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Daniel Appelö

Curriculum Vitae

Employment

2023– **Professor**, *Department of Mathematics, Virginia Tech.*, USA

2020–2023 **Associate Professor**, *Department of Computational Mathematics, Science & Engineering and Department of Mathematics, Michigan State University*, USA

2017–2020 **Associate Professor in Applied Mathematics**, *University of Colorado Boulder*, USA

2017–2019,2022 **Visiting Professor in Scientific Computing (Summers)**, *Uppsala University*, Uppsala, Sweden

2016–2017 **Associate Professor in Applied Mathematics**, *The University of New Mexico*, Albuquerque, USA

2011–2016 **Assistant Professor in Applied Mathematics**, *The University of New Mexico*, Albuquerque, USA

2008–2011 **Postdoctoral scholar in Mechanical Engineering**, *California Institute of Technology*, Pasadena, USA, Advisor: Tim Colonius

2008–2009 **Postdoctoral scholar in Applied Computational Mathematics**, *California Institute of Technology*, Pasadena, USA, Advisor: Oscar Bruno

2006–2008 **Postdoctoral fellow**, *Center for Applied and Scientific Computing, Lawrence Livermore Nat. Lab.*, Livermore, USA, Advisor: Anders Petersson

2006–2006 **Hans Werthen Prize postdoctoral scholar**, *The University of New Mexico*, Albuquerque, USA, Advisor: Thomas Hagstrom

2001–2006 **Graduate student in Numerical Analysis**, *Royal Institute of Technology*, Stockholm, Sweden

Education

2001–2006 **Ph.D. Numerical Analysis**, *Royal Institute of Technology*, Stockholm, Sweden, *Absorbing Layers and Non-Reflecting Boundary Conditions for Wave Propagation Problems*
Advisor: Prof. Gunilla Kreiss

2001–2003 **Licenciates degree in Numerical Analysis**, *Royal Institute of Technology*, Stockholm, Sweden, *Non-reflecting Boundary Conditions for Wave Propagation Problems*
Advisor: Prof. Gunilla Kreiss

1996–2001 **M.S. Electrical Engineering**, *Royal Institute of Technology*, Stockholm, Sweden

Professional Recognition, Honors and Diversity Initiatives

2019 **Program for Mathematics 2019, Knut and Alice Wallenbergs Foundation**, *Visiting Professor at Uppsala University.*, $75,000

2018 **BOLD (Broadening Opportunity through Leadership and Diversity) Faculty Fellow**, *For: Improving Inclusive Excellence in Computational Science & Engineering $10,000*

2018 **IMPART, Implementation of Multicultural Perspectives and Approaches in Research and Teaching Award**, *For: STEMinist Seminar: Fostering Community and Awareness in STEM, $3,980*

2006 **Hans-Werthen Prize 2006.**, *This is a prize for doing a postdoc outside Sweden* $\sim$ *$20,000*

2001 & 2004 **Generalgirektör Waldemar Borgeman prize**

2002 & 2005 **Erik Petersohns minnesfond prize**

2004 & 2005 **Stiftelsen Lars Hiertas minne prize**, *The three above prizes (six awards) tallied $20000 and supported extended research visits (3-6 months), trips to conferences and salary*

Publications

Submitted Articles

[S1] Zhichao Peng, Daniel Appelö, Nils Anders Petersson, Mohamamd Motamed, Fortino Garcia, and Yujin Cho. Deterministic and bayesian characterization of quantum computing devices. *Quantum Journal*, 2023 (submitted).

[S2] Ke Chen, Daniel Appelö, Tracy Babb, and Per-Gunnar Martinsson. Fast and high-order approximation of parabolic equations using hierarchical direct solvers and implicit Runge-Kutta methods. *arXiv preprint arXiv:2306.02526, submitted to Communications on Applied Mathematics and Computation*, 2023.

[S3] F. Garcia, D. Appelö, and O. Runborg. Extensions and analysis of an iterative solution of the Helmholtz equation via the wave equation. 2023.

Accepted Articles

[A4] Yann-Meing Law and D. Appelö. The Hermite-Taylor correction function method for Maxwell's equations. *Communications on Applied Mathematics and Computation*, 2023.

[A5] Zhichao Peng, Daniel Appelö, and Shuang Liu. Universal AMG accelerated embedded boundary method without small cell stiffness. *Journal of Scientiffic Computing*, 2023.

Articles in Archival Journals

[J6] LA Martinez, Z Peng, D Appelö, DM Tennant, N Anders Petersson, JL DuBois, and YJ Rosen. Noise-specific beating in the higher-level ramsey curves of a transmon qubit. *Applied Physics Letters*, 122(11):114002, 2023.

[J7] Daniel Appelö, Lu Zhang, Thomas Hagstrom, and Fengyan Li. An energy-based discontinuous galerkin method with tame cfl numbers for the wave equation. *BIT Numerical Mathematics*, 63(1):5, 2023.

[J8] D. Appelö, F. Garcia, A. Alvarez Loya, and O. Runborg. El-WaveHoltz: A time-domain iterative solver for time-harmonic elastic waves. *Computer Methods in Applied Mechanics and Engineering*, 401:115603, 2022.

[J9] Daniel Appelö, Kiera van der Sande, and Nathan Albin. Fourier continuation discontinuous Galerkin methods for linear hyperbolic problems. *Communications on Applied Mathematics and Computation*, pages 1–21, 2022.

[J10] Zhichao Peng and Daniel Appelö. EM-WaveHoltz: A flexible frequency-domain method built from time-domain solvers. *IEEE Transactions on Antennas and Propagation*, 70(7):5659–5671, 2022.

[J11] Siyang Wang, Daniel Appelö, and Gunilla Kreiss. An energy-based summation-by-parts finite difference method for the wave equation in second order form. *Journal of Scientific Computing*, 91(2):1–22, 2022.

[J12] Yunan Yang, Alex Townsend, and Daniel Appelö. Anderson acceleration based on the H_s sobolev norm for contractive and noncontractive fixed-point operators. *Journal of Computational and Applied Mathematics*, 403:113844, 2022.

[J13] Hao Li, Daniel Appelö, and Xiangxiong Zhang. Accuracy of spectral element method for wave, parabolic, and Schrödinger equations. *SIAM Journal on Numerical Analysis*, 60(1):339–363, 2022.

[J14] Allen Alvarez Loya and Daniel Appelö. A Hermite method with a discontinuity sensor for Hamilton–Jacobi equations. *Journal of Scientific Computing*, 90(3):1–31, 2022.

[J15] Lu Zhang, Daniel Appelö, and Thomas Hagstrom. Energy-based discontinuous Galerkin difference methods for second-order wave equations. *Communications on Applied Mathematics and Computation*, pages 1–25, 2021.

[J16] D. Appelö, F. Garcia, and O. Runborg. WaveHoltz: Iterative solution of the Helmholtz equation via the wave equation. *SIAM Journal on Scientific Computing*, 42(4):A1950–A1983, 2020.

[J17] Daniel Appelö, Thomas Hagstrom, Qi Wang, and Lu Zhang. An energy-based discontinuous Galerkin method for semilinear wave equations. *Journal of Comput. Phys.*, 418:109608, 2020.

[J18] Oleksii Beznosov and Daniel Appelö. Hermite - discontinuous Galerkin overset grid methods for the scalar wave equation. *Communications on Applied Mathematics and Computation*, 2020.

[J19] Klaus Heinemann, Daniel Appelö, Desmond P. Barber, Oleksii Beznosov, and James A. Ellison. Reevaluation of spin-orbit dynamics of polarized e^-e^+ beams in high energy circular accelerators and storage rings: An approach based on a bloch equation. *International Journal of Modern Physics A*, 35(15n16):2041003, 2020.

[J20] Klaus Heinemann, Daniel Appelö, Desmond P. Barber, Oleksii Beznosov, and James A. Ellison. The Bloch equation for spin dynamics in electron storage rings: computational and theoretical aspects. *International Journal of Modern Physics A*, 34(36):1942032, 2019.

[J21] D. Appelö, V. A. Bokil, Y. Cheng, and F. Li. Energy stable SBP-FDTD methods for Maxwell-Duffing models in nonlinear photonics. *IEEE Journal on Multiscale and Multiphysics Computational Techniques*, 4:329–336, 2019.

[J22] M. Motamed and D. Appelö. Wasserstein metric-driven bayesian inversion with application to wave propagation problems. *International Journal for Uncertainty Quantification*, 9(4):395–414, 2019.

[J23] Lu Zhang, Thomas Hagstrom, and Daniel Appelö. An energy-based discontinuous Galerkin method for the wave equation with advection. *SIAM Journal of Numerical Analysis*, 57(5):2469–2492, 2019.

[J24] D. Appelö and S. Wang. An energy-based discontinuous Galerkin method for coupled elasto-acoustic wave equations in second-order form. *International Journal for Numerical Methods in Engineering*, 119(7):618–638, 2019.

[J25] D. Appelö, T. Hagstrom, and A. Vargas. Hermite methods for the scalar wave equation. *SIAM Journal on Scientific Computing*, 40(6):A3902–A3927, 2018.

[J26] A. Kornelus and D. Appelö. Flux-conservative Hermite methods for simulation of nonlinear conservation laws with shocks. *J. of Sci. Comput.*, 76:24–47, 2018.

[J27] M. Motamed and D. Appelö. A MultiOrder discontinuous Galerkin Monte Carlo method for hyperbolic problems with stochastic parameters. *SIAM J. on Numer. Anal.*, 56(1):448–468, 2018.

[J28] D. Appelö and T. Hagstrom. An energy-based discontinuous Galerkin discretization of the elastic wave equation in second order form. *Comput. Meth. Appl. Mech. Engrg.*, 338:362–391, 2018.

[J29] D. Appelö, G. Kreiss, and S. Wang. An explicit Hermite-Taylor method for the Schrödinger equation. *Communications in Computational Physics*, 21(5):1207–1230, 2017.

[J30] D. Appelö and T. Hagstrom. A new discontinuous Galerkin formulation for wave equations in second order form. *SIAM Journal On Numerical Analysis*, 53(6):2705–2726, 2015.

[J31] X. Chen, D. Appelö, and T. Hagstrom. A hybrid Hermite–discontinuous Galerkin method for hyperbolic systems with application to Maxwell's equations. *Journal of Computational Physics*, 257, Part A:501–520, 2014.

[J32] D. Appelö and N. A. Petersson. A fourth-order embedded boundary method for the wave equation. *SIAM Journal on Scientific Computing*, 34(6):2982–3008, 2012.

[J33] D. Appelö, J. W. Banks, W. D. Henshaw, and D. W. Schwendeman. Numerical methods for solid mechanics on overlapping grids: Linear elasticity. *Journal of Computational Physics*, 231(18):6012–6050, 2012.

[J34] T. Hagstrom, D. Appelo, T. Colonius, M. Inkman, and C. Y. Jang. Simulation of compressible flows using Hermite methods. *The Journal of the Acoustical Society of America*, 131(4):3429–3429, 2012.

[J35] D. Appelö and T. Hagstrom. On advection by Hermite methods. *Pacific Journal Of Applied Mathematics*, 4(2):125–139, 2011.

[J36] C.L. Ting, D. Appelö, and Z.G. Wang. Minimum energy path to membrane pore formation and rupture. *Physical Review Letters*, 106(16):168101, 2011.

[J37] A. Samanta, D. Appelö, T. Colonius, J. Nott, and J. Hall. Computational modeling and experiments of natural convection for a titan montgolfiere. *AIAA Journal*, 5:1007–1016, 2010.

[J38] D. Appelö and T. Colonius. A high-order super-grid-scale absorbing layer and its application to linear hyperbolic systems. *Journal of Computational Physics*, 228(11):4200–4217, 2009.

[J39] D. Appelö and N. A. Petersson. A stable finite difference method for the elastic wave equation on complex geometries with free surfaces. *Communications in Computational Physics*, 5(1):84–107, 2009.

[J40] D. Appelö and T. Hagstrom. A general perfectly matched layer model for hyperbolic-parabolic systems. *SIAM Journal on Scientific Computing*, 31(5):3301–3323, 2009.

[J41] V. Eliasson, W. D. Henshaw, and D. Appelö. On cylindrically converging shock waves shaped by obstacles. *Physica D: Nonlinear Phenomena*, 237(14-17):2203–2209, 2008.

[J42] D. Appelö and G. Kreiss. Application of a perfectly matched layer to the nonlinear wave equation. *Wave Motion*, 44(7-8):531–548, 2007.

[J43] T. Hagstrom and D. Appelö. Automatic Symmetrization and Energy Estimates Using Local Operators for Partial Differential Equations. *Communications in Partial Differential Equations*, 32(7):1129–1145, 2007.

[J44] D. Appelö, T. Hagstrom, and G. Kreiss. Perfectly matched layers for hyperbolic systems: General formulation, well-posedness, and stability. *SIAM Journal on Applied Mathematics*, 67(1):1–23, 2006.

[J45] D. Appelö and G. Kreiss. A new absorbing layer for elastic waves. *Journal of Computational Physics*, 215(2):642–660, 2006.

Proceedings

[P46] Tracy Babb, Per Gunnar Martinsson, and Daniel Appelö. HPS accelerated spectral solvers for time dependent problems: Part 1, algorithms. In *Proceedings of: Spectral and High Order Methods for Partial Differential Equations ICOSAHOM 2018*.

[P47] Tracy Babb, Per Gunnar Martinsson, and Daniel Appelö. HPS accelerated spectral solvers for time dependent problems: Part 2, numerical experiments. In *Proceedings of: Spectral and High Order Methods for Partial Differential Equations ICOSAHOM 2018*.

[P48] Daniel Appelö, Fortino Garcia, and Olof Runborg. *WaveHoltz: Parallel and scalable solution of the Helmholtz equation*, pages 1541–1545. 2019.

[P49] D. Appelö, V. Bokil, Y. Cheng, and F. Li. Energy stable staggered high order finite differences for optical media. In *2019 International Applied Computational Electromagnetics Society Symposium (ACES)*, pages 1–2, April 2019.

[P50] A Klaus, Oleksii Beznosov, James A Ellison, Desmond P. Barber, and Daniel Appelö. A pseudospectral method for solving the bloch equations of the polarization density in e- storage rings. In *9th International Particle Accelerator Conference, IPAC2018, Vancouver, BC, Canada*, 2018.

[P51] Adeline Kornelus and Daniel Appelö. On the scaling of entropy viscosity in high order methods. In *Springer Lecture Notes in Computational Science and Engineering: Spectral and High Order Methods for Partial Differential Equations ICOSAHOM 2016: Selected Papers from the ICOSAHOM conference, June 27-July 1, 2016, Rio de Janeiro, Brazil*, pages 175–187. Springer, 2017.

[P52] D. Appelö and S. Wang. An energy based discontinuous Galerkin method for acoustic-elastic waves. Extended abstract Waves 2017.

[P53] D. Appelö, T. Hagstrom, and A. Semenova. An energy based discontinuous Galerkin method for hamiltonian systems. Extended abstract Waves 2017.

[P54] D. Appelö, T. Hagstrom, and A. Kornelus. Sobolev-dG a class of dG methods with tame CFL numbers. Extended abstract Waves 2017.

[P55] D. Appelö and T. Hagstrom. A new discontinuous Galerkin formulation for wave equations in second order form. Extended abstract Waves 2015, 2015.

[P56] A. Kornelus and D. Appelö. Application of the entropy viscosity method to Hermite methods for shock problems. Extended abstract Waves 2015, 2015.

[P57] T. Colonius, A. Sinha, D. Rodríguez, A. Towne, J. Liu, G.A. Brès, D. Appelö, and T. Hagstrom. Simulation and modeling of turbulent jet noise. In Jochen Fröhlich, Hans Kuerten, Bernard J. Geurts, and Vincenzo Armenio, editors, *Direct and Large-Eddy Simulation IX*, ERCOFTAC Series, pages 305–310. Springer International Publishing, 2015.

[P58] Thomas Hagstrom and Daniel Appelö. Solving pdes with hermite interpolation. In *Springer Lecture Notes in Computational Science and Engineering: Spectral and High Order Methods for Partial Differential Equations ICOSAHOM 2014: Selected papers from the ICOSAHOM conference, June 23-27, 2014, Salt Lake City, Utah, USA*, pages 31–49. Springer, 2015.

[P59] C. Y. Jang, D. Appelö, T. Colonius, T. Hagstrom, and M. Inkman. An analysis of dispersion and dissipation properties of Hermite methods and its application to direct numerical simulation of jet noise. In *18th AIAA/CEAS Aeroacoustics Conference (33rd AIAA Aeroacoustics Conference)*. American Institute of Aeronautics and Astronautics, 2013/10/31 2012.

[P60] T. Hagstrom, D. Appelö, and C. Y. Jang. Hermite methods for hyperbolic-parabolic systems. In *Waves2011, Vancouver, Canada.*, 2011.

[P61] D. Appelö, M. Inkman, T. Hagstrom, and T. Colonius. Hermite methods for aeroacoustics: Recent progress. In *17th AIAA/CEAS Aeroacoustics Conference (32nd AIAA Aeroacoustics Conference), Portland, Oregon, June 5-8, 2011*, number AIAA-2011-2757, 2011.

[P62] D. Appelö, T. Colonius, T. Hagstrom, and M. Inkman. Development of arbitrary-order Hermite methods for simulation and analysis of turbulent jet noise. *Procedia Engineering: IUTAM Symposium on Computational Aero-Acoustics for Aircraft Noise Prediction, University of Southampton, 29-31 March*, 2010.

[P63] T. Colonius, D. Appelö, J. Nott, and J. Hall. Computational modeling and experiments of natural convection for a Titan Montgolfiere. In *AIAA Balloon Systems Conference, AIAA-2009-2806, Seattle 2009*, 2009.

[P64] T. Hagstrom and D. Appelö. Experiments with Hermite methods for simulating compressible flows: Runge-Kutta time-stepping and absorbing layers. In *13th AIAA/CEAS Aeroacoustics Conference*, number 2007-3505, 2007.

[P65] D. Appelö, S. Nilsson, A. N. Petersson, and B. Sjögreen. A stable finite difference method for the elastic wave equation on complex domains with free surface boundary conditions. In *Proceedings of Waves 2007, Reading, UK July 23-27*, 2007.

[P66] D. Appelö and G. Kreiss. A new PML for the simulation of elastic waves in anisotropic media. In *The 7th Int. Conf. on Math. and Num. Aspects of Wave Propagation, Brown University, USA, June 20-24*, 2005.

[P67] D. Appelö and T. Hagstrom. Construction of stable PMLs for general 2×2 symmetric hyperbolic systems. In *Proceedings of the Tenth International Conference on Hyperbolic Problems: Theory, Numerics, Applications, Osaka*, 2004.

[P68] D. Appelö and G. Kreiss. Discretely nonreflecting boundary conditions for higher order centerd schemes for wave equations. In Cohen et. al, editor, *Mathematical and Numerical Aspects of Wave Propagation, Proceedings Waves2003*, pages 130–125. Springer Verlag, 2003.

[P69] D. Appelö and G. Kreiss. Evaluation of a well-posed perfectly matched layer for computational acoustics. In T.Y. Hou E. Tadmor, editor, *Hyperbolic Problems: Theory, Numerics, Applications, Proceedings of the Ninth International Conference on Hyperbolic Problems*, pages 285–294. Springer Verlag, 2002.

Thesis

[T70] D. Appelö. *Absorbing Layers and Non-Reflecting Boundary Conditions for Wave Propagation Problems*. PhD thesis, Royal Institute of Technology, October 2005.

[T71] D. Appelö. Non-reflecting boundary conditions for wave propagation problems. Licenciates Thesis, Royal Institute of Technology, 2003.

[T72] D. Appelö. PML-methods for the linearized Euler equations. Master's thesis, Royal Institute of Technology, 2000.

Plenary Presentations

- What's new with the wave equation?, The North American High Order Methods Conference (NAHOMCon) San Diego June 2-5 2019
- How Dark Is the Unilluminable Room?, University of Toronto Institute for Aerospace Studies - Computational Science and Engineering Symposium, Toronto, May 2023

Presentations at Professional Meetings

- How Dark is the Unillumnable Room?, SIAM CSE 2023 March 2023, Amsterdam, Netherlands.

- EM-WaveHoltz: A time-domain frequency-domain solver for Maxwell's equations, Waves 2022 July 2022, Palaiseau, France.
- WaveHoltz-DG: A Wave Equation Based Solver for the Helmholtz Equation, SIAM CSE March 2021, Virtual.
- WaveHoltz: Parallel and Scalable Solution of the Helmholtz Equation via Wave Equation Iteration, SCICADE July 2019, Innsbruck Austria.
- Parallel frequency domain electromagnetic solvers without agonizing pain, ICIAM 2019, Valencia Spain.
* Wasserstein Metric-Driven Deterministic and Bayesian Inversion for Elastic Wave Propagation, ICIAM 2019, July 2019, Valencia Spain.
- Energy Stable Staggered High Order Finite Differences for Optical Media, 2019 International Applied Computational Electromagnetics Society Symposium (ACES), Miami, FL
- Wasserstein Metric-driven Bayesian Inversion with Applications to Wave Propagation Problems, SIAM Conference on Mathematical & Computational Issues in the Geosciences (GS19), Houston, TX, 2019
* Numerical Homogenization for Waves using Hermite Methods, SIAM CSE Spokane 2019
- Hermite and dG methods for wave equations and their application to uncertain and inverse problems, WCCM, 2018, New York, USA, July 2018
* Hermite and dG methods for wave equations and their application to uncertain and inverse problems, ICOSAHOM, 2018, London UK, July 2018
- Energy based discontinuous Galerkin methods for complex materials, ICERM Workshop on Computational Aspects of Time Dependent Electromagnetic Wave Problems in Complex Materials, Providence, USA, June 2018
- Globally Super-Convergent Conservative Hermite Methods for the Scalar Wave Equation. Banff workshop 17w5152 - Connections in Geometric Numerical Integration and Structure-Preserving Discretization, Banff, Canada, June 2017
- Three Tricks to Tame the CFL in Discontinuous Galerkin Methods. SIAM CSE, Atlanta, USA, March 2017
- An Energy Based Discontinuous Galerkin Method for Hamiltonian Systems. The Tenth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens GA, USA, April 2017
* An Energy Based Discontinuous Galerkin Method for Hamiltonian Systems. Waves 2017, Minnesota, USA, May 2017
- Energy Based Discontinuous Galerkin Methods for Nonlinear Waves. SIAM NLWCS, Philladelphia, USA, August 2016
- Energy Based Discontinuous Galerkin Methods for Propagation of Waves in Deterministic and Stochastic Problems, ICOSAHOM, 2016, Rio de Janiero Brazil, 2016
- An energy-based discontinuous Galerkin discretization of the elastic wave equation in second order form, ECCOMAS Congress 2016, Crete, Greece, June 2016
- A Multi-Order Monte Carlo Discontinuous Galerkin Method for Wave Equations with Uncertainty. SIAM UQ 2016, EPFL, Switzerland, April 2016
* A new discontinuous Galerkin formulation for wave equations in second order form. Waves 2015, Karlsruhe, Germany, July 2015
* Upwind DG for Acoustic and Elastic Wave Equations, SIAM CSE, Salt Lake City, March 2015
- A Fourth Order Accurate Embedded Boundary Method for the Wave Equation in Second Order Form, SIAM CSE, Salt Lake City, March 2015
- Discontinuous Galerkin methods for Nonlinear Variational Wave Equations, AMS Western Spring Sectional Meeting, Albuquerque, NM, April 4-6, 2014

* Dissipative and Non-dissipative Hermite Methods for the Wave Equation, ICOSAHOM-2014 Salt Lake City, June 23-27 2014.
- Upwind DG for the wave equation in second order form, 11th International Conference on Theoretical and Computational Acoustics 10-14 March, 2014, Texas A&M University, College Station.
- P-adaptive Hermite methods for the Schrödinger equation. Eighth IMACS international conference on nonlinear evolution equations and wave phenomena: computation and theory Athens, GA, March 25, 2013.
* Hermite Methods for Hyperbolic Systems: Applications and Extensions. SIAM CS&E, Boston, February 26, 2013.
- Jet Noise DNS using Arbitrary-order Hermite Methods. SIAM CS&E, Boston, February 26, 2013.
- SIAM Annual meeting, Minneapolis, Minnesota, July 9-13, 2012. Invited mini symposium on modeling of rare events.
- Nucleation Events in Soft Condensed Matter Using the String Method, SIAM Annual meeting, Minneapolis, Minnesota, July 9-13, 2012, mini symposium on modeling of rare events.
* Hybrid Hermite-Discontinuous-Galerkin Methods for Hyperbolic Systems, SIAM CSE 2011.
- The Minimum Energy Path to Membrane Pore Formation and Rupture, SIAM CSE 2011.
- Hermite Methods for Aeroacoustics: Recent Progress, 6 - 8 Jun 2011,17th AIAA/CEAS Aeroacoustics Conference, Portland OR.
- Development of Arbitrary-Order Hermite Methods for Simulation and Analysis of Turbulent Jet Noise, IUTAM Symposium on Computational Aero-Acoustics for Aircraft Noise Prediction, University of Southampton, 29-31 March 2010.
* Super-Grid-Scale Models as Absorbing Layers for the Navier-Stokes Equations and Other Applications, SIAM Annual Meeting, San Diego, 2008.
- A General Perfectly Matched Layer Model for Hyperbolic Parabolic Systems, SIAM Annual Meeting, San Diego, 2008.
- Studies of Compressible Flows Using Arbitrary-order Hermite Discretizations, SIAM Annual Meeting, San Diego, 2008.
* A Stable Finite Difference Scheme for the Elastic Wave Equation on Complex Domains with Free Surface Boundary Conditions, 8th Int. Conf. on Math. and Numerical Aspects of Waves (Waves 2007), Reading, UK, 2007.
* Simulation of elastic waves in cylindrical shells, CAR Research and Technology Showcase, LLNL, 2007.
* A Stable Finite Difference Scheme for the Elastic Wave Equation on Complex Domains with Free Surface Boundary Conditions, ASCR Applied Mathematics Research PI Meeting, LLNL, May 22-24, 2006.
* A New PML for the simulation of elastic waves in anisotropic media, The 7th Int. Conf. on Math. and Num. Aspects of Wave Propagation, Brown University, USA, June 20-24, 2005.
* Energy Estimates for Perfectly Matched Layers, Tenth International Conference on Hyperbolic Problems, Theory, Numerics, Applications, Osaka, Japan, September 13-17, 2004.
* Discretely Nonreflecting Boundary Conditions for Higher order Centered Schemes for Wave Equations, The Sixth Int. Conf. on Math. and Num. Aspects of Wave Propagation, 2003, Jyväskylä University, Finland.
* Evaluation of a well-posed Perfectly Matched Layer for Computational Acoustics, Ninth Int. Conf. on Hyperbolic Problems Theory, Numerics, Applications, 2002, Caltech, Pasadena, CA, USA.

Colloquium and Departmental Seminars

- What's new with the Wave Equation?, Virginia Tech., February 2023

- WaveHoltz: How the wave equation can be used to solve Helmholtz equation, Arizona State University, January 2023
- WaveHoltz: How the wave equation can be used to solve Helmholtz equation, Virginia Tech., October 2022
- WaveHoltz: How the wave equation can be used to solve Helmholtz equation, Uppsala University, June 2022
- WaveHoltz-DG: A Wave Equation Based Solver for the Helmholtz Equation, Michigan Tech. University April 2022
- WaveHoltz-DG: A Wave Equation Based Solver for the Helmholtz Equation, UC Merced Waves seminar March 2022
- WaveHoltz: Parallel and Scalable Solution of the Helmholtz Equation via Wave Equation Iteration, Comp. Math. Seminar UmeåUniversity, July 2022
- WaveHoltz: Parallel and Scalable Solution of the Helmholtz Equation via Wave Equation Iteration, NA & PDE seminar University of Delaware, Feb 2021
- WaveHoltz: Parallel and Scalable Solution of the Helmholtz Equation via Wave Equation Iteration, Computational Mathematics Seminar, Mathematical Sciences Institute, The Australian National University, Feb 2021
- WaveHoltz: Parallel and Scalable Solution of the Helmholtz Equation via Wave Equation Iteration, Mathematical Sciences Colloquium, RPI , Feb 2020
- WaveHoltz: Parallel and Scalable Solution of the Helmholtz Equation via Wave Equation Iteration, Computational and Applied Math Seminar, Chalmers, Sweden, May 2019
- What's new with the wave equation?, Colloquium Oregon State University, April 2019
- What is new with the wave equation? Analysis sand Applications Seminar University of Colorado Colorado Springs February 2019
- What is new with the wave equation?, Seminar in Numerical Analysis, June 2018, Royal Institute of Technology, Stockholm
- What is new with the wave equation?, Computational and Applied Math Seminar, June 2018, Chalmers Institute of Technology
- What is new with the wave equation?, Applied Math. Colloquium, March, 2018, Colorado School of Mines
- What is new with the wave equation?, Computational and Applied Math. Seminar, March, 2018, Arizona State University
- Energy Based Discontinuous Galerkin Methods, Workshop Seminar, July, 2017, Central China Normal University, Wuhan, China
- Globally Super-Convergent Conservative Hermite Methods for the Scalar Wave Equation, Workshop Seminar, July, 2017, Central China Normal University, Wuhan, China
- A Compact Fourth-Order-Accurate Embedded Boundary Method for the Wave Equation, Workshop Seminar, July, 2017, Central China Normal University, Wuhan, China
- High order accurate methods for time dependent problems, Colloquium, April 14, 2017, Rensselaer Polytechnic Institute
- High order accurate methods for time dependent problems, 2017, University of Colorado at Boulder
- Energy based discontinuous Galerkin methods, Colloquium, January 11 2017, Sandia National Labs
- Energy based discontinuous Galerkin methods, Colloquium, April 2017, Los Alamos National Labs
- Energy based discontinuous Galerkin methods, Colloquium, January 6 2017, Rice University
- Energy based discontinuous Galerkin methods, Colloquium, November 4 2016, Mathematics Department, Virginia Tech

- Energy based discontinuous Galerkin methods, Seminar, September 13, 2016, Lawrence Livermore National Laboratory
- Lagom Order Accurate Methods for Propagation of Waves in Deterministic and Stochastic Problems, Seminar in Numerical Analysis, June 3 2016, Royal Institute of Technology
- Lagom Order Accurate Methods for Propagation of Waves in Deterministic and Stochastic Problems, Seminar in Numerical Analysis, June 2016, Scientific computing seminar Uppsala university, Uppsala, Sweden
- Multi Level Monte Carlo Methods - Overview and Extensions, Statistics Colloquium UNM, April 2016
- High order accurate methods for time dependent problems. October 2015, UNM
- Hermite Methods for Nonlinear Conservation Laws, Team CHIDES take on the dichotomy of scales, SMU Mathematics Research Colloquium, Thursday, October 8, 2015
- A new discontinuous Galerkin formulation for wave equations in second order form, July 2015 TDB Uppsala University
- Hermite methods, basic elements, extensions and applications, CSRI Seminar Sandia Natl. Labs. Sep. 26 2012
- A pedestrians guide to Hermite methods, basic elements and some more sophisticated things, Scientific computing seminar Uppsala university, Uppsala, Sweden, March 20 2012.
- A pedestrians guide to Hermite methods, basic elements and some more sophisticated things, Numerical analysis seminar KTH, Stockholm Sweden, March 15 2012.
- A fourth-order accurate embedded boundary method for the wave equation, Mechanical engineering seminar Dec. 2 2011, NMSU.
- Arbitrary order Hermite methods for compressible flows, Mechanical engineering seminar Nov. 11 2011, UNM.
- Waves, Jet Noise and Membranes, Colloquium at the Department of Mathemathics and Statistics, UNM, Sep. 30.
- Development of Arbitrary-Order Hermite Methods for Simulation and Analysis of Turbulent Jet Noise, Center for Applied Scientific Computing, LLNL, Livermore 15 June 2010.
- Finite Difference Approximations for Time-Dependent Solid-Mechanics, SMU Scientific Computing Seminar, Feb. 25. 2010.
- A Compact Fourth-Order-Accurate Embedded Boundary Method for the Wave Equation, Research colloquium Department of Mathematics, SMU, April 2009.
- A Compact Fourth-Order-Accurate Embedded Boundary Method for the Wave Equation, Colloquium at Department of Numerical Analysis and Computer Science, KTH Stockholm 2009.
- A Compact Fourth-Order-Accurate Embedded Boundary Method for the Wave Equation, Department of Scientific Computing, Uppsala University, Sweden, Oct. 2009.
- A Stable Finite Difference Scheme for the Elastic Wave Equation on Complex Domains with Free Surface Boundary Conditions, Colloquium University of New Mexico, April 17, 2008.
- A General Formulation of Perfectly Matched Layers for Mixed Hyperbolic-Parabolic Systems and its Application to Simulations of Viscous Compressible Flows, Colloquia at Department of Numerical Analysis and Computer Science, KTH Stockholm, Sep. 2007.
- A General Formulation of Perfectly Matched Layers for Mixed Hyperbolic-Parabolic Systems and its Application to Simulations of Viscous Compressible Flows, Department of Scientific Computing, Uppsala University, Sweden, Sep. 2007.
- Perfectly Matched Layers for Wave Propagation Problems on Unbounded Domains: General Formulation, Well-posedness and Stability, ICES seminar, University of Texas at Austin, Apr 11, 2006.
- A Stable Finite Difference Scheme for the Elastic Wave Equation on Complex Domains with Free Surface Boundary Conditions, Applied Math. Seminar Departement of Mathematics, UC Davis, Nov. 5 2007.

Departmental Topical Seminars

* An introduction to absorbing layers and non-reflecting boundary conditions, CU Boulder, 24 October 2017.
* Getting rid of the grid Part 1: Embedded boundary methods for wave equations, CU Boulder, September 12 2017.
* An energy based discontinuous Galerkin formulation for wave equations in second order form, UNM, August 17 2015.
* Stretching, damping and perfectly matched layers, Applied Math Seminar, Feb. 2 2015, UNM.
* A Compact Fourth-Order-Accurate Embedded Boundary Method for the Wave Equation, Applied Math Seminar, Jan. 26 2015, UNM.
* A new discontinuous Galerkin formulation for wave equations in second order form, Applied Math Seminar, Sep. 15 2014, UNM.
* Hermite Methods for Simulating Compressible Flows, Fluid Mechanics Research Conference, GALCIT, Caltech Nov. 10 2010.

Research Funding

Current

$2,965,563 NRT-AI-HDR: Harnessing the data revolution (HDR) to enable predictive multi-scale modeling across STEM. PI Daniel Appelö, NSF 2152014, 07/01/22-06/30/27

$283,456 High Order Wave Equation Algorithms for Frequency Domain Problems. PI Daniel Appelö, NSF (DMS 2208164), 09/15/2022 - 09/15/2025.

$303,373 Numerical Methods for Wave Equations in Time and Frequency Domain. PI Daniel Appelö, NSF (DMS 1913076 & 2210286 (transfer to MSU)), 06/15/2019 - 05/31/2023.

$250,000 DOE: Tough Errors Are no Match (TEAM): Optimizing the quantum compiler for noise resilience, 10/01/2019 - 09/30/2024. $250,000 CU-PI Appelö. This is part of a larger DOE Accelerated Research in Quantum Computing (ARQC) 5-year multi institution program ($9,000,000 total Lead PI: B. David Clader, JHU.)

$15,000 STINT Initiation Grant: Computational Methods for Wave Propagation, PI Olof Runborg (KTH, Sweden) Co-PI Appelö.

Pending

$1,667,472 Scalable Open Source Plasma Framework based on Kokkos (Air Force Office of Scientific Research), PI Christlieb (MSU) Co-PI Appelö, Brian O'Shea, & John Verboncoeur, 10/01/22-09/30/26

Past

$61,000 Uppsala University Visiting Professor fund for the summers 2017 & 2018

$6,000 Fast wave equation solvers for shallow and range dependent underwater acoustics: Inverse problems and uncertainty quantification, Imaging Science IRT seed grant 2019.

$20,000 Differential imaging of evolution in highly scattering composites with unknown micro/macrostructure, Imaging Science IRT seed grant 2019. PI Fatemeh Pourahmadian, Co-PI Appelö

$258,196 Hybrid Hermite-Discontinuous Galerkin Methods with Applications to Elastic and Electromagnetic Waves. PI Daniel Appelö, NSF (DMS-1319054), 09/15/2013 - 08/31/2017, $258,196 ($179,963 direct, $78,233 indirect)

$40,369 **ARRA** Caltech Subaward: CR: Simulation and analysis of Jet Noise. PI Daniel Appelö, NSF / Caltech, 06/01/2012 - 05/31/2014, $40,369 ($26,734 direct, $13,635 indirect)

Teaching

Postdoctoral Advisement

- Zhichao Peng, 2020-
- Yann-Meing Law, 2021-

Doctoral Advisement

- Xi Chen (UNM), Numerical and Analytical Studies of Electromagnetic Waves: Hermite Methods, Supercontinuum Generation, and Multiple Poles in the SEM, 2012. Placement: Researcher at HyPerComp Engineering Inc.
- Adeline Kornelus (UNM); 2017; High order Hermite and discontinuous Galerkin Methods for Hyperbolic Problems. Placement: Postdoc at Arizona State University
- Oleksii Beznosov (UNM); 2020; From Wave Propagation to Spin Dynamics: Mathematical and Computational Aspects. Placement: Postdoc at Los Alamos National Laboratory
- Fortino Garcia; Summer 2021 (CU); Part I: WaveHoltz a new iterative method for frequency domain problems. Part II: Numerical methods for quantum control. Placement: NSF Postdoc at Courant Institute New York University.
- Allen Alvarez Loya; Summer 2022 (CU); High-Order Methods for Wave Phenomena. Placement: NSF Postdoc at Los Alamos National Laboratory.
- Amit Rotem; Spring 2026 (VT, Anticipated); No working title yet.
- Spencer Lee; Spring 2026 (MSU, Anticipated); No working title yet.

Dissertation Committees

- Served as committee member on the dissertation committees at MSU: William Sands, Stephen White, Nick Krupansky, Tianyu Yang, Andrés Galindro, Kai Huang, Shuyang Qin, at CU Boulder: Tracy Babb, Jeremy Thompson, Dylan Abrahamsen, David Gunderman, Mingyu Hu, at UNM: Ming Gong, David Bizzozero, Michael R. Payne, Eric Benner, and: Hao Li (Purdue), Lu Zhang (SMU).

Masters Advisement

- Juan Pablo Madrigal Cianci, UNM 2017, Deterministic and Probabilistic Methods for Seismic Source Inversion.
- Evan Dye, UNM 2014, GPU implementations of Hermite Methods.

All below were co-advised with Prof. G. Kreiss.

- Mohammad Ali Etaati, KTH, Sweden, 2005. An Absorbing Layer for Non-linear Wave equations: First Order Formulation.
- Neda Sepasian, KTH, Sweden, 2005. An Absorbing Layer for Non-linear Wave equations: Second Order Formulation.
- Maria Fröling, KTH, Sweden, 2004. A Numerical Investigation of a Perfectly Matched Layer for Computational Aero Acoustics.
- Mohamad Motamed, KTH, Sweden, 2003. PML Methods for Aero Acoustics Computations.
- Svante Svensson-Frey, KTH, Sweden, 2003. A Comparison of Non-Reflecting Boundary Conditions for the Linearized Euler Equation.

Undergraduate Student Mentoring

Since Fall 2011 I have advised the following undergraduate students. The advisement ranges from giving advice on what classes to take to where to apply for a job or to graduate school to writing letters of recommendation etc.: Acosta Kristina, Black Sarah, Cartee Shannon, Dukes Timothy, McCullough Theresa, Sachs Lauren, Sharp Christopher, Ulibarri Steven, Young Reed, Rodrigo Osuna Orozco, Martinez Melanie, Chavez Christina, Castle Carlin and Areley Miramontes, Dominic Gomez, Donald, Aaron, Legits, Cairn Overturf, Jeanette Varela, Jorge Velarde, Luke Perelli, Alex Sietsma.

Classroom Teaching at VT

Fall 2023	Mathematical Modeling: Methods and Tools II, CMDA 3606.

Classroom Teaching at MSU

Spring 2023	Methods for Parallel Computing, CMSE 401.
Fall 2022	Numerical Linear Algebra, MTH 850.
Fall 2021	Numerical Methods, MTH 451.
Spring 2021	Numerical Linear Algebra, CMSE 823.
Fall 2020	Numerical Linear Algebra, MTH 850.

Classroom Teaching at CU Boulder

Spring 2020	High Performance Computing, APPM 4720/5720.
Fall 2019	APPM 1350: Calculus 1 for Engineers,106 undergraduate students.
Fall 2019	APPM 5600: Numerical Analysis 1, 35 graduate students.
Fall 2018	Intro to numerical partial differential equations, APPM 6610, 10 graduate students.
Fall 2018	Intermediate Numerical Analysis I, APPM/MATH 4650, 80 undergraduate students.
Spring 2017	High Performance Computing, APPM 4720/5720, 12 undergraduate / graduate students.
Fall 2017	Intermediate Numerical Analysis I, APPM/MATH 4650, 52 undergraduate students.

Classroom Teaching at UNM

Spring 2017	Vector Analysis, MATH 311, 30 undergraduate students.
Fall 2016	Vector Analysis, MATH 311, 23 undergraduate students.
	Introduction to Scientific Computing, CS/MATH 471, 22 students.
Spring 2016	Numerical linear algebra, MATH 504, 12 students.
	Special Topic: Advanced Numerical Methods for ODE, MATH 579, 10 graduate students.
	Sem: Applied Math, MATH 679, 4 graduate students
Fall 2015	Intro Numerical Computing, CS/MATH 375, 30 undergraduate students.
	Introduction to Scientific Computing, CS/MATH 471, 26 students.
	Sem: Applied Math, MATH 679, 2 graduate students
Spring 2015	Linear Algebra with Apps, MATH 314, 31 undergraduate students.
	Special Topic: Numerical Analysis (Finite Element Analysis), MATH 579, 11 graduate students.
	Sem: Applied Math, MATH 679, 4 graduate students
Fall 2014	Intro to Numerical Approx & Diff. Eq., MATH 505, 12 graduate students.
	Introduction to Scientific Computing, CS/MATH 471, 16 students.
	Sem: Applied Math, MATH 679, 2 graduate students
	Reading and Research, MATH 650, one graduate student.
Fall 2013	Intro to Numerical Approx & Diff. Eq., MATH 505, 5 graduate students.
	Intro Numerical Computing, CS/MATH 375, 16 undergraduate students.
	Reading and Research, MATH 650, one graduate student.
Spring 2013	Intro Numerical Computing, CS/MATH 375, 21 undergraduate students.
	Linear Algebra with Apps, MATH 314, 36 undergraduate students.
	Reading and Research, MATH 650, one graduate student.
Fall 2012	Intro Numerical Computing, CS/MATH 375, 13 undergraduate students.
	Special Topic: Numerical Analysis (Computational Fluid Dynamics), MATH 579, 7 graduate students.
	Reading and Research, MATH 650, one graduate student.
Summer 2012	MCTP mini course on numerical analysis, about 25 undergraduate students.

Spring 2012 Intro Numerical Computing, CS/MATH 375, 20 undergraduate students.

Reading and Research, MATH 650, one graduate student.

Fall 2011 Intro Numerical Computing, CS/MATH 375, 14 undergraduate students.

Linear Algebra with Apps, MATH 314, 44 undergraduate students.

Teaching at Caltech

Spring 2009 Computational Fluid Dynamics Part 2, AE232. Instructor, 12 graduate and undergraduate students.

Fall 2008 Computational Fluid Dynamics Part 1, AE232. Instructor, 12 graduate and undergraduate students.

Teaching at Royal Institute of Technology

Spring 2006 Numerical Methods Basic Course I, 2D1210. Instructor, lectures, recitation and laboratory work, Lectures have about 80 students, recitations about 25.

2005 Math. Models, Analysis and Simulation, 2D1244, Recitations and laboratory work, about 25 students.

2005 Numerical Treatment of Diff. Eq, 2D1255, Recitations and laboratory work, about 25 students.

2001–2003 Applied Numerical Methods II, 2D1250, Recitations and laboratory work, about 25 students.

2002–2006 Numerical Methods, Basic Course I & II, 2D1210 & 2D1240, Recitations and laboratory work, about 25 students.

Curriculum Development

- Developed the course material for Special Topic: Finite Element Analysis MATH 579. Spring 2015.
- Modernized the course content of Math/CS 471 Introduction to Scientific Computing to include version control with git, openMP and MPI, Spring 2014-.
- Developed the course material for Special Topic: Numerical Analysis (Computational Fluid Dynamics), MATH 579. Fall 2012.
- Developed material for the one week introduction to numerical analysis. Summer 2012.
- Developed several new homework / project sets for Math 375, 2012.

Service

Editorships

2022– Associate editor Numerical Analysis and Scientific Computation (specialty section of Frontiers in Applied Mathematics and Statistics).

2014–2017 Associate editor Rocky Mountain Journal of Mathematics. Handling 10-15 papers per year.

Refereeing for journals and other publications

Journal of Scientific computing (1 per 1 month)

Journal of Computational Physics (1 per 2 months)

Communications in Mathematical Sciences, (1 per year)

Wave Motion (1 per year)

SIAM Journal on Scientific Computing (2 per year)

SIAM Journal on Numerical Analysis (2 per year)

Journal of Computational and Applied Mathematics (3 per year)

AIAA Journal (1 per year)

Applied Computational Mathematics (1 per year)

Reviews for funding organizations

Computational math. NSF, Computational math. for Israel Science Foundation, ASFOR, U.S. Army Corps of Engineers Engineer Research and Development Center, NSF-GRFP, NSF CSSI, NSF NRT

Administrative work on Department, College, University committees

2022/23 Director: NRT-AI-HDR: Harnessing the data revolution (HDR) to enable predictive multi-scale modeling across STEM

2022/23 Chair, Graduate Studies and Admission Committee

2022/23 Member, College of Natural Science Award Committee

2022/23 Member, Promotion and Tenure Committee

2021/22 Chair, Graduate Studies and Admission Committee

2021/22 Member, ECAC

2021/22 Member, College of Natural Science Award Committee

2021/22 Member, Hiring committee quantum algorithms (CMSE)

2020/21 Chair, Graduate Studies and Admission Committee

2020/21 Member, College of Engineering Hearing Committee

2020/21 Member, College of Natural Science Award Committee

2020/21 Member, Thesis citation ad hoc committee

2020/21 Member, Promotion and Tenure Committee

2020/21 Qualify Exam Examinator MTH & CMSE

2020/21 Early Start Grad Student MTH@MSU Committee

2019/20 Member, Graduate Committee

2019/20 Member, Chair's Advisory

2019/20 Member, Ad hoc Multi-year Hiring Committee

2019/20 Member, Promotion and Tenure Committee

2019/20 Member, Post Tenure Review Committee

2019/20 Member, Arts & Science Council & Arts & Science Sub Committee, A&S budget committee

2018/19 Chair of Colloquium committee

2018/19 Chair of search committee in numerical analysis / computational mathematics search

2018/19 Member of the graduate committee

2018/19 Member of College of Arts and Sciences budget committee

2018/19 Member of mid-review committee

2017/18 Member of the graduate committee

2015/16 Member of Center for Applied Scientific Computing Internal Advisory Board

2016/17 Faculty Senator

2016/17 Member of the Putnam preparation committee

2016/17 Member of the UNM-PNM Mathematics contest committee

2015/16 Member of the Undergraduate committee.

2014/15 Member of the NSF CC IIE Campus Networking Infrastructure grant Research Network Faculty Advisory Committee

2014/15 Computer use committee.

2013/14 Webpage committee.

2012/13 Member of the search committee for 2 applied math positions.

Conference Service

I have not included organization of minisymposia here.

Member of the scientific committee for Waves 2022, 15th International Conference on Mathematical and Numerical Aspects of Wave Propagation, 25-29 July 2022, Paris, France.

Member of the scientific committee for the 11th International Conference on Theoretical and Computational Acoustics 10-14 March, 2014, Texas A&M University, College Station.

Outreach and other service

2022 Talk in MSU Math-club, Nov 2022

2022 Talk in MSU AMS chapter, Nov 2022

2015 From Calculus to Waves Outreach to Undergraduates at Navajo Technical University Crownpoint NM, Nov 2015

2014–2016 Organizer of the Applied Math. Seminar. Hosted approximately 65 speakers.

Spring 2013– Faculty sponsor of the UNM Lobo cycling team.

2009– I have organized more than 20 mini-symposiums at international conferences like SIAM Annual Meetings, SIAM Computational Science and Engineering, Waves, ICOSAHOM etc.

2009– As a service to graduate students from other universities I have hosted Kenneth Duru, Stanford (visited me one week at Caltech), Kristoffer Virta, Uppsala University (visited UNM 2 x 3 months), Chang Young, SMU (visited UNM for one week), Kurt Stein (visited UNM one week) and John Lagrone SMU (visited UNM Nov-Dec 2015).