

Małgorzata Peszyńska
CURRICULUM VITÆ

PERSONAL INFORMATION

Born: August 28, 1962, Warsaw, Poland. **Citizenship:** United States and Poland
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EDUCATION AND EMPLOYMENT INFORMATION

EDUCATION

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|-----------------------------|---|------|
| Habilitation (Mathematics) | Warsaw University of Technology, Poland | 2011 |
| Thesis: | <i>Analysis of mathematical and computational models for flow and transport processes</i> | |
| Ph.D. (Mathematics) | University of Augsburg, Augsburg, Germany | 1992 |
| Advisor: | Prof. Dr. Karl-Heinz Hoffmann | |
| Thesis: | <i>Fluid flow through fissured media. Mathematical analysis and numerical approach.</i> | |
| M.Sc. (Applied Mathematics) | Warsaw University of Technology, Warsaw, Poland | 1986 |

EMPLOYMENT

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|------------------------------|--|--------------------|
| Professor | Department of Mathematics Oregon State University | 2012– |
| Program Director | National Science Foundation Division of Mathematical Sciences | 2019-21 |
| Associate Professor | Department of Mathematics Oregon State University | 2006–12 |
| Assistant Professor | Department of Mathematics Oregon State University | 2003–06 |
| Associate Director | CSM TICAM University of Texas at Austin | 2002–03 |
| Research Associate | Center for Subsurface Modeling (CSM) Institute for Computational Engineering and Sciences, (ICES), The University of Texas at Austin | 1998–03 |
| Lecturer | Department of Mathematics The University of Texas at Austin | 1995–98 |
| Visiting Assistant Professor | Department of Mathematics and Center for Applied Math., Purdue University | Fall 93 1994–95 |
| Assistant Professor | Institute of Mathematics Warsaw University of Technology, Warsaw | 1993–94 |
| Senior Researcher | Systems Research Institute, Polish Academy of Sciences (SRI PAS), Warsaw, Poland | 1992–94 |
| DAAD Research Fellow | University of Augsburg Augsburg, Germany | 1990–92 |
| Researcher | Systems Research Institute, Polish Academy of Sciences (SRI PAS), Warsaw, Poland | 1986–90 |

AWARDS

(Please see “Professional Experience” for travel awards.)

- Joel Davis Faculty Scholar, 2022-25.
- Champion of Science award (OSU College of Science), 2022.
- SIAM (Society of Industrial and Applied Mathematics) Geosciences Career Prize, 2021.
- AAAS (American Association for the Advancement of Science) Honorary Fellow, 2020.
- Joel Davis Faculty Excellence Award, awarded by Mathematics Department, 2016
- Graduate Faculty Award, (awarded by Mathematics Graduate students), 2016.
- Kosciuszko Foundation, Distinguished Fellow of the Collegium of Eminent Scientists of Polish Origin and Ancestry, January 2015.
<http://www.thekf.org/kf/programs/eminentscientists/>
- Fulbright Research Scholar, 2009-2010, project “*Coupling of discrete and continuum models of metastable configurations*” in collaboration with Interdisciplinary Centre for Modeling (ICM), University of Warsaw, Warsaw, Poland
- Mortar Board Top Professor Award, Oregon State University, May 2005
- Co-author of [10] nominated for Best Paper in Geophysics by Society of Exploration Geophysicists at the occasion of its 75’th Anniversary, awarded as Honorable Mention - Geophysics Award, presented at the Award Ceremony in Houston, November 4, 2005
- First Award of the Director and Scientific Council of Systems Research Institute, Polish Academy of Sciences, for best research work in 1993
- Stefan Batory (Soros) Foundation International Travel Award (1993)
- Deutscher Akademischer Austauschdienst (DAAD) Research Fellowship, 1990–1992, University of Augsburg, Augsburg, Germany

GRANT SUPPORT

Federal, state, and industry grants

- Principal Investigator, NSF DMS-1912938 “Modeling with Constraints and Phase Transitions in Porous Media” (Total budget amount \$224,450) for 2019-2022; under no-cost extension until 2023.
- Principal Investigator: “APG: Improve STEM graduate student preparedness for workforce.”, \$11,900, NSF DMS-1738014, 2017
- Principal Investigator: “Phase transitions in porous media across multiple scales”, \$383,894K, NSF DMS-1522734, 2015-21. [In 2019-21 Ralph Showalter served as substitute PI due to Peszynska’s service at the NSF].
- Principal Investigator: “Risk Reduction of CO₂ Storage with Stochastic Simulations” (Co-PI Mina Ossiander), DOE NETL project Nov. 15, 2013-October 31, 2014, \$94,000
- Principal Investigator: “Cumulative Evaluation of Spatial Risk & Uncertainty in Support of CO₂ Storage Evaluation” (Co-PI Mina Ossiander), DOE NETL project Nov. 15, 2013-October 31, 2014, \$60,000
- Co-Principal Investigator: “Feasibility of Biogeochemical Sealing of Wellbore Cements: Lab and Simulation Tests” (PI: Marta Torres, CEAOS OSU, Co-PI: Rick Colwell), DOE NETL project Nov. 15, 2013-October 31, 2014, \$258,787

- Principal Investigator: “Hybrid modeling in porous media”, NSF DMS-1115827, 9/15/2011–8/31/2014, \$299,905
Senior Personnel: Dorthie Wildenschild (OSU School of Chemical, Biological, and Environmental Engrg.).
- Co-Principal Investigator: “SOLAR: Enhanced Photovoltaic Efficiency through Heterojunction Assisted Impact Ionization” (subcontract from Univ. of Oregon, PI-Stephen Kevan), NSF DMS-1035513, 9/1/2010-8/31/2013, \$1,638,803. The total OSU amount of approximately \$670K includes a supplement from Oregon Nanosciences and Microtechnologies Institute (ONAMI)
Other OSU co-principal investigators: Janet Tate and Guenter Schneider (OSU Physics).
- NVIDIA Research Professor: received donation of three Graphics Processing Unit cards NVIDIA Tesla C1060 for High Performance Computing (HPC) needs in teaching/research in computational science worth \$1,444.32, Spring 2009
These cards were used in the HPC component of MTH 654/9 taught by Peszynska in Fall 2009, and were part of Math Learning Center Computer Lab.
- Co-Principal Investigator: “Modeling, Analysis and Simulation of Multiscale Preferential Flow”, Department of Energy, Multiscale Mathematics Program DOE 98089, PI: Showalter, 8/15/2005-8/14/2008, extended to 8/15/2010. \$647,329
- Principal Investigator: “Modeling, Analysis and Simulation of Multiscale Nonlinear Systems: Workshop at Oregon State University”, National Science Foundation, NSF-DMS 0707562, 06/01/2007-10/31/2008, \$27,634
- Principal Investigator: “Model adaptivity for porous media”, National Science Foundation, NSF-DMS 0511190, 06/15/2005-05/31/2010. \$306,304
- Co-Principal Investigator: NSF/ITR “Data Intense Challenge: Instrumented Oilfield of the Future” (PI: Wheeler, \$1,461,005, Sept.’01-’03).
- Co-Principal Investigator: NSF 0215389 SCREMS Proposal “A Parallel Computer Cluster for Multiphysics and Multiscale Modeling of Subsurface and Surface Flows” (PI: Wheeler, \$80,664; ’02-’03).
- Senior Personnel and Participant:
 - NSF 9873326 (KDI “Multiscale Physics Based Simulation of Fluid Flow for Energy and Environmental Applications”, PI: Mary F. Wheeler ’98-’02).
 - National Partnership for Advanced Computational Infrastructure, Alpha Project “Coupling of Models for Energy and Environment”, (PI: Mary F. Wheeler ’98-’03).
 - Department of Energy (“Multi block discretizations for multiphysics porous media problems”, PI: Mary F. Wheeler ’98-’01).
 - Department of Energy (“New generation framework of reservoir simulators”, NGOTP, PIs: Tom Morgan, Mary F. Wheeler ’98-’00).
 - Department of Energy (“Two-way coupled flow and geomechanics”, NGOTP, PI: Sue Minkoff, subcontract from Sandia Laboratories, ’00-02).
 - Texas Higher Education Board: Advanced Research/Technology Program “Modeling and computer simulation of environmental remediation using parallel finite elements and PC clusters” (PI: Wheeler, ’99-’01).
 - Industrial Affiliates Program of CSM (’98-’03).

Internal OSU grants

- OSU Faculty Release Time Award, Fall 2010
- OSU Faculty Release Time Award, Fall 2005
- Principal Investigator: OSU Research Equipment Reserve Fund, “Purchase of High Performance Computing (HPC) cluster nodes for computational science research in College of Science (COS)”, 5/2006 \$33,295
- OSU Faculty Release Time Award, Fall 2004

SCHOLARSHIP AND CREATIVE ACTIVITY

RESEARCH AREAS AND INTERESTS

- [A] Analysis and numerical approximation of partial differential equations; problems with memory and hysteresis; coupled phenomena (*multiphysics*). Development of error estimates and estimators, grid and time step adaptivity. Analysis of problems with interfaces and discontinuous data.
- [M] Mathematical modeling of multiphase, multicomponent flow and transport problems in porous media at multiple scales including porescale. Modeling methane hydrates, coalbed methane, shale gas. Multiscale models for carrier transport in solar cells with heterojunctions. Biofilm modeling.
- [H] Hybrid models for coupling continuum and discrete models and deterministic and stochastic models.
- [C] Challenges in scientific computing: (heterogeneous) domain decomposition (*multiphysics*), parallel, distributed, and GPU computing. Couplings of algorithms and models.
- [U] Stochastic and statistical modeling and uncertainty quantification.

PUBLICATIONS

The listing below is chronological in each category. In particular, [1]-[44] are journal publications, [45]-[63] are other refereed publications, [64]-[75] are other publications including conference proceedings and invited book chapters, [76]-[77] are theses, and [78]-[87] are technical reports. Additional outreach materials to which I contributed are at [88]-[91]. For links to the articles please see

<http://www.math.oregonstate.edu/~mpesz/publications>.

Author names marked with a '' are of the undergraduate (*), graduate (**), and postdoctoral (***) students and trainees that I advised, and/or mentored, and/or supported.*

(i) Refereed journal publications

- [1] M. Peszyńska, *Analysis of an integro-differential equation arising from modelling of flows with fading memory through fissured media*, J. Partial Diff. Eqs. **8** (1995), pp. 159–173.
- [2] M. Peszyńska, *On a model for nonisothermal flow in fissured media*, Differential and Integral Equations **8** (1995), no. 6, pp. 497–1516.
- [3] M. Peszyńska, *Finite element approximation of diffusion equations with convolution terms*, Math. Comp. **65** (1996), no. 215, pp 1019-1037.
- [4] J. Douglas, Jr., M. Peszyńska, R. E. Showalter, *Single phase flow in partially fissured media*, Transport in Porous Media **28**, pp. 285–306, 1997.

- [5] M. Peszyńska, R. E. Showalter, *A Transport Model with Adsorption Hysteresis*, Differential and Integral Equations, **11** (1998), no.2, 327–340.
- [6] M. Peszyńska, M. F. Wheeler, I. Yotov, *Mortar upscaling for multiphase flow in porous media*, Comp. Geosciences (6), pp. 73-100, 2002.
- [7] Q. Lu (**), M. Peszyńska, M. F. Wheeler, *A Parallel Multi-Block Black-Oil Model in Multi-Model Implementation*, SPE Journal 7(3), pp. 278-287, September 2002, SPE 79535, revised form of [69].
- [8] M. F. Wheeler, M. Peszyńska, *Computational Engineering and Science Methodologies for Modeling and Simulation of Subsurface Applications*, Advances in Water Resources, 25 (8-12): 1147-1173, Aug-Dec 2002
- [9] S. Minkoff, C. M. Stone, S. Bryant, M. Peszyńska, M. F. Wheeler, *Coupled Fluid Flow and Geomechanical Deformation Modeling*, Journal of Petroleum Science and Engineering (2003), vol 38/1-2 pp 37 - 56.
- [10] S. Minkoff, C. M. Stone, S. Bryant, M. Peszyńska, *Coupled Geomechanics and Flow Simulation for Time-Lapse Seismic Modeling*, Geophysics **69**, No 1, 2004. pp 200-211.
- [11] V. Bhat, V. Matossian, M. Parashar, M. Peszyńska, M. Sen, P. Stoffa, M. F. Wheeler, *Autonomic Oil Reservoir Optimization on the Grid*, Concurrency and Computation: Practice and Experience (**17**), 2005, pp 1-26.
- [12] T. Kurc, U. Catalyurek, X. Zhang, J. Saltz, R. Martino (**), M. F. Wheeler, M. Peszynska, A. Sussman, C. Hansen, M. Sen, R. Seifoullaev, P. Stoffa, C. Torres-Verdin, M. Parashar, *A Simulation and Data Analysis System for Large Scale, Data-Driven Oil Reservoir Simulation Studies*, Concurrency and Computation: Practice and Experience (**17**), 2005, pp 1441-1467.
- [13] M. Peszyńska, *Mortar adaptivity in mixed methods for flow in porous media*, International Journal of Numerical Analysis and Modeling (**2**), No 3, 2005, pp 241–282.
- [14] M. Peszyńska, *The total compressibility condition and resolution of local nonlinearities in an implicit black-oil model with capillary effects*, Transport in Porous Media, (**63**), Number 1, April 2006, pp 201 - 222
- [15] M. Peszyńska, R. E. Showalter, *Multiscale elliptic-parabolic systems for flow and transport*, Electron. J. Diff. Eqns., Vol. 2007(2007), No. 147, pp. 1-30.
- [16] M. Peszyńska, S.-Y. Yi (***) , *Numerical methods for unsaturated flow with dynamic capillary pressure in heterogeneous porous media*, International Journal of Numerical Analysis and Modeling, Vol. 5 (2008), Supp, pp. 126-149.
- [17] C. Garibotti (**), M. Peszyńska, *Upscaling Non-Darcy flow*, Transport in Porous Media, published online March 13, 2009. DOI 10.1007/s11242-009-9369-2, Volume 80, Issue 3 (2009), Pages 401-430.
- [18] M. Peszyńska, R. E. Showalter, S.-Y. Yi (***) , Homogenization of a pseudo-parabolic system, Applicable Analysis, Vol. 88, No.9, September 2009, 1265-1282.
- [19] V. Klein (**), M. Peszyńska. Robust a-posteriori estimators for multilevel discretizations of reaction-diffusion systems. *International Journal of Numerical Analysis and Modeling*, 8(1):1–27, 2011.
- [20] M. Peszyńska, A. Trykozko, *Convergence and Stability in Upscaling of Flow with Inertia from Porescale to Mesoscale*, Intl. J. Multiscale Comp. Engineering, Volume 9, Issue 2 (2011), pp 215-229.
- [21] V. Klein (**), M. Peszyńska, *Adaptive double-diffusion model and comparison to a*

- highly heterogeneous micro-model*, Journal of Applied Mathematics, vol. 2012, Article ID 938727, 26 pages, 2012. doi:10.1155/2012/938727.
- [22] M. Peszyńska, A. Trykozko, “*Pore-to-Core Simulations of Flow with Large Velocities Using Continuum Models and Imaging Data*”, Computational Geosciences, Vol. 36, 2013, pp 277=300. DOI: 10.1007/s10596-013-9344-4.
- [23] M. Peszynska, “*Numerical scheme for a scalar conservation law with memory*”, Numerical Methods for PDEs, Volume 30, Issue 1, pages 239-264, January 2014. DOI=10.1002/num.21806&ArticleID=1159335
- [24] D. Foster (**), T. Costa (**), M. Peszynska, G. Schneider, “*Multiscale modeling of solar cells with interface phenomena*”, Journal of Coupled Systems and Multiscale Dynamics, Vol. 1, Issue 2, 2013.
- [25] N. Gibson, P. Medina (**), M. Peszynska, R. Showalter, “*Evolution of phase transitions in methane hydrate*”, J. Math. Anal. Appl. Volume 409, Issue 2 (2014), 816-833, doi=10.1016/j.jmaa.2013.07.023.
- [26] Y. Zhang (**), M. Peszynska, S. Yim, *Coupling of viscous and potential flow models with free surface for near and fard field wave propagation*, International Journal of Numerical Analysis & Modeling, Series B, Volume 4, Number 3, p 256-282, 2013.
- [27] M. Ossiander, M. Peszynska, V. Vasylykivska (**), *Conditional Stochastic Simulations of Flow and Transport with Karhunen-Loeve Expansions, Stochastic Collocation, and Sequential Gaussian Simulation*, Journal of Applied Mathematics, Volume 2014, Article ID 652594, 21 pages. <http://dx.doi.org/10.1155/2014/652594>
- [28] M. Peszynska, R. Showalter, S.-Y Yi (**), *Flow and transport when scales are not separated: Numerical analysis and simulations of micro- and macro-models*, IJNAM, Volume 12, Number 3, 2015, pp 476-515.
- [29] M. Peszynska, R. Showalter, J. Webster, “*Advection of Methane in the Hydrate Zone: Model, Analysis, and Examples*”, Mathematical Methods for Applied Sciences, Volume 38, pp 4613-4629, 2015, DOI: 10.1002/mma.3401
- [30] T. Costa (**), D. Foster (**), M. Peszynska, “*Progress in modeling of semiconductor structures with heterojunctions*, Journal of Coupled Systems and Multiscale Dynamics, Vol. 3, Issue 1, 2015, pp 2330-152X/2015/001/021, doi:10.1166/jcsmd.2015.1066
- [31] M. Peszynska, A. Trykozko, G. Iltis, S. Schlueter, D. Wildenschild, “*Biofilm growth in porous media: experiments, computational modeling at the porescale, and upscaling*”, Advances in Water Resources, Volume 95 (2016), pages 288-301. <http://dx.doi.org/10.1016/j.advwatres.2015.07.008>.
- [32] A. Trykozko, M. Peszynska, M. Dohnalik “*Modeling non-Darcy flows in realistic porescale proppant geometries*”, Computers and Geotechnics, Vol. 71, January 2016, pp 352-360. <http://dx.doi.org/10.1016/j.compgeo.2015.08.011>.
- [33] M. Peszynska, F.P. Medina (**), W.-L. Hong, M. Torres, “*Methane hydrate formation under conditions of variable salinity II. Time-stepping variants and sensitivity of reduced numerical model*”. Computation. Special Issue on Advances in Flow and Transport in Porous Media, Volume 4, Issue 1, pp 1-19, 2016. doi:10.3390/computation4010001; Open access link: <http://www.mdpi.com/2079-3197/4/1/1>.
- [34] M. Peszynska, W.-L. Hong, M. Torres, J.-H. Kim, “*Methane hydrate formation in Ullung Basin under conditions of variable salinity. Reduced model and experiments*”. Transport in Porous Media, 114 (1), 2016, pages 1-27, DOI 10.1007/s11242-016-

- 0706-y. <http://link.springer.com/article/10.1007/s11242-016-0706-y>
- [35] M. Ossiander, M. Peszynska, L. Madsen, A. Mur, W. Harbert, “*Estimation and simulation for geospatial porosity and permeability data*, *Environmental and Ecological Statistics*”, Volume 24, Issue 1 (2017), Page 109, doi:10.1007/s10651-016-0362-y
- [36] F.P. Medina (**), M. Peszynska, “*Stability for implicit-explicit schemes for non-equilibrium kinetic systems in weighted spaces with symmetrization*”, *Journal of Computational and Applied Mathematics*, Volume 328, 15 January 2018, Pages 216-231. doi: 10.1016/j.cam.2017.07.020 <https://doi.org/10.1016/j.cam.2017.07.020>
- [37] T. Costa (**), K. Kennedy (**), M. Peszynska, “*Hybrid three-scale model for evolving pore-scale geometries*”, *Computational Geosciences*, 2018, Volume 22: p. 925-950. <https://doi.org/10.1007/s10596-018-9733-9> 2018.
- [38] A. Alhammali (**), M. Peszynska, *Numerical Analysis of a Parabolic Variational Inequality System Modeling Biofilm Growth at the Porescale*, *Numerical Methods for PDEs*, Volume 36, Issue 5, 2020, pp 941-971. DOI:10.1002/num.22458.
- [39] M. Peszynska, R.E. Showalter, *Approximation of Scalar Conservation Law with hysteresis*, *SIAM Journal Numerical Analysis*, Vol. 58, No. 2, 2020, pp. 962-987, <https://epubs.siam.org/doi/abs/10.1137/18M1197679>
- [40] M. Peszynska, R.E. Showalter, *Approximation of Hysteresis Functional*, *Journal of Computational and Applied Mathematics*, Volume 381, 113356, June, 2021. <https://doi.org/10.1016/j.cam.2020.113356>
- [41] M. Peszynska, J. Umhoefer (**), C. Shin (**), *Reduced Model for Properties of Multiscale Porous Media with Changing Geometry*, *Computation* (2021), 9(3), 28, <https://doi.org/10.3390/computation9030028>.
- [42] C. Shin (**), A. Alhammali (**), L. Bigler (**), N. Vohra (**), M. Peszynska, *Coupled flow and biomass-nutrient growth at pore-scale with permeable biofilm, adaptive singularity and multiple species*, *Mathematical Biosciences and Engineering*, 2021, 18(3): 2097-2149. doi: 10.3934/mbe.2021108
- [43] M. Peszynska, C. Shin (**), “Stability of a numerical scheme for methane transport in hydrate zone under equilibrium and non-equilibrium conditions”, *Computational Geosciences*, 2021, 25 (5), 2021, 1855-1886. <https://doi.org/10.1007/s10596-021-10053-2>
- [44] L. Bigler (**), M. Peszynska, N. Vohra (**), “Heterogeneous Stefan problem and permafrost models with P0-P0 finite elements and fully implicit monolithic solver”, *Electronic Research Archive*, Volume 30, Issue 4: 1477-1531. doi: 10.3934/era.2022078 (Special issue on “Computational modeling and numerical analysis of complex interfacial problems”).

(ii) Refereed conference proceedings and book chapters

- [45] M. Peszyńska, *Finite element approximation of a model of nonisothermal flow through fissured media*, in *Finite Element Methods*, M. Krizek, P. Neittaanmaki, R. Stenberg (Eds), *Lecture Notes in Pure and Applied Mathematics* **164** (1994), pp. 357–366, Marcel Dekker.
- [46] M. Peszyńska, *Memory effects and microscale*, *Proceedings of IFIP Conference “Modelling and Optimization of Distributed Parameter Systems with Application in Engineering”*, Warsaw, July 17-21, 1995 *Proceedings*: K. Malanowski, Z. Nahorski, M. Peszyńska (Eds.), Chapman & Hall, 1996.

- [47] M. Peszyńska, *A Differential Model of Adsorption Hysteresis with Applications to Chromatography*, III Coloquio sobre Ecuaciones Diferenciales Y Aplicaciones, May 1997, Vol. II, Angel Domingo Rueda, Jorge Guinez, eds., 1998 Universidad del Zulia, Venezuela.
- [48] M. Peszyńska, Q. Lu (**), M. F. Wheeler, *Coupling different numerical algorithms for two-phase fluid flow*, MAFELAP 1999, Brunel University, June 1999, The Mathematics of Finite Elements and Applications X, MAFELAP X, J.R. Whiteman, Ed., Elsevier, 2000, pp. 205-214, August 1999.
- [49] M. Peszyńska, *Advanced Techniques and Algorithms for Reservoir Simulation, III: Multiphysics coupling for two phase flow in degenerate conditions*, IMA Volumes in Mathematics and its Applications, Volume 131: Resource Recovery, Confinement, and Remediation of Environmental Hazards, Eds.: J. Chadam, A. Cunningham, R.E. Ewing, P. Ortoleva, and M. F. Wheeler, pp 21-40, Springer-Verlag, 2002.
- [50] M. Peszyńska, E. W. Jenkins, M. F. Wheeler, *Boundary conditions for fully implicit two-phase flow model*, "Recent Advances in Numerical Methods for Partial Differential Equations and Applications", Xiaobing Feng and Tim P. Schulze, eds., Contemporary Mathematics Series (306), 2002, pp 85-106, American Mathematical Society.
- [51] J. Saltz, U. Catalyurek, T. Kurc, M. Gray, S. Hastings, S. Langella, S. Narayanan, R. Martino, S. Bryant, M. Peszynska, M. F. Wheeler, A. Sussman, M. Beynon, C. Hansen, D. Stredney, and D. Sessana. *Driving Scientific Applications by Data in Distributed Environments*, Proceedings of International Conference on Computational Science (ICCS 2003) Part IV, Melbourne, Australia (June 2-4, 2003). Lecture Notes in Computer Science, Vol. 2660, pp. 355-364, 2003.
- [52] M. Peszyńska, *Multiphysics Coupling of Three-Phase and Two-Phase Models of Flow in Porous Media*, in "Analysis and Simulation of Multifield Problems", Eds: Wolfgang Wendland, Messoud Efendiev, Lecture Notes in Applied and Computational Mechanics **12**, Springer-Verlag, 2003.
- [53] M. Peszyńska, A. Trykozko, K. Augustson (*), *Computational upscaling of inertia effects from porescale to mesoscale*, ICCS 2009 Proceedings, Eds. : G. Allen, J. Nabrzyski, E. Seidel, D. van Albada, J. Dongarra, and P. Sloot, LNCS 5544, Part I, pp. 695-704. Springer-Verlag, Berlin-Heidelberg, 2009.
- [54] M. Peszyńska, A. Trykozko, W. Sobieski, *Forchheimer law in computational and experimental studies of flow through porous media at porescale and mesoscale*, Current Advances in Nonlinear Analysis and Related Topics, GAKUTO Internat. Ser. Math. Sci. Appl., Vol. 32 (2010), pp. 463-482.
- [55] M. Peszyńska, M. Torres, A. Tréhu. *Adaptive modeling of methane hydrates*, Proceedings of International Conference on Computational Science, ICCS 2010 Procedia Computer Science Vol. 1 (2010), pp 709-717. Available online via www.elsevier.com/locate/procedia and www.sciencedirect.com
- [56] M. Peszyńska, A. Trykozko, K. Kennedy (**), *Sensitivity to anisotropy in non-Darcy flow model from porescale through mesoscale*, In *Proceedings of CMWR XVIII in Barcelona, June 21-24, 2010*. available online at <http://congress.cimne.com/CMWR2010/Proceedings>, 2010. paper 46.
- [57] V. Klein (**), M. Peszyńska. *Adaptive multi-level modeling of coupled multi-scale phenomena with applications to methane evolution in subsurface*, In *Pro-*

- ceedings of CMWR XVIII in Barcelona, June 21-24, 2010.* available online at <http://congress.cimne.com/CMWR2010/Proceedings>, 2010. paper 47.
- [58] S.-Y. Yi (**), M. Pezzyńska, and R. Showalter. *Numerical upscaled model of transport with non-separated scales*, In *Proceedings of CMWR XVIII in Barcelona, June 21-24, 2010*, available online at <http://congress.cimne.com/CMWR2010/Proceedings>, 2010. paper 188.
- [59] M. Pezzyńska, *Methane in subsurface: mathematical modeling and computational challenges*, Computational Challenges in the Geosciences, edited by Clint Dawson and Margot Gerritsen, Springer, 2013, ISBN 978-1-4614-7433-3.
- [60] A. Trykozko, M. Pezzyńska, “*Pore-Scale Simulations of Pore Clogging and Upscaling With Large Velocities*”, GAKUTO International Series, Mathematical Sciences and Applications, Vol. 36 (2013), 277-300.
- [61] T. Costa (**), D. Foster (**), M. Pezzyńska, “*Domain Decomposition for Heterojunction Problems in Semiconductors*”, VECPAR 2014, International Meeting on High Performance Computing for Computational Science, Eugene, OR June 30-July 3, 2014, http://www.vecpar.org/papers/vecpar2014_submission_2.pdf. Revised and accepted for Springer LNCS, 2014.
- [62] M. Pezzyńska, “*Modeling and Problem Solving: Curriculum and Program Development*”, The Interdisciplinary Contest in Modeling: Culturing Interdisciplinary Problem Solving, COMAP, 2014, Edited by Chris Arney and Paul J. Campbell, pp 177-192. ISBN 9781933223529.
- [63] Wei-Li Hong, M. Pezzyńska, “*Numerical modeling of gas hydrate dynamics in nature marine sediments: Case studies from Hydrate Ridge, Cascadia Margin and Ulleung Basin*”, in *Gas Hydrates: from Characterization and Modeling to Applications*, Chapter 11, edited by Daniel Broseta, Livio Ruffine, Arnaud Desmedt; Wiley, April 2018; <https://doi.org/10.1002/9781119451174.ch11>.

(iii) Other including non-refereed conference proceedings and invited book chapters

- [64] M. F. Wheeler, T. Arbogast, S. Bryant, J. Eaton, Q. Lu (**), M. Pezzyńska, I. Yotov, *Parallel Multiblock/Multidomain Approach for Reservoir Simulation*, SPE 51884, 15th SPE Reservoir Simulation Symposium, Houston, TX, Feb. 14-17, 1999.
- [65] S.E. Minkoff, C.M. Stone, J.G. Arguello, S. Bryant, J. Eaton, M. Pezzyńska, M. F. Wheeler, *Staggered in Time Coupling of Reservoir Flow Simulation and Geomechanical Deformation: Step 1 - One-Way Coupling*, SPE 51920, 15th SPE Reservoir Simulation Symposium, Houston, TX, Feb. 14-17, 1999.
- [66] S. Minkoff, C. Stone, J. Arguello, S. Bryant, J. Eaton, M. Pezzyńska, and M. Wheeler. *Coupled Geomechanics and Flow Simulation for Time-Lapse Seismic Modeling*. In: Expanded Abstracts. Soc. 5 Expl. Geophys., 1999, pp. 16671670. doi: 10.1190/1.1820852. url: <https://library.seg.org/doi/abs/10.1190/1.1820852>.
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(iv) Theses

- [76] M. Peszyńska, *Fluid flow through fissured media. Mathematical analysis and numerical approach*, Ph.D. Thesis, University of Augsburg, 1992, Augsburg, Germany
- [77] M. Peszyńska, *“Analysis of mathematical and computational models for flow and transport processes”*, Habilitation Dissertation (extended abstract) (in Polish), Warsaw University of Technology, Warsaw, Poland, 2011, 11 pages

(v) Technical Reports

- [78] M. Peszyńska, *The domain decomposition module for parallel realization of the algorithm for boundary value problems solving*, (in Polish), University of Warsaw, Research Report R.R.I.14, Warsaw, 1989.
- [79] M. Niezgódka, A. Siemińska-Lewandowska, B. Przygodzka, P. Kowalski, M. Peszyńska, and A. Trykozko, *A study of artificial freezing ground techniques for the needs of underground construction in Warsaw*, (in Polish), Systems Research Institute, Polish Academy of Sciences, Warsaw, April 1990.
- [80] M. Peszyńska, *The numerical implementation of SAM (Schwarz Additive Method) for discrete parabolic problems*, University of Warsaw, Research Report R.R.I.14, II.5.2, Warsaw 1990.
- [81] M. Peszyńska, S. Bryant, S. Sun (**), T. LaForce, S. Snider, *Modeling of Couplex1 case with IPARS TRCHEM module*, TICAM Report 01-31, 2001.

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- [83] Q. Lu (**), M. Peszyńska and Gai Xiuli (**), *Implicit Black-oil Model in IPARS Framework*, TICAM Report 01-33, 2001.
- [84] M. Peszyńska, A. Doud (**), and M. F. Wheeler, *Stochastic reservoir simulations with GSLIB and two-phase and black-oil models under IPARS*, TICAM Report 03-30, 2003.
- [85] Circe Verba, Andrew Thurber, Yvan Alleau, Dipankar Koley, Malgorzata Peszynska, Frederick Colwell, Marta Torres, “*Feasibility of Biogeochemical Sealing of Wellbore Cements: Lab and Simulation tests*”, (NETL-PUB-20070, DOE-NETL), August 2015.
- [86] Cumulative Evaluation of Spatial Risk & Uncertainty in Support of CO2 Storage Evaluation, L. Madsen, J. Nelson (**), M. Ossiander, M. Peszynska, J. Bauer, J. Mbuthia, K. Rose, (Preliminary report, DOE-NETL Task 21), November 2014
- [87] L. Madsen, M. Ossiander, M. Peszynska, A. Goodman, G. Bromhal, W. Harbert, Risk reduction of CO2 storage with stochastic simulations, (Preliminary report, DOE-NETL Task 22), November 2014

(vi) Miscellaneous articles with my contribution

- [88] M. F. Wheeler, J. Saltz, M. Peszyńska, *Addressing Domestic Energy Shortages with Reservoir Simulations*, National Partnership for Advanced Computational Infrastructure (NPACI) Partnership Report 2002, Eds.: R. Graham.
- [89] M. F. Wheeler, S. Bryant, R. Martino, M. Peszyńska, A. Sussmann, J. Saltz, M. Parashar, *Exploiting Aging Oil Fields with Advanced Computational Tools*, Envision (Quarterly Science Magazine) **18**, No. 1, (2002), Eds.: R. Graham.
- [90] (featured in:) Nick Houtman, *The Glass Half Full (roughly speaking). It takes a model to measure subsurface water*, Oregon State University TERRA magazine, Summer 2007. <http://www.oregonstate.edu/terra>
- [91] (featured in:) Kat Kothen, *Solving the worlds real-life math problems*, Daily Barometer, Dec. 4, 2014. http://www.orangemedianetwork.com/daily_barometer/news/solving-the-world-s-real-life-math-problems/article_05e5fe70-8114-5e96-88d5-7607908dfc7d.html

PRESENTATIONS

The listing below is in reverse chronological order in all categories.

(i) Plenary talks, colloquia, and guest lectures, since 1998: 172–218

- 218. (Plenary) IFIP TC7 Systems Modeling and Optimization, Warsaw, July 4-9, 2022.
- 217. (Plenary) MATH+ Day, Berlin Mathematical Research Centre, including the presence of European Women in Mathematics, November 5, 2021, *The hardest subject in Mathematics*; on the issues surrounding gender in mathematics profession in US and Europe.
- 216. (Plenary, award talk) Plenary talk; SIAM Geosciences Career award, SIAM Geosciences conference 2021, Milan (virtual); June 21-24, 2021,

215. (Colloquium) University of Idaho colloquium, May 6, 2021.
214. (Colloquium) Virginia Tech colloquium, April 23, 2021.
213. (Colloquium) *Adsorption in scalar conservation law: modeling, analysis, simulation*, NSF DMS Colloquium, Feb. 4, 2021.
212. (Colloquium) *Modeling biofilm and flow dynamics in multiscale porous media*, UMBC Colloquium, November 13, 2020.
211. (Minitutorial) *Phase transitions in porous media: a minitutorial*, at SIAM Geosciences 2019, Houston March 11-15, 2019.
210. (Guest Lecture) *Modeling Methane Hydrate across the Scales*, Energy Resources Engineering Seminar, Stanford University, Nov. 27, 2017.
209. (Plenary talk) *Methane hydrate modeling, analysis, and simulation: coupled systems and scales*. SIAM Geosciences 2017, invited plenary talk, Erlangen, Germany, Sep 11-14, 2017.
208. (Guest Lecture) *Hybrid multiscale modeling of multicomponent adsorption for ECBM (Enhanced Coalbed Methane Recovery)*. Hydromechanics and Modelling of Hydrosystems Department, University of Stuttgart, Nov. 15, 2016.
207. (Guest Lecture) *Biofilm growth and other coupled processes: from imaging to numerical model at porescale and upscaling*, Department of Mathematics, University of Bergen, Nov. 10, 2016.
206. (Guest Lecture) *Computational modeling of adsorption*, Graduate program in Computational Engineering, University of Warsaw, Data Science Center, Nov. 3, 2016
205. (Colloquium) “*Adsorption: new mathematics and computations for multiple components*”, Maseeh Mathematics & Statistics Colloquium Series, Portland State University, Sep. 30, 2016
204. (Colloquium) (University of Washington Applied PDE Colloquium) *Methane hydrate evolution: framework for analysis and modeling*, June 2, 2016
203. (Plenary talk) “*Multiscale modeling of Modeling, Analysis and Simulation of processes in Evolving Porous Media. Applications to Methane Hydrate and Biocementation*”, Oberwolfach Workshop on Reactive Flows in Deformable, Complex Media, September 21-26, 2014
202. (Plenary talk) *Computational Modeling of Methane Hydrates at Multiple Scales*, Workshop on Unconventional Reservoirs, Research Center of Petrobras, (CENPES) Rio de Janeiro, Brazil, August 27-28, 2014
201. (Plenary presentation) “*Computational Mathematics Modeling in Support of Observatories*”, 2014 Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, Texas, USA, March 23-28, 2014
200. (Colloquium) *Hybrid Models and Interfaces*, University of Utah Mathematics Colloquium, Nov. 7, 2013
199. (Plenary presentation) “*Phase transitions in multiphase multicomponent models at core2pore2core*”, Gordon Research Conference, Les Diablerets, Switzerland, June 24-29, 2012
198. (Colloquium) “*Beyond numerical PDEs in subsurface modeling*”, Shell Lecture Series on Energy-Related Mathematics, Rice University, Computational & Applied Mathematics Department, April 16, 2012
197. (Colloquium) “*Mathematical modeling of methane in subsurface: toward hybrid models*”, Maseeh Mathematics & Statistics Colloquium Series, Portland State University,

- Jan. 27, 2012
196. (Colloquium) “*Mathematical and computational challenges in models of methane evolution in subsurface*”, Mathematics Department, Oregon State University, Nov. 7, 2011
 195. (Colloquium) “*Analysis of mathematical and computational models of flow and transport processes*”, Warsaw University of Technology, Department of Mathematics and Information Science, June 13, 2011
 194. (Invited plenary talk) “*Methane in subsurface: resource and hazard. Towards hybrid mathematical models and computational solutions*”, IMA Workshop on Societally Relevant Computing, April 11-15, 2011, IMA, University of Minnesota
 193. (Colloquium), “*Flow and transport with adsorption hysteresis in porous media from porescale through mesoscale to reservoir scale: connecting Navier-Stokes, elliptic solvers, and Ising-like adsorption models*”, Institute of Fundamental Technological Research, Polish Academy of Sciences, June 30, 2010.
 192. (Plenary talk), “*Mathematical models of some coupled subsurface processes relevant to climate change*”, Interdisciplinary Centre for Modeling, University of Warsaw, High Performance Computing Retreat, Bartlowizna, April 14-17, 2010
 191. (Guest Lecture) “*Modeling CO₂ storage and sequestration*”, Mathematics Department, Technische Universität München, September 22, 2009
 190. (Guest lecture) “*Numerics for CO₂ storage and sequestration*”, Mathematics Department, Technische Universität München, September 23, 2009
 189. (Principal Speaker) *Computational multiscale methods for coupled phenomena in subsurface*, DOE Summer School on Multiscale Mathematics and High Performance Computing, WSU at Tri-Cities August 4-6, 2008
 188. (Principal Speaker) *Survey of new continuum numerical multiscale approaches and limitations*, DOE Summer School on Multiscale Mathematics and High Performance Computing, Oregon State University, June 29-July 3, 2007
 187. (Main speaker): Rocky Mountains Mathematics Consortium Summer School, 6/18-22/2007, 10h of talks:
 - i) *RMMC I: Flow and transport in porous media at multiple scales*
 - ii) *RMMC II: Well models, geostatistical simulations using wells*
 - iii) *RMMC III: How to include inertia and flow-rate dependent effects*
 - iv) *RMMC IV: Black oil model and total compressibility condition*
 - v) *RMMC V: Coupled processes in porous media*
 186. (Colloquium) *Nonlocal models of transport in multiscale porous media*, University of Pittsburgh, 4/19/2007,
 185. (Invited lead speaker) *Multiscale models of flow and transport in porous media: modeling and computational aspects*, Northwest Consortium in Multiscale Mathematics Workshop on Multiscale Modeling of Materials, May 25 - 30, 2006 Tacoma, WA
 184. (Invited principal speaker) *Nonlocal models of transport in multiscale porous media: something old and something new*, Mathematical and Numerical Treatment of Fluid Flow and Transport in Porous Media May 22-26, 2006 at University of Nevada, Las Vegas
 183. (Colloquium), Physics Colloquium, OSU, April 17, 2006, *Adaptive modeling of flow and transport in multiscale porous media*
 182. (Colloquium) *Adaptive modeling in porous media*, Mathematics Department, OSU,

Nov 22, 2005

181. (Plenary keynote speaker), Workshop on “Modeling Coupled Processes in Porous Media” in Utrecht, Sept. 19-20, 2005
180. (Colloquium) *Adaptive numerical methods for flow in porous media*, New Mexico State University, Department of Mathematics, February 3, 2005
179. (Colloquium) Portland State University, Dept. of Math., February 13, 2004
178. (Colloquium) Oregon State University, Dept. of Math., February 27, 2003
177. (Colloquium) University of Laramie, Math Dept., February 11, 2003
176. (Colloquium) University of Colorado in Denver, June 17, 2002
175. (Colloquium) “*Coupling of models for multiphase flow and transport in porous media with multiple scales*”, Faculty of Mathematik and Informatik, University of Saarbrücken. April 11, 2002
174. (Invited Plenary Talk) *Coupling of models for multiphase flow and transport in porous media with multiple scales*, IMA Minisymposium: Numerical Methods in the Geosciences, March 13-15, 2002
173. (Colloquium) Schlumberger Research Center, Ridgefield, Connecticut, July 2000
172. (Colloquium) *Hysteresis in Porous Media*, Southwest Texas State University, February 1998

(ii) Invited lectures & workshop and (contributed) conference presentations since 1998: 77–171

171. CMWR (Computational Methods for Water Resources), Gdansk June 19-23, 2022
170. (Invited) AWM Research Symposium, IMA (Minneapolis), June 16-19, 2022
169. (Invited) *Methane Hydrate Across the Scales*, Woodwell Climate Research Center, May 27, 2022.
168. (Invited) *Analysis of methane hydrate model* SIAM PNW May 2–22, 2022, session on Numerical Analysis.
167. (Invited) What does Mathematics know about permafrost (and what lies beneath)? IGNITE Colloquium, OSU CEAOS, Feb. 25, 2022
166. (Invited) Applied and Computational Math seminar, Portland State, November 15, 2021.
165. (Invited) *Adsorption hysteresis* SIAM GS minisymposium, SIAM GS 2011 in Milan (virtual), June 21-24, 2021.
164. (Invited) *Coupled process and scales in hydrate models*, SIAM CSE minisymposium, March 1-5, 2021.
163. (Invited) *Adsorption in scalar conservation law: modeling, analysis, simulation*, Montana State Applied Math Seminar, Feb. 18, 2021
162. (Invited) *Biofilm with multiple species: variational inequality versus other approaches*, JMM (virtual), January 2021. Special session “Complex fluids in living systems”.
161. (Invited, [Virtual talk] Interpore 2020, special session in honor of Rainer Helmig), “*Equilibria, constraints, kinetics, and multiple scales*”, Aug 30-Sep 4, 2020.
160. (Contributed, CASCADE RAIN, Regional Applied, Interdisciplinary, and Numerical), Oregon State University, *Approximation of Hysteresis Functional*, April 4, 2019
159. (Invited) “Numerical analysis of a biofilm-nutrient model involving a variational inequality.”, SIAM Minisymposium on Recent Advances and New Trends in Modeling and Simulation of Systems with Multiple Scales, Coupled Phenomena and Interfaces, JMM in Denver, Colorado, Jan. 15-20, 2020

158. (Contributed) “FE Analysis of a system of PVI”, FE Circus at Virginia Tech, Nov 1-2, 2019.
157. (Special session on “Numerical analysis and scientific computing”), SIAM PNW at Seattle University, October 16-18, 2019
156. (Invited, Minisymposium on “Multiscale and Asymptotic Analysis, Modeling, and Simulation for Materials Science”), “Modeling adsorption hysteresis in porous media across the scales”, ICIAM 2019, Valencia, Spain, July 15 2019, 2019.
155. (Invited, Minisymposium on “New Developments in Computational Modeling of Cryosphere Systems”), Methane hydrate modeling across the scales, ICIAM 2019, Valencia, Spain, July 15 2019, 2019.
154. Finite Element analysis of a coupled system of variational inequalities modeling biofilm growth at the porescale, MAFELAP 2019 at Brunel University, London, June 18-21, 2019.
153. (CASCADE RAIN, Regional Applied, Interdisciplinary, and Numerical), University of Washington Bothell, *Hysteresis model coupled to transport*, April 13, 2019
152. *Phase Field Model for Partially Miscible Fluids at Porescale* (M. Peszynska). SIAM Geosciences 2019, invited minisymposium talk, session on Advances in Modeling and Simulation of Pore Scale Flows; Houston, March 11-14, 2019.
151. *Modeling hydrate across the scales.*, CBEE seminar, Oregon State University, Nov 19, 2018.
150. *Modeling hysteresis using ODEs with constraints. Numerical stability and other properties*, NC State Numerical Analysis Seminar, Nov 13, 2018.
149. *Phase interface in multicomponent mixtures. What matters when upscaling?*, BIRS workshop on Numerical Analysis of Coupled and Multi-Physics Problems with Dynamic Interfaces (18w5077), July 29-August 3, 2018, Oaxaca, Mexico.
148. “*Hydrate modeling across the scales*”, minisymposium, SIAM Annual 2018 meeting in Portland, July 8-13, 2018 (organizers: Lynn Bennethum, M. Peszynska)
147. (CASCADE RAIN, Regional Applied, Interdisciplinary, and Numerical), University of Washington Bothell, *Hysteresis model coupled to transport*, April 13, 2018
146. *Challenges of micro-meso-macro porous media* (M. Peszynska, T., Costa, K. Kennedy, A. Trykozko). SIAM Geosciences 2017, invited minisymposium talk, session on Advances and applications of periodic and stochastic homogenisation; Erlangen, Germany, Sep 11-14, 2017.
145. “*Phase transitions in porous media: new applications and results*”, AMS (Spring Western Sectional Meeting), April 22-23, 2017, Washington State University, Pullman, WA
144. (CASCADE RAIN, Regional Applied, Interdisciplinary, and Numerical), Portland State University *Strong Stability of Kinetic Adsorption Systems*, April 7, 2017
143. “*Computational model of biofilm evolution with a Variational Inequality*”, AWM Research Symposium, Special Session WINASC on Recent Research Development on Numerical Partial Differential Equations and Scientific Computing, invited speaker, UCLA, April 7-8, 2017.
142. “*Pore2core modeling with evolving pore geometry*”, ICES, The University of Texas at Austin, March 31, 2017
141. *Bofilm growth: modeling, simulation, anlysis, and upscaling from porescale*, Nonlinear Analysis seminar, Interdisciplinary Centre for Modeling, University of Warsaw, Nov.

- 22, 2016
140. “*Stochastic Reduced Model for Multiple Scales in Porous Media*”, minisymposium on “Multifidelity Simulation and Approximation in the Computational Sciences”, SIAM CSE, Atlanta, 2/27-3/3, 2017
 139. *Reduced Order Hybrid Modeling from Pore-scale to Core-scale*, AIMS Conference, Orlando, FL, July 1-5, 2016
 138. *Modeling biofilm evolution with a variational inequality*, (International conference on evolution equations), invited presentation in the session “Analysis and control of PDE evolutions with an interface”. Nashville, TN, May 2016
 137. *Two-phase three-component model of methane hydrates*, (Interpore 2016), Cincinnati, Session on “Computational challenges in porous media”, May 2016
 136. (CASCADE RAIN, Regional Applied, Interdisciplinary, and Numerical), Washington State University Vancouver, *Reduced models for methane hydrate evolution*, April 9, 2016
 135. *From Micro-imaging across Multiple Scales*, SIAM PDE Conference in Scottsdale, Arizona, December 2015
 134. “*Time-Stepping for Methane Hydrate Model with variable salinity*”, SIAM Geosciences 2015 in Stanford University June 28-July 2, 2015
 133. (CASCADE RAIN, Regional Applied and Interdisciplinary, Computational and Applied Mathematics Seminar), Portland State University, *Weak and strong stability for transport with memory*, April 4, 2015
 132. *Phase transitions without regularizations*, Finite Element Circus, IMA, Univ. of Minnesota, October 24-25, 2014
 131. *Computational modeling of biofilms*, Pacific Northwest Numerical Analysis Seminar (PNWNAS), Portland State University, Oct. 18, 2014
 130. “*Hybrid models of adsorption*”, CMWR XX International Conference on Computational Methods in Water Resources, June 13-27, 2014, University of Stuttgart.
 129. *Evolution of methane hydrates*, (Interpore 2014), Milwaukee, Session on “Computational challenges in porous media”
 128. (Physics Research Seminar), “*Methane Hydrates. Modeling, Analysis, and Simulation*”, OSU, April 30, 2014
 127. (CASCADE Computational and Applied Mathematics Seminar), Oregon State University, *Time-stepping for methane hydrate model*, April 5, 2014
 126. “*Phase Transitions Across the Scales*”, minisymposium on “Non-equilibrium Models for Flows in Porous Media”, SIAM Geosciences 2013 in Padova, Italy, June 17-20, 2013 (organizers: I. Sorin Pop, Florin Radu)
 125. “*Coupled and Hybrid Models for Methane Evolution in Subsurface*”, minisymposium on “Coupled and Hybrid Models and Multiple Scales in Mathematical Geosciences”, SIAM Annual 2012 meeting in Minneapolis, July 8-12, 2012 (organizers: Lynn Bennethum, Son-Young Yi, M. Peszynska)
 124. “*Modeling Flow and Coupled Transport with Adsorption from Pore to Core*”, with A. Trykozko, minisymposium on “Homogenization and Model Reduction Methods for Multiscale Phenomena”, SIAM Annual 2012 meeting in Minneapolis, July 8-12, 2012 (organizer: Yulia Gorb)
 123. “*Continuum and discrete models of adsorption at pore2core*”, CMWR XIX International Conference on Computational Methods in Water Resources, June 17-21, 2012,

University of Illinois at Urbana-Champaign.

122. *“Evolution Under Constraints: Fate of Methane in Subsurface”*, SIAM Meeting on Analysis of PDEs, San-Diego, CA, Nov 14-17, 2011, minisymposium on “Partial Differential Equations for Non-linear Processes in Porous Media” (organizers: Akif Ibragimov, Luan Hoang, M. Pezysnska)
121. *“Numerical approximation of scalar conservation law with hysteresis, relaxation, and double-porosity”*, AMS Western Section Fall Meeting, Salt Lake City, Utah, October 22-23, 2011, special session on “Recent Progress in Numerical PDEs” (organizers: Jichun Li, S. Chow)
120. *“PDEs with inequality constraints”*, Warsaw University of Technology, Department of Mathematics and Information Science, June 13, 2011
119. *“Phase Transitions in Coupled Models: Equilibrium and Kinetic Models”*, SIAM Geosciences 2011, Long Beach, CA, March 21-24, 2011, Minisymposium on Modeling Coupled Phenomena at Multiple Scales for New Technologies (3 parts, organizers: M. Pezysnska, R. Helmig)
118. *“Modeling and analysis of coupled multiscale processes in porous media. What, why, and how”*, PDE Seminar, Mathematics Department, University of Warsaw, August 27, 2010
117. *“Sensitivity to anisotropy in non-Darcy flow model from porescale through mesoscale”*, CMWR XVIII International Conference on Computational Methods in Water Resources, June 21-24, 2010, Barcelona, Spain
116. *“Adaptive modeling of methane hydrates”*, ICCS 2010 Conference in Amsterdam, 7th Workshop on Simulation of Multiphase Multiscale problems, May 31-June 2, 2010, Amsterdam
115. *“A-posteriori error analysis: flow and transport problems”*, Numerical Analysis Seminar, Mathematics Department, University of Warsaw, May 20, 2010.
114. *“Adsorption and adsorption hysteresis: modeling and analysis”*, Mathematical Physics Seminar, Mathematics Department, University of Warsaw, April 8, 2010
113. *“Modeling multiphase flow with dynamic capillary pressure in heterogeneous media”*, Mathematical Physics Seminar, Mathematics Department, University of Warsaw, March 25, 2010
112. *“Upscaling in flow through porous media from porescale to mesoscale and beyond”*, Faculty of Materials Science, Warsaw University of Technology) Feb. 25, 2010
111. *“Upscaling for flow”*, March 2, 2010, Phd-MATH seminar, Interdisciplinary Centre for Modeling, University of Warsaw
110. *“Flow and transport in subsurface with multiple scales”*, *MathFest*, Portland, Oregon. August 8, 2009 Invited Papers Session on Fluids Modeling (organizer: K. Socha)
109. *“Multiscale Adaptive Modeling of Inertia and Non-equilibrium Processes”* SIAM Geosciences in Leipzig, June 15-19, 2009. Minisymposium on Modeling of Inertia and Non-Equilibrium Processes
108. *“Upscaling inertia effects in flow”* Minisymposium on Upscaling and Multiscale Techniques for Subsurface Flow and Transport, SIAM Geosciences in Leipzig, Germany, June 15-19, 2009
107. *“Computational upscaling from porescale to mesoscale”*, Minsiympoium on Multi-scale, Multiphysics Applications, International Conference on Computational Science in Baton Rouge, Louisiana, May 25-27, 2009

106. *Upscaling non-Darcy flow*, Minisymposium on Multiscale Solution Algorithms with Applications to Earth Science (organizer: Sue Minkoff). SIAM Annual in San-Diego, July 7-11, 2008
105. *Multiscale modeling of preferential flow, Part I*, Workshop on Multiscale Nonlinear Systems, Oregon State University, June 25-29, 2007
104. *A-posteriori error estimator for mortar mixed methods for flow in porous media*, Finite Element Circus, University of Maryland) 4/21/2007
103. *How to remove a logarithmic singularity from a numerical solution and to maximize the number N_c* , University of Pittsburgh (Applied Math Seminar), 4/19/2007
102. *Adaptive multiscale methods for flow and transport in porous media*, Pacific Northwest Numerical Analysis Seminar (PNWNAS), Simon Fraser University, Sept. 30, 2006
101. *Adaptive modeling and upscaling*, AMS Regional Meeting, University of Oregon, Minisymposium on PDEs and applications, Nov. 12-13, 2005
100. *Geostatistical simulations with a black-oil model*, SIAM Annual Meeting, Portland, July 12-16, 2004
99. (Hydrophiles Seminar Invited Talk), Oregon State University, March 10, 2004
98. SIAM Conference on Mathematical and Computational Issues in the Geosciences (GS03), March 17-20, 2003
 - *Multiscale and adaptive modeling for multiphase multicomponent flow*
 - *Breaking the “input-run-output” paradigm in reservoir simulation*
97. *Co-processing Viz for IPARS: Interactive Demo*, Industrial Affiliates. Meeting, Center for Subsurface Modeling, The university of Texas at Austin, October 23, 2002
96. *Dynamic Data-Driven Reservoir Simulation with IPARS*, Industrial Affiliates Meeting, Center for Subsurface Modeling, The University of Texas at Austin, October 23, 2002
95. *“Nonlinear solver for phase transitions with capillary effects in an implicit three-phase three-component black-oil model of flow in porous media”*, Minisymposium on “Numerical Methods for Fully Implicit Formulations of Nonlinear Systems” SIAM 50’t^h Anniversary Meeting, Philadelphia, July 8-12, 2002
94. *“Coupling of models for multiphase flow and transport in porous media with multiple scales”*, Minisymposium on “Mathematical Modeling and Simulation in the Geosciences”, SIAM 50’t^h Anniversary Meeting, Philadelphia, July 8-12, 2002
93. Computational Methods in Water Resources XIV, Delft, June 2002
92. *“Coupling of models for multiphase flow and transport in porous media with multiple scales”*, International Conference on Multifield Problems, University of Stuttgart, April 8-10, 2002
91. *Upscaling and boundary conditions for multiphase flow in IPARS multiphysics*, Industrial Affiliates Meeting, Center for Subsurface Modeling, The University of Texas at Austin, October 30, 2001
90. *Numerical issues for hysteresis in porous media*, Minisymposium on “Modeling, Analysis and Simulation of Hysteresis in Porous Media” at Sixth SIAM Conference on Mathematical and Computational Issues in the Geosciences, SIAM Geosciences, Boulder, CO, June 10-14 2001
89. *Modeling with multiphysics couplings for multiphase flow*, Minisymposium on “Multiphysics Couplings for Geosciences” at Sixth SIAM Conference on Mathematical and Computational Issues in the Geosciences, Boulder, CO, June 10-14 2001

88. *Parallel Clusters and Subsurface Modeling*, Session “The Future of Massively Parallel PC Clusters in Supercomputing” at NPACI All-Hands Meeting, San Diego, CA, February 6-9, 2001
87. *Developments in IPARS Multimodel, Multiphysics and Visualization Tools*, Industrial Affiliates Meeting, Center for Subsurface Modeling, The University of Texas at Austin, October 11, 2000
86. *Mathematical Issues in the Coupling of Multiphase Flow Models*, Minisymposium on “Mathematical Modeling and Numerical Simulation of Subsurface and Surface Flow Problems” at SIAM Annual Meeting, July 10-14, 2000, Puerto Rico
85. *Multiphysics Coupling of Codes*, XIII International Conference on Computational Methods in Water Resources, Calgary, Alberta, Canada, June 25-29, 2000
84. *Coupling of different fluid flow codes for multiphase flow and transport*, Conference “Finite Elements in Flow 2000”, Austin, TX, April 30-May 4, 2000
83. *Mathematical Issues in the Coupling of Single Phase Flow and Two-Phase Flow Models*, Texas PDE, March 25-26, 2000
82. *Coupling of different multiphase flow models in IPARS framework*, Institute of Mathematics and Applications, Workshop on Resource Recovery, February 2000, Minneapolis
81. Industrial Affiliates Meeting, Center for Subsurface Modeling, The University of Texas at Austin, October 27, 1999
80. *Multimodel Multiphysics Implementation under IPARS framework*, Minisymposium on “Computational Methods in Geoscience Applications” at the Society for Engineering Science 36th Annual Technical Meeting, Austin, TX, Oct. 25-27, 1999
79. *Domain Decomposition for Multiphase Flow: Interface Coupling of Different Numerical and Physical Models*, Mathematics of Finite Elements and Applications, MAFE-LAP 1999, Brunel University, June 1999
78. *Multiple Numerical Methods in a Multiblock Framework*, SIAM Conf. on Geosciences in San Antonio, March 24-28, 1999
77. *IPARS Multiblock Multi-Model*, Industrial Affiliates Meeting, Center for Subsurface Modeling, The University of Texas at Austin, October 27, 1998

(iii) Seminar talks since 2004: 31–76

76. (Analysis Seminar), Oregon State University, *Interfaces and free boundaries*, April 2022.
75. (Applied Mathematics and Computation Seminar), Oregon State University, *Modeling with multiple scales: when to use homogenization (and when not)*, January 21, 2022.
74. (Applied Mathematics and Computation Seminar), Oregon State University, *BIO2020 team*, Spring 2022.
73. (Applied Mathematics and Computation Seminar), Oregon State University, *Approximation of scalar conservation law with hysteresis*, February 15, 2019
72. (Applied Mathematics and Computation Seminar), Oregon State University, *Hydrate modeling across the scales*, February 9, 2018
71. (Applied Mathematics and Computation Seminar), Oregon State University, *Phase field models: an introduction*, January 12, 2018
70. (Applied Mathematics and Computation Seminar), Oregon State University, *Sym-*

- metrization and rescaling give (strong) stability easily* , February 11, 2017
69. (Applied Mathematics and Computation Seminar), Oregon State University, *Hybrid modeling of adsorption = conservation laws coupled to statistical mechanics. Analysis and simulations* , October 14, 2016
 68. (Applied Mathematics and Computation Seminar), Oregon State University, *From X-ray Images to Doubly Nonlinear PDEs: Biofilm Model* October 2, 2015
 67. (Analysis Seminar), Oregon State University, “*Parabolic Variational Inequalities: what they are, and a new application*”, June 1, 2015
 66. (Applied Mathematics and Computation Seminar), Oregon State University, *Multi-scale modeling of flow and transport*, April. 24, 2015
 65. [(Mathematics Graduate Seminar)], “*Interdisciplinary Mathematics = Modeling + Analysis + Simulation*”, OSU, February 18, 2015
 64. (Invited talk) *Computational modeling of biofilms*, Mathematical Biology Seminar, Nov. 20, 2014
 63. (Analysis Seminar), Oregon State University, “*Analysis of degenerate and singular reaction-diffusion equations*”, June 2, 2014
 62. [(Mathematics Graduate Seminar)], “*Interdisciplinary Mathematics = Modeling + Analysis + Simulation*”, OSU, April. 30, 2014
 61. (Applied Mathematics and Computation Seminar), Oregon State University, *Modeling from porescale to Darcy scale: then, now, and next*, Feb. 14, 2014
 60. (Applied Mathematics and Computation Seminar), Oregon State University, *Memory effects=Subscale diffusion. Numerical approximation*, Nov. 8, 2013
 59. [(Mathematics Graduate seminar)], “*Hybrid modeling*”, OSU, Feb. 20, 2013
 58. (Applied Mathematics and Computation Seminar), Oregon State University, “*Discrete and continuum models of adsorption at multiple scales*”, Jan. 25, 2013
 57. (Applied Mathematics and Computation Seminar), Oregon State University, “*Numerical solution of nonlinear evolution equations*”, Oct. 12, 2012
 56. (Analysis Seminar), Oregon State University, “*Smoothness in fractional conservation laws II*”, March 12, 2012
 55. (Analysis Seminar), Oregon State University, “*Smoothness in fractional conservation laws I*”, Feb. 27, 2012
 54. (Applied Mathematics and Computation Seminar), Oregon State University, “*Solving problems with inequality constraints II*”, Feb. 17, 2012
 53. (Applied Mathematics and Computation Seminar), Oregon State University, “*Solving problems with inequality constraints I*”, Dec. 2, 2011
 52. [(Mathematics Graduate seminar)], “*Mathematical modeling, analysis, and simulation of flow and transport problems*”, OSU, Nov. 30, 2011
 51. (Applied Mathematics and Computation Seminar), Oregon State University, “*Flow with inertia and coupled transport: from porescale up to mesoscale*”, April 29, 2011
 50. [(Mathematics Graduate seminar)], “*Mathematical analysis, and simulation of problems relevant to environment and energy resources*”, OSU, March 2, 2011
 49. (Applied Mathematics and Computation Seminar), Oregon State University, “*Mixed methods for linear problems: variational and numerical point of view*”, October 15, 2010
 48. (Applied Mathematics and Computation Seminar), Oregon State University, “*ABCO2: modeling CO2 sequestration*”, November 13, 2009.

47. (Applied Mathematics and Computation Seminar), Oregon State University, “*Upscaling of inertia terms from porescale to mesoscale and from mesoscale to macroscale*” (with A. Trykozko, K. Augustson), May 29, 2009
46. (Applied Mathematics and Computation Seminar), Oregon State University, *Modeling, analysis, and simulation of adsorption and adsorption hysteresis*, Mar 13, 2009
45. (Applied Mathematics and Computation Seminar), Oregon State University, *Modeling liquid-gas phase transitions in an implicit black-oil model*, November 21, 2008
44. (Applied Mathematics and Computation Seminar), Oregon State University, *Overview of numerical multiscale methods*, May 23, 2008.
43. (Applied Mathematics and Computation Seminar), Oregon State University, *Upscaling for linear and nonlinear elliptic problems with finite element methods. Part II*, Jan. 11, 2008
42. (Applied Mathematics and Computation Seminar), Oregon State University, *Upscaling for linear and nonlinear elliptic problems with finite element methods. Part I*, Nov. 30, 2007
41. (Applied Mathematics and Computation Seminar), Oregon State University, April 13, 2007, *A-posteriori error estimate framework in finite element and finite difference methods*
40. (Applied Mathematics and Computation Seminar) Oregon State University, March 16, 2007, *Wells continued: large scale computing, geostatistical simulations and optimization*
39. (Applied Mathematics and Computation Seminar) Oregon State University, March 2, 2007 *Peaceman and Thiem well models or how to remove a logarithmic singularity from your numerical solution*
38. (Applied Mathematics and Computation Seminar) Oregon State University, June 9, 2006, “*Pore-scale simulations with a vorticity-stream function solver for Navier-Stokes equations*”, shared with Kyle Augustson
37. (Applied Mathematics and Computation Seminar) Oregon State University, June 2, 2006, “*Nonlocal models of flow and transport: something old and something new, something borrowed ...*”, with R. E. Showalter
36. (Applied Mathematics and Computation Seminar), OSU, Dec. 2, 2005 and Jan. 13, 2006, “*Lagrange multipliers and LBB condition in discrete mixed methods for Darcy and Stokes flow. Part I and Part II*”
35. (Seminar), Applied Mathematics and Computation Seminar, Oregon State University, June 3, 2005, *Secondary diffusion*
34. (Seminar), Applied Mathematics and Computation Seminar, Oregon State University, April 29, 2005, “*Primer on domain decomposition methods for flow and transport*”
33. (Applied Mathematics and Computation Seminar) Oregon State University, January 28, 2005, “*Nonlocal (memory) terms in flow and transport*”
32. (Applied Mathematics and Computation Seminar) Oregon State University, November 5, 2004 “*Introduction to heterogeneous multiphase flow*”
31. (Applied Mathematics and Computation Seminar) Oregon State University, October 1, 2004 “*Introduction to porous and fractured media*” (shared with Ralph Showalter).

(iv) Undergraduate and outreach talks since 2004: 11–30

30. (Math REU talk) *“Interdisciplinary mathematics”*, Mathematics, OSU, August 7, 2019
29. MTH 507 Mathematics Graduate Seminar, April 2019
28. PUMP program at California State University Northridge, July 25, 2017, Mathematics Graduate Program at Oregon State presentation
27. MTH 599 Mathematics Graduate Seminar, April 2017
26. MTH 599 Mathematics Graduate Seminar, April 2016
25. (OSU Honors College-Science thesis event) , February 25, 2016
24. (OSU Honors College-Science matching event) , January, 2016
23. (OSU Mathematics undergraduate talk) *“Undergraduate research and Interdisciplinary Mathematics”*, Dec. 1, 2015
22. (OSU Mathematics undergraduate talk) *“Interdisciplinary mathematics (discrete and continuous) needs you”*, Nov. 5, 2012
21. (Math REU talk) *“What can differential equations (not) do for climate change ?”*, Mathematics, OSU, July 18, 2011
20. (Graduate Seminar), Oregon State University, *“10,000 hours of modeling, analysis, and simulation”*, November 23, 2009
19. (REU talk) (OSU Mathematics), July 21, 2008, *Upscaling elliptic PDEs*
18. (OSU Academy of Lifelong Learning, invited talk) *From Copernicus and Sklodowska-Curie to Banach, Schauder and Ulam*, 4/26/2007
17. (Mathematics REU at OSU program), *Multi-* Mathematics and Careers*, Oregon State University, Aug.8, 2006
16. (Seminar, Introduction to Mathematics Research at OSU), April 26, 2006, *The purpose of Numerical Analysis is insight, not movies*
15. (Undergraduate Colloquium), Lewis and Clark University, April 19, 2006, *Multi-* Mathematics in Subsurface*
14. (Mathematics REU talk), *Mathematics of Adsorption*, Oregon State University, July 27, 2005
13. (Math. Grad. Students Research Seminar, OSU), *Multi-* Mathematics*, Oregon State University, February 9, 2004
12. (REU talk) *Mathematics of Adsorption*, Mathematics REU at OSU, Oregon State University, July 21, 2004
11. (Math. Grad. Students Research Seminar), Oregon State University, June 1, 2004

(v) Posters and demonstrations, since 2000: 1–10

10. (Poster) *“Tired of Delta T? Reduced models overcome the complexity of transport simulations in evolving pore-scale geometries* 2016 Gordon Research Conference on Flow and Transport in Porous Media, Girona, Spain, August 1-5, 2016
9. (Poster) *“Progress in Computational Mathematics Modeling of Methane hydrates”*, 2016 Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, Texas, USA, February, 2016
8. (Poster) *“Hybrid Pore-scale Modeling with Three Scales”* (joint with A. Trykozko, K. Kennedy, T. Costa, M. Prodanovic, and D. Wildenschild), SIAM Geosciences 2015, Stanford University, June 28-July 2, 2015
7. (Poster) *“Hybrid Pore-scale Modeling with Three Scales”* (joint with A. Trykozko, K. Kennedy, T. Costa, M. Prodanovic, and D. Wildenschild), IMA Workshop on

- Hydraulic Fracturing, May 11-14, 2015, University of Minnesota
6. (Poster) “*Stochastic parametrizations and simulations in porous media*” (joint with M. Ossiander and V. Vasylykivska), poster at IMA Workshop “Computing with Uncertainty: Mathematical Modeling, Numerical Approximation and Large Scale Optimization of Complex Systems with Uncertainty”, Oct. 18-22, 2010, University of Minnesota
 5. (Poster) *Numerical modeling of dynamic capillary pressure (joint with S.-Y. Yi)* Workshop on Multiscale Nonlinear Systems, Oregon State University, June 25-29, 2007
 4. (Poster) *Upscaling non-Darcy flow* (joint with C. Garibotti), (Workshop on Multiscale Nonlinear Systems, Oregon State University, June 25-29, 2007)
 3. (Poster) *Nonlocal models of flow and transport* (joint with R. E. Showalter), Workshop on Multiscale Nonlinear Systems, Oregon State University, June 25-29, 2007
 2. (Demonstration) *NPACI and TACC booths*, Supercomputing 2002, Baltimore, Nov. 16-22, 2002
 1. (Demonstration) “*Visualize to optimize (oil production)*”, National Science Foundation ACCESS center, Sept. 2000

SERVICE

SERVICE TO THE PROFESSION

- **Editorial boards:**

- Associate Editor of *Results in Applied Mathematics*, 2022-
- Associate Editor of *SIAM Journal on Numerical Analysis*, 2014-17; 2017-20; 2020-current.
- Member of the Editorial Board of *Computation*, 2016-current
- Associate Editor of *Journal of Applied Mathematics*, 2006-2019
- Associate Editor of *International Journal of Numerical Analysis & Modeling*, 2003-current

- **Other editorial work:**

- Co-editor of *White Paper from Forward Looking Workshop on Mathematical Geosciences* November 13, 2011, Editors: Frank Giraldo, Michel Kern, Malgorzata Peszynska, Ivan Yotov, at <http://wiki.siam.org/siag-gs/images/siag-gs/8/88/ForwardLookingWorkshopWhitePaper.pdf>
- Co-editor of Proceedings of Workshop on Multiscale Nonlinear Systems, published in *International Journal of Numerical Analysis & Modeling*, (13 papers accepted), Issue 5, September, 2008
- Guest Editor of *Concurrency and Computation: Practice and Experience, Special issue on “High Performance Computing in Geosciences”*, **17**, 2005, M. Peszynska, M. F. Wheeler, <http://onlinelibrary.wiley.com/doi/10.1002/cpe.896/pdf>, DOI: 10.1002/cpe.896
- Co-Editor of refereed conference proceedings volume: *Modelling and optimization of distributed parameter systems*. Eds: K. Malanowski, Z. Nahorski, M. Peszyńska, Chapman & Hall, New York, 1996, 387 pages

- **Reviewer and panelist for funding agencies:**

- National Science Foundation review panels (17x since 2002-): *Information Technology Research, Applied Analysis, Collaboration in Mathematical Geosciences, RTG, Computation and Data Enabled Science and Engineering, Computational Mathematics: Computational Fluids, Early Career, Numerical Methods and Applications, Numerical Partial Differential Equations.*
- National Science Foundation: (in addition to the panel work and DMS) reviewer for EPSCOR, EAR: Hydrology.
- Deutsche Forschungsgemeinschaft (DFG) review panel for Collaborative Research Center CRC 1313, “Interface-Driven Multi-Field Processes in Porous Media - Flow, Transport and Deformation”, University of Stuttgart, July 2021 (renewal).
- Deutsche Forschungsgemeinschaft (DFG) review panel for Collaborative Research Center CRC 1313, “Interface-Driven Multi-Field Processes in Porous Media - Flow, Transport and Deformation”, University of Stuttgart, July 2017 (inaugural).
- Reviewer for DFG, 2019.
- Fulbright STEM Impact awards reviewer; Summer 2020.
- Fulbright - CIES, Peer Reviewer Summer 2017.
- CRDF (Cooperative Grants Program of the U.S. Civilian Research and Development Foundation), 2005,2008.
- Israeli Science Foundation.
- Portuguese Science and Technology Foundation (FCT).
- Netherlands Organisation for Scientific Research (NWO).
- United States Department of Energy.
- Army Research Office.
- American Chemical Society (Petroleum Research Fund).
- **Review and referee service:**
 - Referee for journals (average 10 articles per year, since 1996-): *Advances in Water Resources, AIMS Material Science, Annales Polonici Mathematici, Applicable Analysis, Applied Numerical Mathematics, Applied Mathematical Modeling, Computational Geosciences, Communications in Numerical Methods in Engineering, Computer Methods in Applied Mechanics and Engineering, Computers & Mathematics with Applications, Computing and Visualization in Science, Concurrency and Computation: Practice and Experience, Electronic Journal of Differential Equations, European Journal of Applied Mathematics, G-cubed (Geochemistry, Geophysics, Geosystems), IMA Journal Numerical Analysis, International Journal of Heat and Mass Transfer, International Journal of Mathematics and Mathematical Sciences, International Journal for Numerical Methods in Engineering, International Journal for Numerical Methods in Fluids, International Journal of Thermal Sciences, Journal of Computational Physics, Journal of Mathematical Analysis and Applications, Journal of Petroleum Science and Engineering, Journal of Thermal Science, Marine and Petroleum Geology, Mathematical Methods in the Applied Sciences, Mathematics & Computers in Simulation, Multiscale Modeling & Simulation (SIAM), Numerical Methods for Partial Differential Equations, Oil & Gas Science and Technology, Progress in Computational Fluid Dynamics, SIAM Journal on Scientific Computing, SIAM Journal on Numerical Analysis, SPE Journal, Transport in Porous Media, Water*

- Resources Research, Zeitschrift fuer Angewandte Mathematik und Physik.*
- Referee of Conference Proceedings in refereed volumes: 5x since 1995
 - Reviewer for *Mathematical Reviews*: over 129 reviews 1998-present.
 - **External referee for tenure, promotion, and habilitation:** (12 cases) = 6 Associate Professor (tenure) + 1 Habilitation + 5 Full Professor
 - **Committees, highlights:**
 - Pacific Math Alliance, **Executive Board** (elected), 2022-24.
 - SIAM Pacific Northwest Section, **President**; May 2018-April 2020 (elected).
 - SIAM Pacific Northwest Section, **Vice-President**; May 2016-April 2018 (inaugural).
 - **Chair of Organizing Committee**, SIAM Pacific Northwest Section biennial conference co-located with PNWNAS, October 27-29, 2017, at Oregon State University.
 - **Chair** of Organizing Committee, Forward Looking Workshop in Mathematical Geosciences in connection with evaluation of NSF program on Collaboration in Mathematical Geosciences, sponsored by NSF-DMS and SIAM Activity group on Geosciences, Crystal City, Sept. 16-17, 2011 at http://wiki.siam.org/siag-gs/index.php/Forward_Looking_Workshop
 - **Chair** for SIAM Activity Group on Geosciences, January 1, 2011-December 31, 2012. (elected)
 - **Chair of the Organizing Committee** of SIAM Geosciences (GS11), March 21-24, 2011, held at Long Beach, CA.
 - **Program Officer** for SIAM Activity Group on Geosciences, January 1, 2009-December 31, 2010. (elected)
 - **Committees:** (full list excluding those above)
 - SIAM CSE 2022 Officer Nominating Committee.
 - SIAM Geosciences 2023 Organizing Committee, member, April 2022-. (conference scheduled to take place in Bergen, Norway, June 2023).
 - AWM-SIAM Committee, 2022-24.
 - SIAM PNW Officer Nominating Committee, 2022.
 - Co-organizer, Oberwolfach workshop on “Multiscale Coupled Models for Complex Media: From Analysis to Simulation in Geophysics and Medicine”, 1/23/2021-1/29/2022, with Sorin Pop, Barbara Wohlmuth, Zohar Yosibach.
 - SIAM Geosciences 2021 Organizing Committee, member, June 2020-June 21. (conference took place in Milan, June 2021).
 - **(Chair)** SIAM GS Officer Nominating Committee, May-July 2020.
 - SIAM-JMM Committee, member, 2018–20 (**Chair 2019**).
 - (Organizing Committee member), SIAM Pacific Northwest Section biennial conference, October 2019, at Seattle University.
 - AWM Sonia Kovalevsky Selection Committee, Feb. 1, 2019-July 31, 2021. [**Chair, 2020**].
 - SIAM-(Future of JMM)-Adhoc Committee, member, Fall 2019–Summer 2020.
 - SIAM Geosciences Prize Committee for Career and Junior Scientist prizes, awarded at SIAM-GS 2019 Conference, 2018-19
 - SIAM Committee on Programs and Conferences, member, 2017-19, 2019-21, 2021-23

- SIAM Geosciences Officer Nominating Committee, 2014
- **Chair of Organizing Committee**, CASCADE Computational and Applied Mathematics Seminar 2014, OSU Campus, Corvallis, OR, April 5, 2014
- Program Committee of Interpore 2014, Milwaukee, May 27-30, 2014
- SIAM Annual 2014 Organizing Committee, Geosciences track organizer, 2013-14
- Program Committee of Interpore 2013, Prague, May 22-24, 2013
- SIAM Geosciences Prize Committee for Career and Junior Scientist prizes, awarded at SIAM-GS Conference, 2013
- **Chair** of Organizing Committee, Forward Looking Workshop in Mathematical Geosciences in connection with evaluation of NSF program on Collaboration in Mathematical Geosciences, sponsored by NSF-DMS and SIAM Activity group on Geosciences, Crystal City, Sept. 16-17, 2011 at http://wiki.siam.org/siag-gs/index.php/Forward_Looking_Workshop
- International Program Committee, *SIMULTECH* 2011 International Conference on Simulation and Modeling Methodologies, Technologies and Applications, Noordwijkerhout, The Netherlands, 29-31 July, 2011.
- Program Committee, *Computer Aspects of Numerical Algorithms (CANA'10)*, Wisla, Poland, October 18-20, 2010
- Panelist at DOE Computational Subsurface Science Workshop, panel on Priority Research Directions in Coupled Phenomena, Bethesda, MD, Jan. 9-12, 2007
- Hiring Committee: Applied Analysis and Reservoir Mechanics/Industrial Mathematics, Department of Mathematics, University of Bergen, June–December 2004
- Secretary of Organizing Committee of the IFIP Conference “Modelling and Optimization of Distributed Parameter Systems with Application in Engineering”, Warsaw, July 17-21, 1995
- **Other significant professional service (includes conference organization):**
 - Session convener, CMWR (Computational Methods for Water Resources), Gdansk June 19-23, 2022 (Session on “Computational hydrology in cold climate regions” and “Reactive transport coupled to flow”).
 - Organizer, “Scientific computing for modeling hazards in PNW area”, SIAM PNW at WSU Vancouver, WA, May 20-22, 2022.
 - Co-organizer of two sessions at CMWR Gdansk, June 2022: “Geochemical transport” and “Modeling processes in cold regions”.
 - Computation Travel Award 2019; evaluation committee, Spring 2019
 - Organizer of minisymposium (with Michel Kern) and mini-tutorial at SIAM Geosciences 2019, Houston, March 2019
 - Organizer of minisymposium at SIAM Annual 2018 (Geosciences track), Portland, OR, July 2018
 - Session organizer, CMWR (Computational Methods in Water Resources XXII) 2018; June 3-7, 2018; Saint Malo, France.
 - Organizer of minisymposium at SIAM GS 2017 “*In memory of Jim Douglas, Jr.*”, Erlangen, Germany, Sep 11-14, 2017
 - Math Alliance F-GAP mentor, 2016; 2017, 2018-
 - Computation Travel Award 2017; evaluation committee, Spring 2017
 - Poster judge, AWM Research Symposium, April 7-8, 2017
 - Mentor and Student Opportunities Lab Volunteer, Broader Engagement program

- sponsored by Sustainable Horizons Institute, SIAM CSE 2017, Atlanta, 2/27-3/3, 2017
- Organizer of minisymposium at SIAM CSE “*New Approaches to Complex Coupled Multiscale Systems*”, Atlanta, 2/27-3/3, 2017
 - Women in Data Science ambassador, local satellite event organizer, at Oregon State University, February 3, 2017
 - Co-organizer of session “*Computational challenges in porous media*” (joint with Chaozhong Qin, Utrecht University), Interpore 2016
 - Co-organizer of session “*Hybrid modeling and Reconstruction in Porous Media*” (joint with A. Trykozko), SIAM Geosciences 2015, Stanford University, June 28-July 2, 2015
 - Co-organizer of a minisymposium at SIAM Geosciences (GS13), *Coupled Phenomena and Scales for Greener Energy Resources* (2 parts, with Lynn Bennethum and Rainer Helmig), June 17-21, 2013, Padova, Italy
 - Co-organizer of a minisymposium at SIAM Geosciences (GS13), *Advances in Pore-Scale Modeling and Upscaling* (4 parts, with Tim Scheibe, Matt Balhoff, Masa Prodanovic, Ken Sorbie, Pavel Tomin), June 17-21, 2013, Padova, Italy
 - Co-organizer of a minisymposium at SIAM Annual 2012 (with L. Bennethum and S.-Y. Yi), *Coupled and hybrid models at multiple scales in geosciences*, Minneapolis, MN, July 9-13, 2012,
 - Co-organizer of a minisymposium at SIAM UQ 2012 (with M. Ossiander and N. Gibson), *Random Media: Models, Simulations, and Applications*, Raleigh, NC, April 2-5, 2012
 - (Invited) convener of the session “Multiphase and pore-scale modeling: challenges and perspectives” (with Vahid Joekar-Niasar, Utrecht University), Computational Methods for Water Resources 2012, University of Illinois, Urbana-Champaign.
 - Co-organizer of Porescale Benchmark at <http://www.porescalebenchmark.pbworks.com> (with Masa Prodanovic, Dorte Wildenschild), initiated Fall 2011.
 - Co-organizer of a minisymposium at SIAM PDE 2011 (PD11) (with A. Ibragimov and L. Hoang), *PDEs for Nonlinear Processes in Porous Media*, November 14-17, San Diego, CA
 - Co-organizer of a minisymposium at SIAM Geosciences (GS11), *Modeling Coupled Phenomena at Multiple Scales for New Technologies* (3 parts, with Rainer Helmig), March 21-24, 2011, Long Beach, CA
 - Organizer of a minisymposium at SIAM Geosciences (GS09), *Modeling of Inertia and Non-Equilibrium Processes*, June 14-18, 2009, Leipzig, Germany
 - Organizer (with R. Showalter and Son-Young Yi) of Workshop on “Modeling, Analysis and Simulation of Multiscale Nonlinear Systems” in cooperation with Society of Industrial and Applied Mathematics (SIAM) Activity Group on Geosciences, Oregon State University, June 25-29, 2007
 - Co-organizer (with S. Minkoff) of a minisymposium at SIAM Conference on Mathematical and Computational Issues in the Geosciences (GS05), *Multiscale Modeling in the Earth Sciences*, Avignon, France, June 7-10, 2005
 - ICES, University of Texas at Austin, Computer Committee (2003)
 - Organizer of a minisymposium at SIAM Conference on Mathematical and Com-

- putational Issues in the Geosciences (GS03), *Electronic Fields of the Future: Mathematical and Computational Challenges*, March 17-20, 2003, Austin, Texas
- Organizer of a special session “Mathematical and Numerical Modeling for Sub-surface and Surface Problems” at CMWR (Computational Methods in Water Resources), Delft, June 2002
 - Organizer of two minisymposia at Sixth SIAM Conference on Mathematical and Computational Issues in the Geosciences, June 10-14 2001, Boulder, CO
 - * “*Modeling, Analysis and Simulation of Hysteresis in Porous Media*”
 - * “*Multiphysics Couplings for Geosciences*” (with C. Dawson, Mary F. Wheeler)
 - Coordinator of multiblock multiphysics simulator IPARS (Integrated Parallel Accurate Reservoir Simulator) framework, Austin, Texas, 1998-2003
 - Coordinator of REU NPACI (National Partnership for Advanced Computational Infrastructure), Austin, TX, Summer 2000
 - Member of a Committee for selection of textbooks, Math Dept UT Austin, Spring 96
 - Member of Scientific Council of the Systems Research Institute, Polish Academy of Sciences, 1993-1994

UNIVERSITY SERVICE

- **Mathematics Department committees**

- **Graduate Committee Chair 2015-2019**
- **(Co-)organizer of Applied Mathematics and Computation Seminar:** an interdisciplinary weekly seminar at Oregon State University, Fall 2004-09, Fall 2010-current, meets Fridays 12:00-12:50.
http://www.math.oregonstate.edu/amc_seminar
The AMC seminar has been attended by a large audience from across campus, consisting of faculty and students from OSU Physics, Geosciences, Forestry, COAS, and Engineering, as well as by colleagues from nearby universities and other visitors. Its program consists of expository and technical presentations as well as short tutorials given by the participants on their research or current topics of interest.
- **Organizer, Applied Mathematics and Computation Journal Club:** a bi-weekly event for graduate students of mathematics and other disciplines at Oregon State University, Fall 2010, Winter 2011, Winter-Spring 2012, Winter-Spring 2013, Winter 2014, Winter 2017, Winter 2018.
http://www.math.oregonstate.edu/amc_journal
In addition to registered mathematics graduate students, the journal club has been attended by mathematics faculty and engineering students.
- **Numerical Analysis Postdoc Search committee [Chair] (2021-22)**
- Faculty Search committee: Analysis (2021-22)
- Graduate Advisor and Graduate Committee member, 2006-2009, 2010-2011, 2013-15, 2015-19, 2021-
- Advisory Committee, 2012-2014
- Mid-Tenure Faculty Review Committee, 2014-15
- **Undergraduate Task Force, Applied and Computational Mathematics Option, 2013-14**

- Promotion and Tenure (Dossier Preparation) Committee, 2013-14
- Undergraduate Advisor, 2005-2006, 2010-2011
- Teaching committee 2004-2005, 2011-2012
- Faculty Search Committee for IGERT positions, 2004-2005; 2005-2006
- Computer committee 2003-2006, 2007-2009 [**Chair 2007-2009**]
- Website committee 2003-2009, [**Chair 2004-2009**]
- Foreign language examiner 2003-2005
- **Oregon State University committes:**
 - Beaver Connect (LSAMP) faculty adviser, 2021-22.
 - Faculty Senate Promotion & Tenure committee, 2022-24.
 - DataScience@OregonState, Academic Advisory Committee, 2019-
 - Water Resources Graduate Program Steering Committee, 2018-
 - College of Science Dean Advisory Council, 2018-2020.
 - Faculty Senator, Fall 2018.
 - Faculty Senate Computing Resources Committee, 2016-18 [**Chair 2017-18**].
 - College of Science Martin-ONEill Graduate Fellowship committee, 2018.
 - College of Science ARCS Scholarship committee, 2016, 2017, 2018.
 - Water Resources Task Force, June 2015-May 2016.
 - College of Science OSU Associate Dean Search committee, 2013-2014.
 - OSU Faculty Senate Bacc-core committee, 2013-2016.
 - Member, OSU President’s Commission on the Status of Women 2013-2016. [Leadership Team 13-15, Mentoring and Creer Advancement 13-14, Scholarships and Awards 14-15]
 - Internal Advisory Committee on the “NSF ADVANCE” grant (PI: Susan Shaw), May 2013-16.
- **Graduate Council Representative** on committees: Ren Dakai (Wood Sci, MSc April 2005), Mike Stewart (Nucl Engrg, MSc April 2005), Jacob Zechmann (EECS, MSc June 2005), Zac Gonsior (MSc in Geology, 3/06), Tao Xu (EECS, PhD committee), Yu Zhang (PhD in EECE, 9/06), Alison Ainsworth, (M.Sc. in Fish and Wildlife, 3/13/2007), Carlos Sierra (PhD Forest Engineering, 2007-2009), Razvan Nes (PhD in Nuclear Engineering, October 7, 2013).
- **OIMT 2007:** wrote an exam for Oregon Invitational Mathematics Tournament (Pre-calculus part), May 2007
- **OIMT 2011:** wrote an exam for Oregon Invitational Mathematics Tournament (Calculus part), May 2011
- **Convener of STOMP short course:** organized a short course on OSU Campus of STOMP (Subsurface Transport over Multiple Phases, software developed at Pacific Northwest National Laboratory), May 24-25, 2007. Course open to 11 OSU faculty/students and 7 external participants.

PROFESSIONAL MEMBERSHIPS

Current: American Association for Advancement in Science; Association for Women in Mathematics; Intepore; Society for Industrial and Applied Mathematics (SIAM) [Activity Groups on Geosciences, Partial Differential Equations, Mathematics of Planet Earth, Computational Science and Engineering, Uncertainty Quantification].

Past: American Geophysical Union, American Mathematical Society, Society for Engineering Science, SIAM AG on Supercomputing.

PROFESSIONAL EXPERIENCE

Travel support and grants obtained from host institution are marked with ()*

- Participant, Finite Element Circus, hybrid, November 5-6, 2021
- NSF program director rotator in DMS (Division of Mathematical Sciences): managed proposal review and award decisions in the programs: Computational Mathematics, CDS&E-MSS Computational and Data Science Enabled Science and Engineering; Infrastructure. Led the team DMS Virtual Office Hours September 2020-August 2021. Provided support for MSPRF (Mathematical Sciences Postdoctoral Research Fellowship); Broadening Participation workshop (MPS), Graduate Research Fellowships. Was involved on Management Teams: Secure and Trustworthy Cyberspace; Future of Manufacturing; Algorithms for Modern Power Systems; Wildfire-BIO Initiative; Climate and Sustainability; Climate Change Coordinating Committee, member of “Observations and Modeling” group.
- Trainee, Search Advocate Training, Oregon State University, December 2021.
- Participant, workshop on “Initiating Difficult Conversations”, Oregon State University, October 2021.
- Participant, Bridging disciplinary divides for behaviorally modulated mathematical models in human epidemiology, May 6 - 7, 2021 NSF DMS/SBE/U Illinois.
- Participant, Nobel Prize Summit (online), April 26-28 2021, NAS.
- Participant and introducer, National Math Festival weekend, virtual, April 16-18, 2021
- Participant, Finite Element Circus, virtual, April 9-10, 2021
- Participant, “Imagining the Future of Undergraduate Education”, virtual, November 2020
- Participant, “Black Heroes of Mathematics” (Oxford u.), virtual, October 2020
- Participant, 50th Finite Element Circus, virtual, November 6-7, 2020
- Participant, PNWNAS (virtual), October 2020
- Participant, “Black Heroes of Mathematics”, (virtual) October 2020.
- “Living with AI: The Human Aspects of AI” (AAAS), June 11, 2020
- OSU Graduate School Workshop, “Is getting graduate degree bad for your health?”, May 2019
- OSU Graduate School Workshop, “The Professor is In”, April 2019
- Visitor (*), NC State University, Nov 13-14, 2018.
- Participant and presenter (*), BIRS CMO (Casa Matematica Oaxaca), July 27-Aug 3, 2018
- Visitor, ICES, The University of Texas at Austin, March 31-April 3, 2017
- Participant and presenter (*), Workshop on Sustainable Research Pathways, Lawrence Berkeley Lab, Dec 6-7, 2016
- Participant, ESSAM-ICM School on Data Science, University of Warsaw, Dec 1, 2016.
- Visitor (*), University of Stuttgart, Institute for Hydromechanics and Modelling of Hydrosystems, Nov. 14-18, 2016

- Visitor, Interdisciplinary Centre for Modeling, University of Warsaw, November 2016
- Visitor (*), University of Bergen, Dept. of Mathematics, Nov. 7-11, 2016
- Visitor, Data Science Center, Interdisciplinary Centre for Modeling, University of Warsaw, August 2016.
- Participant, IMA Special Workshop Mathematics and Mechanics in the 22nd Century: Seven Decades and Counting..., Eugene, OR, October 23-25, 2015
- Participant, PNWNAS 2015 , Bellingham, WA, October 17, 2015
- Participant (*), IMA Special Workshop, Structure-Preserving Discretizations of Partial Differential Equations, October 22-24, 2014
- Visitor (*), Laboratorio Nacional de Computacao Cientifica (LNCC), Petropolis, Brazil, August 2014
- Visitor, Interdisciplinary Centre for Modeling, University of Warsaw, July 2014
- Marine Gas Hydrate Community Workshop (*), Consortium for Ocean Leadership, Washington, DC, June 3-6, 2013
- Center for Teaching and Learning workshop at Oregon State University, Nov. 7, 2011 “Using Social Media for Teaching & Learning”
- Habilitation at Warsaw University of Technology, Department of Mathematics and Information Science, March 2010-June 2011
- Participant (*), IMA Workshop “Large-scale Inverse Problems and Quantification of Uncertainty”, IMA, University of Minnesota, June 6-10, 2011
- Professional visit: AGH University of Science and Technology, Energy and Fuels Department, Cracow, May 15, 2010
- Participant (*), IMA Workshop “Hot Topics Workshop: Uncertainty Quantification in Industrial and Energy Applications: Experiences and Challenges” IMA, University of Minnesota, June 2-4, 2011
- IMA short-term visitor (*), “Simulating our complex world” thematic program, IMA, University of Minnesota, April 11-21 and June 1-11, 2011
- Participant (*), IMA Workshop “Computing with Uncertainty: Mathematical Modeling, Numerical Approximation and Large Scale Optimization of Complex Systems with Uncertainty”, Oct. 18-22, 2010, University of Minnesota
- Sabbatical visitor (*, Fulbright Research Scholarship): Interdisciplinary Centre for Mathematical and Computational Modeling (ICM), University of Warsaw, December 28-August 28, 2010
- Visitor (*), Department of Mathematics, Technical University of Munich, Munich, Germany, December 14-18, 2009
- NVIDIA Research Summit at GPU Technology Conference, San Jose, CA, Sep.28-Oct.2, 2009
- Visitor (*), Department of Mathematics, Technical University of Munich, Munich, Germany, September 20-25, 2009
- Participant, Institute for Mathematics and its Applications (IMA) Workshop “Molecular Simulations: Algorithms, Analysis, and Applications” May 18-22, 2009, University of Minnesota
- Participant (*), NSF Knowledge and Distributed Intelligence workshop “Research Study of Scientific Collaboration”, April 26-28, 2002 in New Orleans
- Participant (*), ACTS (DOE Advanced Computational Software Collection) Collection Workshop, Robust and High Performance Tools for Scientific Computing,

- Lawrence Berkeley National Laboratories, Sep. 4-7, 2002
- InterChange Meeting (*), Schlumberger and Sema, Houston, May 15-16, 2001
- Society of Actuaries, Actuarial examination: Course 100, 110 (Grade 10), February 1997
- Teaching Workshop, The University of Texas at Austin, August 1995
- Teaching Workshop, Purdue University, May 1995

TEACHING, ADVISING AND OTHER ASSIGNMENTS

GRADUATE, UNDERGRADUATE, AND POSTDOCTORAL TRAINEES

- **Postdoc supervision**
 - David Foster, 2010-2014 (co-)advisor (with Guenter Schneider, OSU Physics), supported by the grant NSF DMS-1035513.
(Foster is currently employed by Rincorp, Arizona).
 - Son-Young Yi, 2006-09 (co-)advisor (with R.E. Showalter, OSU Mathematics) partially supported from DOE 98089.
Asisstant (2009-2015) and Associate (2015-) Professor, University of Texas at El Paso.
- **Major professor of graduate students**
 - In progress: (6)
 6. Naren Vohra (PhD in progress), expected 2023.
 5. Nachuan Zhang (PhD in progress), expected 2023.
 4. Nicholas Pantuso (MS in progress), expected 2022,
 3. Madison Phelps (PhD and MS in progress), expected 2026,
 2. Tyler Fara (PhD and MS in progress), expected 2026.
 1. Praveeni Mathangadeera (PhD in progress), expected 2027.
 - Completed PhD: (9)
 9. Lisa Bigler (PhD in Mathematics, May 17 2022), “Computational Modeling of Phase Change at Different Scales with Applications”.
Position: postdoc at Sandia National Labs, 2022-.
 8. Choah Shin (PhD in Mathematics, May 24, 2021), “Multiphase Flow and Transport in Porous Media with Phase Transition at Multiple Scales: Modeling, Numerical Analysis, and Simulation”.
Position: Ab Initio consulting company; internal consultant), 2021-
 7. Joseph Umhoefer (PhD in Mathematics, June 4, 2019), “Modeling Flow and Transport at Pore Scale with Obstructions”.
Position: Solid Modeling Solutions (VP for Emerging Technologies), 2019-22. NVIDIA 2022-
 6. Azhar Alhammali (PhD in Mathematics, May 30, 2019), “Numerical Analysis of a System of Parabolic Variational Inequalities with Application to Biofilm Growth”.
Position: Asst. Prof., Imam Abdulrahman Bin Faisal University, 2019-
 5. Ken Kennedy (PhD in Mathematics, May 30, 2017), “Model Adaptivity and Numerical Solutions Using Sensitivity Analysis”.
Self-employed farm owner, North Plains, OR.

4. Timothy Costa (PhD in Mathematics, May 31, 2016), “Hybrid Multiscale Methods with Applications to Semiconductors, Porous Media, and Materials Science”;
Intel Portland, Math Kernel Library team (software enngr), June 2016-17; Machine Learning team and Scientific Computing teams, July 2017-Jan 2019 (Senior Software Engineer); NVIDIA (Jan 2019-): Product Manager, CUDA Math Libraries.
 3. F. Patricia Medina, PhD in Mathematics, (5/13/2014), “Mathematical treatment and simulation of methane hydrates and adsorption models”
Instructor at OSU 2014-16. Post-doc at WPI, 2016-2019, Assistant Prof., Yeshiva College, 2019-22. CUNY College City Tech 2022-
 2. Veronika Vasylykivska (co-advising with M. Ossiander), PhD in Mathematics (9/6/2012) “Stochastic analysis of flow and transport in porous media”.
First position: postdoctoral associate at Oregon State University funded partially by Bonneville Power Administration. Current position: DOE NETL ORISE fellow and contractor, Albany OR.
 1. Viviane Klein, PhD in Mathematics (5/26/2011) “Two-grid a-priori and a-posteriori error analysis for coupled elliptic and parabolic systems with applications to flow and transport problems”.
Current position: tenure track at Federal University of Rio Grande do Norte (UFRN), Natal, Rio Grande del Norte, Brasil. First positions: postdoc at Mathematics Dept., University of Sao Paulo in San Carlos, Brasil, Asst. Prof. at UFSC (Universidade Federal de Santa Catarina, Brasil). Asst. Prof. at UFRN, Natal, Brasil.
- Completed MS: (15)
15. Nachuan Zhang; May 24, 2021; expository paper on “Explorations of Optimization Methods for Deep Learning with Examples from Various Applications”;
Continued towards PhD in Math, OSU.
 14. Naren Vohra (MS in Mathematics), May 28, 2020 (exam option).
Continued towards PhD in Math, OSU.
 13. Lisa Bigler (MS in Mathematics), Jan 3, 2019; thesis “Numerical Study of Convexity Splitting Scheme for Coupled Phase Field and Stefan Free Boundary Problems”,
Continued towards PhD in Math, OSU.
 12. Diana Gonzalez (MS in Mathematics), July 27 2018; expository paper “An Exploration of Modeling Concepts for Coupled Flow and Energy Systems with Applications to Geyser Modeling”,
California Gas Company.
 11. Zachary Barry (MS in Mathematics), May 31, 2018; expository paper “Mathematical and Computational Considerations of a Model of Microbiologically Induced Calcite Precipitation”,
Instructor at COCC; consulting for Northwest Mathematics, LLC. Data analyst, G5 Bend.
 10. Choah Shin (MS in Mathematics), May 17, 2018 (exam option).
Continued towards PHD in Mathematics at Oregon State

9. Joseph Umhoefer (MS in Mathematics), March 2016. “Interpolation Schemes for Two Dimensional Flow with Applications”.
Continued towards PHD in Mathematics at Oregon State
 8. Adriana Mendoza, MS in Mathematics, (7/23/2014), “Numerical Modeling of Biofilms”.
Current position: tenure track Instructor at Green River College
 7. Natasha McClellan (MSc in Mathematics), (6/5/2014), “Nonlinear Finite Difference Schemes for the Klausmeier System”,
Instructor, Lassen Community College
 6. Timothy Costa, MSc in Mathematics (2/27/2014) “ Analysis of Domain Decomposition Methods for the Simulation of Charge Transport in Semiconductor Structures with Heterojunctions”.
Continued in PhD program in Mathematics at OSU
 5. Yi Zhang, MSc in Mathematics (3/14/2013) “A heterogeneous flow numerical model based on domain decomposition methods”,
PhD in Engrg. December 2013, postdoc at School of Civil Construction Engineering at OSU’13-’14; Altair Engineering’14-
 4. Kenneth Kennedy, MSc Defense (10/23/2009), by examination.
Continued at OSU towards a PhD
 3. Cheryll Woodall, MSc Defense (9/14/2008), expository paper “Time Discretization for Double-Diffusion Models”.
Current position: Bonneville Power Administration.
 2. Shannon Biedermann, MSc Thesis Defense (2/8/2007) “Nonlinear Solvers for a Model Problem of Fluid Flow in Subsurface”.
Current position: Instructor at LBCC.
 1. Cristiano Garibotti, MSc Thesis Defense (3/8/2007) “Upscaling Non-Darcy Flow using Mixed Finite Element Method”.
First position: PhD, Federal University of Santa Catarina. Current position: Asst. Prof. at Institute of Mathematics Statistics and Physics (IMEF) at the Federal University of Rio Grande (FURG), Brazil
- **Undergraduate research, papers, and theses supervised (14)**
 14. Wylea Walker, Spring 2022-
 13. Kyla Jones: “Discrete biofilm models”, Fall 2020-June 2021.
 12. Maria Campuzano Jimenez, Winter 2019: “Solvers for equilibrium phase behavior”.
 11. Anneli Brackbill (URSA Engage 2019): “BVP for nuclear contamination scenarios”
 10. Nathanael Bowles (URSA Engage 2019 and SURE summer scholarship 2019): “ODEs and optimization with graphs”
 9. Zach Barry (BS in Mathematics, ACM option, and AMP program), 2016-2017, “Reactive transport and monotone operators”
 8. Ian Goode, (BS in Physics-Mathematics), Spring 2016, “Introduction to statistical mechanics”
 7. Erik Theirheimer, (BS in Mathematics), Spring 2016, “Working with kernels”
 6. Malgorzata Tyczynska (exchange student from Denmark), research paper “Numerical Simulation of the Chemotaxis Model for Dispersal of Biological Species”,

- Winter-Spring 2015.
5. Clarice Mottet, research paper “Modeling with ODE systems”, Winter 2015
 4. Jessica Armstrong, (adviser for) Honors BS Thesis in Mathematics, “Modeling and Simulation of Reaction-Diffusion Problems Applied to Biofilm Growth”, presented Dec. 2, 2014
 3. Scott Clark “Finite Element Modeling of Uncertain Interfaces”, (September 2007–June 2008) under NSF 0511190 and OSU grant URISC, Senior Thesis in Mathematics presented June 6, 2008.
I was a Faculty Advisor and Co-Sponsor of Clark’s URISC (Undergraduate Research, Innovation, Scholarship and Creativity) award “Finite Element Modeling of Uncertain Interfaces”, Oregon State University, Winter-Spring 2008
 2. Kyle Augustson “Pore-scale simulations with a vorticity-stream function solver for Navier-Stokes equations”, senior paper presented in June 2006. (research project under NSF 0511190 and DOE 98089), Mathematics Department OSU, Summer 2005–Spring 2006
 1. Doug Fettig (development of MATLAB-based tools for numerical linear algebra, DeLoach Honors Scholarship, OSU, Winter 2005)
- **Committee member, undergraduate theses (2)**
 2. Jasmin Kennard (Honors BS in Chemical Engineering, committee member), 2018
 1. Jessica Kincaid (honors thesis, committee member), completed May 2005
 - **Committee member of graduate students: current (3)**
 3. Austin Bosgraf (Oregon State Mathematics), PhD expected 2025
 2. Peter Cowal (Oregon State Mathematics), MS/PhD expected 2026
 1. Gregory Detweiler (Oregon State Mathematics), PhD expected 2023
 - **Committee member of PhD students: past (18)**
 18. Alireza Hosseinkhan (Oregon State Mathematics), PhD June 2022.
 17. Ehsan Taghizadeh (OSU PhD Chemical Engineering), March 2021.
 16. Anthony Alberti (OSU PhD Nuclear Engrg), August 2019.
 15. Doug Woods (OSU PhD Nuclear Engrg), June 2018.
 14. Enrico Facca (University of Padova, PhD in Mathematics), external reviewer, Spring 2018.
 13. Abbas Abdollahi (OSU PhD in Civil and Construction Engineering), March 2017.
 12. Jason Albright (University of Utah, Spring 2017), External member.
 11. Matthew Robinson (OSU PhD Nuclear Engrg), March 10, 2016.
 10. Sooie Hoe Loke (OSU PhD Mathematics), Fall 2015.
 9. Minji Zhu (OSU PhD in Civil, Construction & Environmental Engineering), Nov. 2014.
 8. Mark Mueller (University of Colorado at Denver), prelim Winter 2013, External member.
 7. Yi Zhang (OSU PhD in Civil, Construction & Environmental Engrg), Dec, 2013.
 6. Justin Finn (OSU PhD in Mechanical Engrg), April 2013.
 5. Fernando Morales (OSU PhD in Mathematics), May 2011.
 4. Seshu Nimmala (OSU PhD in Civil, Construction & Environmental Engineering, minor adviser in Mathematics), Sep. 2010.
 3. Ben Dickinson (OSU PhD in Mechanical Engineering), August 12, 2009.
 2. Mark Porter (OSU PhD in Water Resources), June 13, 2008.

1. Bertrand Laubsch (OSU PhD candidate in Physics, 2004-2006).
- **Committee member of MS students: past (23)**
 23. Sarah Vesneske (Oregon State Mathematics), MS August 2022.
 22. Gil Parnon, (Oregon State Mathematics), MS May 2022.
 21. Rachel Wofford (Oregon State Mathematics), MS May 2022.
 20. Gregory Detweiler (Oregon State Mathematics), MS May 2022.
 19. Blaec Bejarano, (Oregon State Mathematics), MS 2021.
 18. Alireza Hosseinkhan (Oregon State Mathematics), MS 2018.
 17. Doug Woods (OSU MS Nuclear Engrg), Winter 2016.
 16. Liz Berg (OSU MS in Mathematics), completed June 2015.
 15. Chelsea Hall (OSU MSc in Mathematics), completed Dec.13, 2013.
 14. Duncan McGregor (OSU MSc in Mathematics), completed April 29, 2013.
 13. Maryam Alarfaj (OSU MSc in Mathematics), completed Dec. 7, 2012.
 12. Paul Talbot (OSU MSc in Nucl. Engrg.), completed Sept. 28, 2012.
 11. Karlan Wolfkill (OSU MSc in Mathematics), completed June 13, 2012.
 10. Brian McKenzie (OSU MSc in Mathematics), completed Dec. 1, 2011.
 9. Fernando Morales (OSU PhD in Mathematics), completed May 2011.
 8. Anna Kirk (OSU MSc in Mathematics), completed May 24, 2011.
 7. Nick Myers (OSU MSc in Nucl. Engrg), completed May 2011.
 6. Scott Henderson (OSU MSc in Mathematics), completed June 10, 2008.
 5. John Osborne (OSU MSc in Mathematics), completed September 21, 2007.
 4. Fernando Morales (OSU MSc in Mathematics), completed February 2007.
 3. Andrew Coe (OSU MSc in Mathematics), completed June 1, 2005.
 2. Clark Musselmann (OSU MSc in Mathematics), completed July 26, 2005.
 1. Roman Androsov (OSU MSc in Mathematics), completed July 27, 2005.
- **Graduate students supervised on funded research, other than advisees (10)**
 10. Michael Renne (OSU mathematics), Summer 2017, from NSF 1522734.
 9. Jake Nelson (OSU CEAOS), Winter-Summer 2014, under NETL Task 21-22.
 8. John Osborne (OSU Mathematics) Summer 2006, under DOE 98089.
 7. Nicholas Stanford (OSU Mathematics) Summer 2006, under DOE 98089.
 6. Bahareh Momken (Ph. D., Math. Dept. UT, Dec. 2000).
 5. Qin Lu (Ph. D., Petroleum and Geosystems Eng., UT Austin, May 2000).
 4. Xiuli Gai (Ph. D., Petroleum and Geosystems Eng., Ph. D. UT Austin, 2003).
 3. Shuyu Sun (Ph. D., Computational and Applied Math., Ph.D. UT Austin, 2003).
 2. Ryan Martino (Computational and Applied Math., M.Sc. UT Austin, 2002).
 1. Andrew Doud (M. Sc., Computational and Applied Math., UT Austin, 2003).

CREDIT COURSES

In the listing of courses below, ' u ' and ' g ' denote the number of undergraduate and graduate students enrolled in class, respectively, and ' a ' denotes the number of students or faculty auditing class.

Oregon State University 2021-22

| | | |
|--|-----------------|-------------------------|
| Finite Elements (MTH 654/9) | (13g+3g) | Fall 2021 |
| PDEs (MTH 621-2-3; MTH 657) | (29g, 22g, 10g) | Fall-Winter-Spring 2019 |
| Applied Math and Computation Seminar (MTH 607) | (16g, 13g, 14g) | |

Oregon State University 2018-19

| | | |
|--|----------|-------------|
| Large Scale Scientific Computing (MTH 655/9) | (12g+5g) | Winter 2019 |
| Models and Methods of Applied Math (MTH 420/520) | (27u+5g) | Spring 2019 |
| Introduction to Mathematics as Profession(MTH 599) | 18 | Winter 2019 |
| Introduction to Mathematics as Profession(MTH 599) | 17 | Spring 2019 |
| Applied Math and Computation Seminar (MTH 607) | | |

Oregon State University 2017-18

| | | |
|--|-----------|-------------|
| Numerical Linear Algebra (MTH 4/551) | 19u+19g | Fall 2017 |
| Numerical ODEs (MTH 4/552) | (17g+14u) | Winter 2018 |
| Numerical PDEs (MTH 4/553) | (10g+7u) | Spring 2018 |
| Introduction to Mathematics as Profession(MTH 599) | 18 | Winter 2018 |
| Introduction to Mathematics as Profession(MTH 599) | 17 | Spring 2018 |
| Applied Math and Computation Seminar (MTH 607) | | |

Oregon State University 2016-17

| | | |
|--|---------|-------------|
| Finite Element Methods (MTH 655/9) | 12+4+1g | Winter 2017 |
| Introduction to Mathematics as Profession(MTH 599) | 18 | Winter 2017 |
| Introduction to Mathematics as Profession(MTH 599) | 15 | Spring 2017 |
| Applied Math and Computation Seminar (MTH 607) | | |

Oregon State University 2015-16

| | | |
|--|-----------|-------------|
| Advanced Calculus(MTH 311) | 33 | Fall 2015 |
| Differential and Integral Equations of Math. Physics (MTH 621,657) | 14g+3g+1a | Fall 2015 |
| Differential and Integral Equations of Math. Physics (MTH 622) | 11g | Winter 2016 |
| Introduction to Mathematics as Profession(MTH 599) | 19 | Winter 2016 |
| Numerical Functional Analysis (MTH 655/9) | 10g+4g | Winter 2016 |
| XSEDE (Special online class) (MTH 699) | 4g | Winter 2016 |
| Differential and Integral Equations of Math. Physics (MTH 623,657) | 8g | Spring 2016 |
| Models and Methods of Applied Math (MTH 420/520) | 30u+1g | Spring 2016 |
| Applied Math and Computation Seminar (MTH 607) | | |

Oregon State University 2014-15

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|---|--------------|-------------|
| Numerical Linear Algebra (MTH 451-551) | 25u+13g | Fall 2004 |
| Mathematical Methods for Engineers and Scientists (MTH 481/581) | 6u+15g+1(UO) | Fall 2014 |
| Applied Partial Differential Equations (MTH 482/582) | 2u+15g | Winter 2015 |
| Models and Methods of Applied Math (MTH 420/520) | 21u+5g | Spring 2015 |
| Applied Math and Computation Seminar (MTH 607) | | |
| Applied Math and Computation Journal Club (MTH 607) | | |

Oregon State University 2013-14

| | | |
|---|----------------|-------------|
| Discrete Math (MTH 355) | 26u | Fall 2013 |
| Finite Elements (MTH 654/9) | 9g+1u+1f+2(UO) | Fall 2013 |
| Systems of ODEs (MTH 480) | 31u | Winter 2014 |
| Models and Methods of Applied Math (MTH 499/599) | 12u+9g | Spring 2014 |
| Applied Math and Computation Seminar (MTH 607) | | |
| Applied Math and Computation Journal Club (MTH 607) | | |

Oregon State University 2012-13

| | | |
|--|--------|-------------|
| Advanced Calculus (MTH 311) | 23u | Fall 2012 |
| Advanced Calculus (MTH 312) | 26u | Winter 2013 |
| Large Scale Scientific Computing (MTH 655/9) | 11g+1g | Winter 2013 |
| Numerical Solution of ODEs (MTH 452-552) | 6u+10g | Winter 2013 |
| Numerical Solution of PDEs (MTH 453-553) | 6u+7g | Spring 2013 |

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|---|--|--|
| Applied Math and Computation Seminar (MTH 607) | | |
| Applied Math and Computation Journal Club (MTH 607) | | |

Oregon State University 2011-12

| | | |
|--|--------|-------------|
| Differential and Integral Equations of Math. Physics (MTH 621,657) | 15+4g | Fall 2011 |
| Finite Elements (MTH 654/9) | 16g+3g | Fall 2011 |
| Differential and Integral Equations of Math. Physics (MTH 622) | 13g | Winter 2012 |
| Multivariate Calculus (MTH 254) | 74u | Winter 2011 |
| Differential and Integral Equations of Math. Physics (MTH 623) | 7g | Spring 2012 |

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|---|--|--|
| Applied Math and Computation Seminar (MTH 607) | | |
| Applied Math and Computation Journal Club (MTH 607) | | |

Oregon State University 2010-11

| | | |
|---|-----|-------------|
| Numerical Functional Analysis (MTH 654/9) | 11g | Winter 2011 |
| Multivariate Calculus (MTH 254) | 79u | Winter 2011 |
| Intro. Num. Anal. (MTH 351) | 24u | Winter 2011 |

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|---|---------|-------------------|
| Applied Math and Computation Seminar (MTH 607) co-teach | 14g+10g | Fall'10-Winter'11 |
| Applied Math and Computation Journal Club (MTH 607) | 5g+7a | Winter'11 |

Oregon State University 2009-10

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|--|-----|-----------|
| Large Scale Scientific Computing (MTH 654) | 19g | Fall 2009 |
|--|-----|-----------|

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|---|-----|---------|
| Applied Math and Computation Seminar (MTH 607) co-teach | 14g | Fall'09 |
|---|-----|---------|

Oregon State University 2008-09

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|--|-----|-------------|
| Differential and Integral Equations of Math. Physics (MTH 621) | 10g | Fall 2008 |
| Linear Algebra (MTH 341) | 30u | Fall 2008 |
| Differential and Integral Equations of Math. Physics (MTH 622) | 13g | Winter 2009 |
| Differential and Integral Equations of Math. Physics (MTH 623) | 7g | Spring 2009 |

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|---|-----|-------------------|
| Applied Math and Computation Seminar (MTH 607) co-teach | 12g | Fall'08-Winter'09 |
| Applied Math and Computation Seminar (MTH 607) co-teach | 10g | Spring'09 |

Oregon State University 2007-08

| | | |
|--|-----------|-------------|
| Multivariate Calculus (MTH 254) | 68u | Fall 2007 |
| Numerical Linear Algebra (MTH 551) | 10g | Fall 2007 |
| Numerical Solution of ODEs (MTH 452-552) | 8u+9g | Winter 2008 |
| Numerical Solution of PDEs (MTH 453-553) | 4u+5g | Spring 2008 |
| Finite Elements (MTH 655) | 12g+1u+2a | Winter 2008 |

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|---|--------|-------------|
| Applied Math and Computation Seminar (MTH 607) co-teach | 10g+1u | Fall 2007 |
| | 7g | Winter 2008 |
| | 8g | Spring 2008 |

Oregon State University 2006-07

| | | |
|---|--------|-------------|
| Advanced Calculus (MTH 311) | 31u | Fall 2006 |
| Thesis (MTH 503) | 2g | Fall 2006 |
| Advanced Calculus (MTH 312) | 17u | Winter 2007 |
| Large Scale Scientific Computing (MTH 655) | 13g+4a | Winter 2007 |
| Applied Math and Computation Seminar (MTH 607) co-teach | 7g | Fall 2006 |
| | 9g | Winter 2007 |
| | 10g | Spring 2007 |

Oregon State University 2005-06

| | | |
|---|------|-------------|
| Intro. Num. Anal. (MTH 351) | 20u | Fall 2005 |
| Finite Elements (MTH 655) | 13g | Winter 2006 |
| Applied Differential Equations (MTH 256) | 100u | Winter 2006 |
| Intro. Num. Anal. (MTH 351) | 35u | Spring 2006 |
| Applied Math and Computation Seminar (MTH 607) co-teach | 8g | Fall 2005 |
| | 11g | Winter 2006 |
| | 8g | Spring 2006 |

Oregon State University 2004-05

| | | |
|---|---------|-------------|
| Numerical Linear Algebra (MTH 451-551) | 10u+10g | Fall 2004 |
| Multivariate Calculus (MTH 254) | 56u | Winter 2005 |
| Numerical Solution of ODEs (MTH 452-552) | 1u+10g | Winter 2005 |
| Numerical Solution of PDEs (MTH 453-553) | 5u+13g | Spring 2005 |
| Applied Math and Computation Seminar (MTH 607) co-teach | 2g | Fall 2004 |
| | 5g | Winter 2005 |
| | 5g | Spring 2005 |

Oregon State University 2003-04

| | | |
|--|-----|-------------|
| Advanced Calculus (MTH 311) | 35u | Fall 2003 |
| Advanced Calculus (MTH 312) | 20u | Winter 2004 |
| Intro. Num. Anal. (MTH 351) | 35u | Winter 2004 |
| Intro. Num. Anal. (MTH 351) | 35u | Spring 2004 |
| Intro. Math. Asp. Fin. Elem. (MTH 659) | 11g | Spring 2004 |

The University of Texas at Austin 1995-97

| | | |
|---|--------|---|
| Vector Calculus | 2x120u | Fall 95, Spring 96 |
| Introduction to Probability | 5x35u | Fall 95, 2xSumm. 96 Spring and Fall 97 |
| Discrete Math (Intro to Proofs) | 25u | Spring 96 |
| Calculus II for Business | 135u | Fall 96 |
| Diff. and Int. Calculus for Sci. and Eng. | 2x120u | Spring and Fall 97 |
| Linear Algebra with Applications | 120u | Summer 97 |
| Student Supervision: Essential Writing Component | 3u | Fall 95-Fall96 |

Purdue University 1994-95

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|---|-------|------------|
| Introduction to Analysis I | 2x40u | 2 sem., 94 |
| Diff. Equations for Eng. and the Sciences (incl. PDEs) | 40u | Spring 95 |
| Multivariate Calculus | 40u | Spring 95 |

SUMMER SCHOOLS and NON-CREDIT COURSES

- Local instructor for the Blue Waters class MTH 699, “Extreme Scaling Course”, Winter 2016 (4g from Mathematics and Nuclear Engineering).
- Summer School lecturer, Multiscale Mathematics and High-Performance Computing Summer School (for graduate and post-graduate participants) sponsored by Department of Energy, Richmond, WA, August 4-6, 2008, see Presentation # 189
- Summer School lecturer, Multiscale Mathematics and High-Performance Computing Summer School (for graduate and post-graduate participants) sponsored by Department of Energy, Oregon State University, June 29-July 3, 2007, see Presentation # 188
- Lead Speaker (10h lectures) at Rocky Mountain Mathematics Consortium (for graduate and post-graduate participants), University of Wyoming, Laramie, June 18-23, 2007, see Presentation # 187
- Introduction to Scientific Computing (4g), Nov. 2005, Mathematics Department at OSU

CURRICULUM DEVELOPMENT

- Organized and provided materials for professional development within MTH 599, “Introduction to Mathematics as Profession”, Winter-Spring 2016, 2017, 2018, 2019.
- Co-developed “Applied and Computational Math Option” to be offered within Mathematics undergraduate major at Oregon State, 2013-14.
- Developed a new class “*Models and Methods of Applied Mathematics (MMAM)*” taught as MTH 499/599 (Spring 2014). The class was approved as a Category II proposal by Oregon State University Curriculum Council, and runs as MTH 420/520 since Spring 2014.

The content of the class is: discrete and continuous mathematical models and methods for analysis, including linear analysis, equilibrium and minimum principles, calculus of variations, principal component analysis and orthogonal expansions, asymptotic and Fourier analysis, least squares, constrained and unconstrained optimization, inverse problems, and Monte Carlo techniques. The class includes a weekly lab on guided projects.

- Developed curriculum for the graduate course MTH 659 (Spring 2004, Winter 2006, Winter 2008, Fall 2011) on “*Introduction to Mathematical Aspects of Finite Elements*”.

Finite Element Method is a classical topic in numerical analysis and is the basis for most advanced computational techniques in engineering design, fluid dynamics, and many other disciplines. The class covers the basic mathematical background and algorithmic aspects of finite element method and is designed for Mathematics students as well as others from EECE, Physics, ME, Civil Engrg, Nucl. Engrg., Forest Engineering, COAS and other departments.

- Developed curriculum for the graduate course MTH 655/659 (Winter 2007, Fall 2009) on “*Large Scale Scientific Computing*”.

The class is attended by students from Mathematics, Physics, Mechanical and Nuclear Engineering, Civil Engineering, and EECE, as well as by several Mathematics and Engineering faculty. The class covers iterative methods for large linear and nonlinear systems and introduces the basics of parallel and distributed computing. A mandatory

computational projects lab runs once a week. In Fall 2009 the class included a special module on GPU (Graphic Processing Unit) computing.

- Developed curriculum for the graduate course MTH 655/659 (Winter 2011) on “*Numerical Functional Analysis with Applications*”

This class develops functional analysis background necessary for the study of advanced topics in numerical analysis. It is oriented at the theory rather than at the applications and thus is best suited for Mathematics students.

- Initiated the Applied Mathematics and Computation Journal Club MTH 607 (F’10-W’11, W-S’12, W-S’13, W’14).

This activity is designed to help the students interested in applied and computational mathematics to read research articles in and outside their primary research focus area.

INTERNATIONAL TEACHING

Warsaw University of Technology 1993-94

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|---|-------|---------------|
| Programming Languages I/II | 2x20u | 3 sem., 93-94 |
| Multiprocessor and Multiprocessing Environments and Applications | 40g | Fall 93 |
| Student Supervision: PVM System | 2g | Spring 94 |
