, *Peking University, Beijing, China*
Title: "*High-order generalized-α methods and splitting schemes*"

April 2019 **Computational mathematics seminar**, *Chinese Academy of Sciences, Beijing, China*
Title: "*Spectral approximation of elliptic operators by the Hybrid High-Order method*"

April 2019 **Mathematics seminar**, *University of Science and Technology of China, Hefei, Anhui, China*
Title: "*Spectral approximation of elliptic operators by the Hybrid High-Order method*"

Mar. 2019 **Mathematics and Statistics seminar**, *Curtin University, Perth, WA, Australia*
Title: "*Spectral approximation of elliptic operators by the Hybrid High-Order method*"

July 2018 **Minisymposium "High-order isogeometric solvers" at the International Conference on Spectral and High-Order Methods (ICOSAHOM)**, *Imperial College London, London, UK*
Title: "*High-order isogeometric spectral approximation properties*"

Sep. 2017 **Complex Systems seminar**, *University of Western Australia, Perth, WA, Australia*
Title: "*Numerical spectral approximations*"

May 2017 **Serena seminar**, *INRIA, Paris, France*
Title: "*Dispersion optimized quadratures for isogeometric analysis*"

Contributed Talks at Conferences & Workshops

Aug. 2022 **Minisymposium "Advanced HPC Methods for Eigenvalue Problems and Beyond" at the WCCM-APCOM Conference)**, *Yokohama, Japan*
Title: "*SoftIGA for differential eigenvalue problems*"

June 2022 **Minisymposium "Artificial Intelligence and High-Performance Computing for Advanced Simulations – AIHPC4AS" at the International Conference on Computational Science (ICCS)**, *London, United Kingdom*, Online
Title: "*Isogeometric Analysis of Bound States of a Quantum Three-Body Problem in 1D*"

June 2021 **Minisymposium "Artificial Intelligence and High-Performance Computing for Advanced Simulations – AIHPC4AS" at the International Conference on Computational Science (ICCS)**, *Krakow, Poland*, Online
Title: "*Outlier removal for isogeometric spectral approximation with the optimally-blended quadratures*"

June 2021 **Sea Ice Workshop: Modeling the Granular Nature of Sea Ice**, *Online*
Title: "*Lagrangian DA and UQ for Sea Ice Floes with Superfloe Parameterization*"

Nov. 2020 **50th Anniversary of the Finite Element Circus**, *Online*
Title: "*SoftFEM: Revisit FEM spectral approximation*"

June 2019 **Workshop "Agent-Based Simulations, Adaptive Algorithms and Solvers (ABS-AAS)" at the International Conference on Computational Science (ICCS)**, *University of Algarve, Faro, Portugal*
Title: "*Residual minimization for isogeometric analysis in reduced and mixed forms*"

June 2018 **Minisymposium "Higher Order Finite Element Methods" at the Emerging Trends in Applied Mathematics and Mechanics (ETAMM)**, *Jagiellonian University, Kraków, Poland*
Title: "*Spectral approximation of elliptic operators by the Hybrid High-Order method*"

June 2017 **Workshop "Agent-Based Simulations, Adaptive Algorithms and Solvers (ABS-AAS)" at the International Conference on Computational Science (ICCS)**, *ETH Zürich, Switzerland*
Title: "*Quadrature blending for isogeometric analysis*"

April 2016 **Finite Element Circus**, *University of Maryland, College Park, MD, USA*
Title: "*High order continuous local-conserving flux and finite-volume-like finite element solutions for elliptic equations*"

Mar. 2016 **Finite Element Rodeo**, *Texas A&M University, College Station, TX, USA*
Title: "*Construction of locally conservative fluxes for high order continuous Galerkin finite element methods*"

Oct. 2015 **Finite Element Circus**, *University of Massachusetts Dartmouth, North Dartmouth, MA, USA*
Title: "*Construction of locally conservative fluxes for high order continuous Galerkin finite element methods*"

Feb. 2015 **Finite Element Rodeo**, *Southern Methodist University, Dallas, TX, USA*
Title: "*A locally conservative stress recovery technique for continuous Galerkin FEM in linear elasticity*"

May 2014 **Center for Fundamentals of Subsurface Flow Workshop: Experimentation, Mathematical Modeling and Numerical Simulation**, *University of Wyoming, Laramie, WY, USA*
Title: "*A postprocessing technique for FEM for advection-diffusion equation with application to semiconductor material model problem*"

April 2014 **Analysis and Computational Mathematics seminar**, *University of Wyoming, Laramie, WY, USA*
Title: "*SUPG with a post-processing technique for the drift-diffusion equations*"

Feb. 2014 **Finite Element Rodeo**, *University of Texas at Austin, Austin, TX, USA*
Title: "*SUPG with a post-processing technique for the drift-diffusion equations*"

Mar. 2013 **SIAM Front Range Student Conference**, *University of Colorado at Denver, Denver, CO, USA*
Title: "*Symmetric interior penalty Galerkin method for solving semilinear elliptic problems*"

July 2012 **SAMSI 2012 Industrial Math/Stat Modeling Workshop**, *North Carolina State University, Raleigh, NC, USA*
Title: "*Saltwater intrusion and freshwater supply in coastal aquifers*"

Research Programs/Schools & Travels

May–June 2019 **Visiting Scholar**, *INRIA & CERMICS, INRIA Paris & ENPC, Paris, France*, three weeks
visited Prof. Alexandre Ern, Martin Vohralík, and their groups to collaborate on the spectral error estimators, time-integrators, and splitting schemes

May 2019 **Visiting Scholar**, *Department of Computer Science, AGH University of Science and Technology, Kraków, Poland*, two weeks
visited Prof. Maciej Paszyński and his group to collaborate on the development of splitting methods for Stokes problems

April 2019 **Visiting Scholar**, *Department of Mathematics, University of Science and Technology of China, Hefei, Anhui, China*, two weeks
visited Prof. Xin Li to discuss optimal blending quadratures and potential research collaborating work on spectral approximation using B-splines

June-July 2018 **Visiting Scholar**, *Department of Computer Science, AGH University of Science and Technology, Kraków, Poland*, three weeks
visited Prof. Maciej Paszyński and his group to collaborate on splitting methods for isogeometric residual minimization (iGRM)

June 2018 **Visiting Scholar**, *Institute for Computational Civil Engineering, Cracow University of Technology, Kraków, Poland*, one week
visited the Institute for Computational Civil Engineering to study discontinuous Petrov-Galerkin (DPG) methodology with Prof. Leszek Demkowicz

June 2017 **Visiting Scholar**, *CERMICS, ENPC, Paris, France*, one week
visited Prof. Alexandre Ern and his group to collaborate on the spectral properties of the Hybrid High-Order Methods

April–May 2017 **Visiting Scholar**, *CERMICS, ENPC, Paris, France*, three weeks
visited Prof. Alexandre Ern and his group to collaborate on the spectral properties of the Hybrid High-Order Methods

Jan. 2016 **Visiting Student**, *Department of Mathematics, Texas A&M University, College Station, TX, USA*, one week
visited the Department of Mathematics to study numerical schemes for geometric PDEs with Prof. Ricardo Nochetto and Prof. Andrea Bonito as well as the package deal.ii with Prof. Timo Heister

Jan. 2016 **Visiting Student**, *Joint Mathematics Meetings, Seattle, WA, USA*

May 2015 **Visiting Student**, *IMA Hot Topics Workshop: Hydraulic Fracturing: From Modeling and Simulation to Reconstruction and Characterization, University of Minnesota, Minneapolis, MN*

Feb. 2014 **Visiting Student**, *SIAM Conference on Parallel Processing for Scientific Computing, Portland, OR, USA*

June 2012 **Visiting Student**, *Workshop on the Stability of Coherent Structures and Patterns, University of Washington, Seattle, WA*

May 2012 **Visiting Student**, *IMA Annual Program Year Workshop: User-Centered Modeling, University of Minnesota, Minneapolis, MN*

July-Aug. 2012 **Visiting Student**, *Department of Mathematics, North Carolina State University, Raleigh, NC, USA*
visited the Department of Mathematics to work on a project titled 'Saltwater Intrusion and Freshwater Supply in Coastal Aquifers', led by Prof. Matthew Farthing and Prof. Lea Jenkins

Professional Activities & Services

- **Committees:**

- NCI Adapter Scheme Evaluation Committee 2022-
- ANU NECTAR mentoring program 2022-

- **Journal editorial board:**
  - Frontiers Editorial Board: Frontiers in Applied Mathematics and Statistics - Numerical Analysis and Scientific Computation, 2022-
  - MDPI Mathematics, 2021-
- **Organization and chairmen of conference sessions:**
  - Organize and co-chair the minisymposium "Advanced HPC Methods for Eigenvalue Problems and Beyond" at the 15th World Congress on Computational Mechanics & 8th Asian Pacific Congress on Computational Mechanics (WCCM-APCOM 2022)
  - Organize and co-chair the minisymposium "HPC Methods for Eigenvalue Problems in Applied Science and Engineering" at the European Community on Computational Methods in Applied Sciences (ECCOMAS 2022)
  - Organize and co-chair the minisymposium "Variational Stabilization, Structure- and Positivity-Preserving Techniques for Complex Flows" at the US National Congress on Computational Mechanics (USNCCM) 2019
  - Organize and co-chair the thematic workshop on ABS-AA-S, International Conference on Computational Science 2019.
  - Organize and co-chair the thematic workshop on ABS-AA-S, International Conference on Computational Science 2017.
- **Referee for peer-reviewed journals & conferences:**
  - ESAIM: Mathematical Modelling and Numerical Analysis
  - Advances in Computational Mathematics
  - Applied Mathematical Modelling
  - Computer Methods in Applied Mechanics and Engineering
  - International Journal for Numerical Methods in Engineering
  - Journal of Computational and Applied Mathematics
  - Journal of Computational Science
  - International Journal for Numerical Methods in Fluids
  - Mathematical Reviews
  - zbMATH
  - Electronic Research Archive
  - Mathematical Biosciences and Engineering
  - Applied Numerical Mathematics
  - Journal of Computer Science
  - Journal of Low Frequency Noise, Vibration & Active Control
  - Journal of Parallel Computing
  - Journal of Wave Motion
  - Journal of Computer Methods in Materials Science
  - International Conference on Computational Science (2017–)
  - International Conference on Numerical Modelling in Engineering (2019)
- **Service:** *writing recommendation letters to support students' applications.*

Teaching Experience

Spring 2021 **Instructor**, *Math 320, Linear Algebra and Differential Equations, 3 credit hours*, University of Wisconsin-Madison, Instruction mode: Synchronously online

Fall 2020 **Instructor**, *Math 211, Calculus, 5 credit hours*, University of Wisconsin-Madison, Instruction mode: Synchronously online
Teaching evaluation available on homepage, overall score 3.06/5, 224 (out of 354) students evaluated.

Spring 2015 **Instructor**, *College Algebra, 3 credit hours*, University of Wyoming

Fall 2014 **Instructor**, *Trigonometry, 3 credit hours*, University of Wyoming

Summer 2013 **Instructor**, *Business Calculus, 4 credit hours*, University of Wyoming

Spring 2013 **Instructor**, *Calculus, 4 credit hours*, University of Wyoming

Fall 2012 **Instructor**, *Trigonometry, 3 credit hours*, University of Wyoming

Summer 2012 **Instructor**, *Finite Math, 3 credit hours*, University of Wyoming

Spring 2012 **Teaching Assistant**, *College Algebra, 3 credit hours*, University of Wyoming

Fall 2011 **Teaching Assistant**, *College Algebra, 3 credit hours*, University of Wyoming

Awards & Grants

March 2020 **2020 Mathematics Travel Award**, *MDPI Mathematics Journal*

May 2015 **Paul Stock Award**, *University of Wyoming, Laramie, WY, USA*

April 2013 **Virindra & Gail Sehgal Award**, *University of Wyoming, Laramie, WY, USA*

2016-2019 **Travel Grant**, *Curtin University, Perth, WA, Australia*

2017-2019 **Travel Grants**, *AGH-UST Poland, ENPC France, USTC China, INRIA Paris*

Jan. 2016 **TAMU grant for Winter Graduate School**, *Texas A&M University, College Station, TX, USA*

May 2015 **IMA grant for IMA hot topics workshop**, *University of Minnesota, Minneapolis, MN, USA*

Mar. 2015 **Graduate Travel Grant**, *University of Wyoming, Laramie, WY, USA*

July 2012 **SAMSI grant for industrial workshop**, *North Carolina State University, Raleigh, NC, USA*

June 2012 **NSF travel grant for workshop**, *University of Washington, Seattle, WA, USA*

May 2012 **IMA grant for annual program year workshop**, *University of Minnesota, Minneapolis, MN, USA*