

BIJAN SEYEDNASROLLAH

<https://bnasr.github.io>
bijan.s.nasr@gmail.com
GitHub: @bnasr
(919) 599-4380

1295 S. Knoles Dr.
PO Box 5693
Flagstaff, AZ 86011

ACADEMIC APPOINTMENTS

Harvard University , Department of Organismic and Evolutionary Biology/ Northern Arizona University , School of Informatics, Computing, and Cyber Systems Postdoctoral Research Associate	2017 - present
Duke University , Nicholas School of the Environment Doctoral Research and Teaching Assistant	2011 - 2017
Research Institute of Petroleum Industry (Iran) , Department of Energy and Environment Senior Researcher	2006 - 2011

EDUCATION

Duke University , Durham, NC Ph.D. in Quantitative Environmental Science Dissertation: "Ecosystem response to a changing climate: vulnerability, impact and monitoring" Advisor: Dr. Jim Clark	2017
Sharif University of Technology , Tehran, Iran M.Sc. in Mechanical Engineering, Energy Conversion Thesis: "Modeling of multi-phase flow in porous media" Advisor: Dr. Mehrdad T. Manzari	2006
University of Semnan , Semnan, Iran B.Sc. in Mechanical Engineering, Heat and Fluid Flow Thesis: "Numerical modeling of conductive heat transfer" Advisor: Dr. Farhad Talebi	2003

SELECTED PEER-REVIEWED JOURNAL PUBLICATIONS

-
- B. Seyednasrollah**, A. M. Young, K. Hufkens, T. Milliman, M. A. Friedl, S. Frolking, A. D. Richardson, "Tracking vegetation phenology across diverse biomes using PhenoCam imagery: The PhenoCam Dataset v2.0", *Nature Scientific Data*, submitted.
- B. Seyednasrollah**, J. S. Clark, "Nutrient-demanding species and drought vulnerability: the role of habitat heterogeneity", *Global Change Biology*, in review.
- B. Seyednasrollah**, A. D. Richardson, T. Milliman, "Data extraction from digital repeat photography using xROI: An interactive framework to facilitate the process", *ISPRS Journal of Photogrammetry and Remote Sensing*, Volume 152, June 2019, Pages 132-144, doi:10.1016/j.isprsjprs.2019.04.009.
- M. S. Carbone, **B. Seyednasrollah**, T. T. Rademacher, D. Basler, J. Le Moine, S. Beals, J. Beasley, A. Greene, J. Kelroy, A. D. Richardson, "Flux Puppy: an open source software application and portable system design for low-cost manual measurements of CO₂ and H₂O fluxes", *Agricultural and Forest Meteorology*, Volume 274, 15 August 2019, Pages 1-6, doi:10.1016/j.agrformet.2019.04.012.
- B. Seyednasrollah**, J. C. Domec, J. S. Clark (2019) "Spatiotemporal sensitivity of thermal stress for monitoring canopy hydrological stress in near real-time", *Agricultural and Forest Meteorology*, Volumes 269-270, 15 May 2019, Pages 220-230, doi:10.1016/j.agrformet.2019.02.016.
- A. D. Richardson, K. Hufkens, T. Milliman, D. M. Aubrecht, M. E. Furze, **B. Seyednasrollah**, M. B. Krassovski, J. M. Latimer, W. R. Nettles, R. R. Heiderman, J. M. Warren, and P. J. Hanson (2018) "Ecosystem warming extends

vegetation activity but heightens cold temperature vulnerability”, *Nature*, Volume 560, pages368371 (2018), doi:10.1038/s41586-018-0399-1.

B. Seyednasrollah, J. J. Swenson, J. C. Domec, J. S. Clark (2018) “Leaf phenology paradox: why warming matters most where it is already warm”, *Remote Sensing of Environment*, Volume 209, May 2018, Pages 446-455, ISSN 0034-4257, doi:10.1016/j.rse.2018.02.059.

J. S. Clark, D. Nemergut, **B. Seyednasrollah**, P. Turner, and S. Zhang (2017). “Generalized joint attribute modeling for biodiversity analysis: Median-zero, multivariate, multifarious data”, *Ecological Monographs*, 87(1), 34-56. doi:10.1002/ecm.1241.

B. Seyednasrollah, and M. Kumar (2014). “Net radiation in a snow-covered discontinuous forest gap for a range of gap sizes and topographic configurations”, *J Geophys Res-Atmos*, 119, 10,32310,342. doi:10.1002/2014JD021809.

B. Seyednasrollah, and M. Kumar (2013). “Effects of tree morphometry on net snowcover radiation on forest floor for varying forest densities”, *J Geophys Res-Atmos*, 118, 12,50812,521, doi:10.1002/2012JD019378.

B. Seyednasrollah, M. Kumar, and T. E. Link (2013). “On the role of vegetation density on net snow cover radiation at the forest floor”, *J. Geophys. Res. Atmos*, 118, 83598374, doi:10.1002/jgrd.50575.

R. M. Khorsani, **B. Seyednasrollah**, M. T. Manzari and S. K. Hannani. “Dimensional numerical simulation of hydrocarbon reservoirs using a black oil model implicit finite difference method”, in *Sharif Journal of Mechanical Engineering*, 2010, Vol. 26, No. 1. (In Persian)

F. Talebi, **B. Seyednasrollah** and F. Yousefi. “Analysis and optimization of reducing steady state time for heating systems”, in *International Journal Of Advanced Design And Manufacturing Technology*, 2009, Vol. 2 No. 2. (In Persian)

FEATURED IN THE MEDIA

KNAU Radio: Interview on monitoring drought in near real-time and “open-data, open-source science”, scheduled for April 11, 2019.

NAU News: Maybe I could just do this: NAU Researcher Helps Develop Near Real-time Drought Monitoring Tool, <https://news.nau.edu/drought-monitoring-tool/>, April 2, 2019.

El Heraldo: El Cambio Climático Desde Varios Frentes, <https://www.elheraldo.co/medio-ambiente/el-cambio-climatico-desde-varios-frentes-612018>, March 27, 2019.

Weather Nation: A Faster and More Accurate Way to Monitor Drought, <http://www.weathernationtv.com/news/a-faster-and-more-accurate-way-to-monitor-drought/>, March 13, 2019.

Futurity: Free Drought Eye Maps Ecipicts Thermal Stress, <https://www.futurity.org/droughts-map-1999812/>, March 5, 2019.

Science Daily: Thermal Stress Measurements Sound the Alarm About Drought Conditions Sooner, <https://www.sciencedaily.com/releases/2019/03/190304154858.htm>, March 4, 2019.

AAAS EurekAlert: A faster, more accurate way to monitor drought, https://www.eurekalert.org/pub_releases/2019-03/du-afm030419.php, March 4, 2019.

Duke University: A Faster, More Accurate Way to Monitor Drought, <https://nicholas.duke.edu/about/news/faster-more-accurate-way-monitor-drought>, March 4, 2019.

PEER-REVIEWED DATASETS AND OPEN-SOURCE SOFTWARE APPLICATIONS

B. Seyednasrollah, et al. (2019) “PhenoCam Dataset v2.0: Vegetation Phenology from Digital Camera Imagery, 2000-2018”. ORNL Distributed Active Archive Center <https://doi.org/10.3334/ORNLDAAAC/1674>.

T. Milliman, **B. Seyednasrollah**, et al. (2019) “PhenoCam Dataset v2.0: Digital Camera Imagery from the PhenoCam Network, 2000-2018”. ORNL Distributed Active Archive Center <https://doi.org/10.3334/ORNLDAAAC/1689>.

B. Seyednasrollah, D. Basler, S. Beals, J. Beasley, A. Greene, J. Kelroy, M. S. Carbone, and A. D. Richardson (2018), "FluxPuppy: Android Interface to Licor LI-820 and LI-840 gas analyzers". Zenodo. <http://doi.org/10.5281/zenodo.1438548>

A. D. Richardson, K. Hufkens, T. Milliman, D. M. Aubrecht, M. E. Furze, **B. Seyednasrollah**, M. B. Krassovski, and P. J. Hanson (2018), "SPRUCE Vegetation Phenology in Experimental Plots from Phenocam Imagery, 2015-2016." ORNLTESSFA (Oak Ridge National Lab's Terrestrial Ecosystem Science Scientific Focus Area (ORNL TES SFA)); Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States)

B. Seyednasrollah, T. Milliman and A. D. Richardson (2018), "xROI: A Toolkit to Delineate Region of Interests (ROI's) and Extract Time-series Data from Digital Repeat Photography Images". Zenodo. <http://doi.org/10.5281/zenodo.1202273>

B. Seyednasrollah, J. J. Swenson, J. C. Domec, J. S. Clark (2018), "phenoCDM: Continuous Development Models for Incremental Time-Series Analysis". Zenodo. <http://doi.org/10.5281/zenodo.1204614>

B. Seyednasrollah, "drawROI: An interactive toolkit to extract phenological time series data from digital repeat photography". Zenodo. <http://doi.org/10.5281/zenodo.1066588>

B. Seyednasrollah, "hazer: Quantifying haze factor for RGB images to identify cloudy and foggy weather", Zenodo. <http://doi.org/10.5281/zenodo.1008568>, 2017.

B. Seyednasrollah, "solrad: To calculate solar radiation and related variables based on location, time and topographical conditions", Zenodo. <http://doi.org/10.5281/zenodo.1249673>, 2016.

B. Seyednasrollah, "GaRM: A Forest Gap Radiation Model", Zenodo. <http://doi.org/10.5281/zenodo.840998>, 2014.

B. Seyednasrollah, "FoRM: A physically based forest radiation model", Zenodo. <http://doi.org/10.5281/zenodo.841001>, 2014.

SELECTED PRESENTATIONS, ABSTRACTS AND OTHER PUBLICATIONS

B. Seyednasrollah (invited), K. Duffy, A. M. Young, A. D. Richardson, "Flux-PhenoCam Data Fusion to Understand Surface Energy Balance", NEON Surface Atmosphere Exchange Workshop, Washington DC, 11/12/2018.

B. Seyednasrollah (invited), A. D. Richardson, "PhenoCam data and validation of remotely sensed vegetation indices", NASA CEOS LPV Workshop, Washington DC, 12/12/2018.

B. Seyednasrollah, T. E. Milliman, M. A. Friedl, A. D. Richardson, "Phenology of temperate deciduous forests: Roles of energy and moisture", American Geophysical Union Fall Meeting 2018, Washington, DC.

E. K. Melaas, **B. Seyednasrollah**, A. D. Richardson, K. Hufkens, M. A. Friedl, "Using PhenoCams and Landsat to improve understanding of photoperiod control on spring phenology of deciduous forests in the Eastern US", American Geophysical Union Fall Meeting 2018, Washington, DC.

M. Kumar, X Chen, **B. Seyednasrollah**, T. Zi, T. E. Link, B. L. McGlynn, J. D. Albertson, "Improving process representations in models: An exercise in scientific exploration or a societal need?", American Geophysical Union Fall Meeting 2018, Washington, DC.

B. Seyednasrollah, T. Milliman, A. D. Richardson, "Tackling challenges of extracting time-series data from digital repeat photography", Early Career Researcher Symposium 2018, Computing Community Consortium, Washington, DC.

B. Seyednasrollah (invited), A. Young, K. Duffy, T. Milliman, A. D. Richardson, "Phenocams: Tracking vegetation activity from digital cameras", Data Institute 2018, National Ecological Observatory Network, Boulder, CO.

B. Seyednasrollah, T. E. Milliman, K. Hufkens, M. Kosmala, A. D. Richardson, "An interactive toolkit to extract phenological time series data from digital repeat photography", American Geophysical Union Fall Meeting 2017, New Orleans, LA.

B. Seyednasrollah (invited), J. Clark, "Understanding Phenology across Scales and Improving Linkages to Ecosystem Functions", American Geophysical Union Fall Meeting 2015, San Francisco, CA.

B. Seyednasrollah, J. Clark, "Attributing the effects of climate on phenology change suggests high sensitivity in coastal zones", American Geophysical Union Fall Meeting 2015, San Francisco, CA.

J. Clark, A. Berdanier, **B. Seyednasrollah**, Brad Tomasek, "Forecasting the forest and the trees: consequences of drought in competitive forests", American Geophysical Union Fall Meeting 2015, San Francisco, CA.

J. Clark, **B. Seyednasrollah**, B. Tomasek, "Forecasting the forest and the trees: climate impacts from individuals to communities to traits", Coweeta LTER Summer Symposium and Meeting Agenda, June, 2015, Coweeta, NC.

B. Seyednasrollah, "Sensitivity of green-up phenology across different ecosystems using hierarchical modeling", Richardson Lab, Harvard University, Cambridge, MA, October 2015.

B. Seyednasrollah, "Dynamics of forest green-up across different ecosystems", Joint Ecology / Marine Lab (JEM) Symposium, Duke University, Beaufort, NC, November 2015.

B. Seyednasrollah, J. S. Clark, J.C. Domec, "Drought-induced stomatal closure rising canopy temperature observed from space", Ecological Society of America Annual Meeting 2015, Baltimore, MD.

J. S. Clark, B. Beckage, A. Berdanier, M. Dietze, C. M. Gough, B. Hardiman, M. Kwit, J. Mohan, S. M. Pearson, W. J. Platt, A. Schwantes, **B. Seyednasrollah**, B. J. Tomasek, C. W. Woodall, P. H. Wyckoff, K. Zhu, "Forecasting the forest and the trees: Consequences of competition and climate for biodiversity change", Ecological Society of America Annual Meeting 2015, Baltimore, MD.

J. HilleRisLambers, I. K. Breckheimer, **B. Seyednasrollah**, J. S. Clark, J. F. Franklin, A. J. Larson, J. A. Freund, "Competitive interactions between tree species will slow compositional turnover with climate change", Ecological Society of America Annual Meeting 2015, Baltimore, MD.

B. Seyednasrollah (invited), Andrew Latimer, Leah Johnson, Janneke Hille Ris Lambers, "Applications of Joint Species Distribution Modeling with Case Studies", The Statistical and Applied Mathematical Sciences Institute (SAMSI), ECOL: Transition Workshop: May 4-6, 2015.

B. Seyednasrollah, "How fast forests green up in different habitats?", Duke University Ecology Symposium, Duke Marine Laboratory, Beaufort, NC, April 2015.

B. Seyednasrollah (invited), Andrew Latimer, Ian Breckheimer, Janneke Hille Ris Lambers, "Applications of Joint Species Distribution Modeling with Case Studies", The Statistical and Applied Mathematical Sciences Institute (SAMSI), ECOL: Multivariate Models in Ecology: March 2-4, 2015.

B. Seyednasrollah "From Snow Hydrology to Forest Ecology", Nicholas School Graduate Students Seminar, Duke University, October, 2014.

M. Kumar, X. Chen, **B. Seyednasrollah**, A. Winstral, M. Reba, D. Marks, "Assessment of Hydrologic Impacts of Snowdrift in a Snow Dominated Watershed", American Geophysical Union Fall Meeting, 2014, San Francisco, CA.

M. Kumar, **B. Seyednasrollah**, T. E. Link, "In search of radiation minima for balancing the needs of forest and water management in snow dominated watersheds", American Geophysical Union Fall Meeting 2013, San Francisco, CA.

B. Seyednasrollah, M. Kumar, "Using Forest Radiation Model (FoRM) to Quantify the Role of Canopy Coverage on Net Snow Cover Radiation", American Geophysical Union Fall Meeting 2013, San Francisco, CA.

B. Seyednasrollah, M. Kumar, "Understanding the Role of Canopy Coverage and Tree Morphometry on Net Snow Cover Radiation Using Forest Radiation Model (FoRM)", CUAHSI Hydroinformatic 2013, Logan, UT.

T. E. Link, M. Kumar, J. Pomeroy, **B. Seyednasrollah**, C. Ellis, R. Lawler, and R. Essery, "Opportunities and challenges to conserve water on the landscape in snow-dominated forests: The quest for the radiative minima and more...", American Geophysical Union Fall Meeting 2012, San Francisco, CA.

B. Seyednasrollah, M. Kumar, T. E. Link, "Looking for Radiation Optimality on Snow Covered Forest Floor", American Geophysical Union Fall Meeting 2012, San Francisco, CA.

B. Seyednasrollah, M. Khosravy-el-Hossani, "Exergy Analysis of excess air variation in boilers", International Conference on Advances in Mechanical Engineering (ICAME), 2010, Malaysia.

B. Seyednasrollah, M. Khosravy-el-Hossani, "Investigation of Excess Air Variations Effects on Dry Flue Gas Loss", International Conference on Advances in Mechanical Engineering (ICAME), 2010, Malaysia.

F. Yousefi, **B. Seyednasrollah**, F. Talebi, "Global Analysis for Two Effective Method to Reduction of Control Time in Steady State of Thermal Systems", The Annual Conference (International) on Mechanical Engineering (ISME), 2008, Kerman, Iran.

B. Seyednasrollah, S.E. Hossein. , F. Talebi, "An Effective Method to Reduction of Control Time in Steady State of Thermal Systems", The Annual Conference (International) on Mechanical Engineering (ISME), 2007, Tehran, Iran

F. Talebi., **B. Seyednasrollah**, "An Effective Method to Reduction of Control Time in Steady State Convectonal Heat Transfer", The Annual International Conference of Mechanical Engineering (ISME), 2005, Isfahan, Iran.

TEACHING AND MENTORSHIP EXPERIENCE

Graduate Student Mentorships

- Stephanie Arcusa (PhD student, CLM Project, Northern Arizona University) 2018-2019

Undergraduate Students Mentorships

- Kevyn Sisante (Undergraduate student, machine learning project, Northern Arizona University) 2019
- Kevyn Sisante (Undergraduate student, work-study program, Northern Arizona University) 2018
- Amberlee Pavey (Undergraduate student, work-study program, Northern Arizona University) 2018
- Jasque Saydyk (Undergraduate student, Open-source software, Northern Arizona University) 2018
- Evan Russell (Undergraduate student, Open-source software, Northern Arizona University) 2018
- Ryan Ladwig (Undergraduate student, Open-source software, Northern Arizona University) 2018
- Yuxuan Zhu (Undergraduate student, Open-source software, Northern Arizona University) 2018

Co-founder, SciCademy: A Science Academy for Teaching Quantitative Science 2018-present

Workshop Organizer / Instructor

- Lecture in "New Advances in Land Carbon Cycle Modeling" Workshop: Studying Environmental Change Using Repeat Photography: Introduction to PhenoCam Data Products and Software Tools (Northern Arizona University) 2019 (scheduled)
- Studying Biological Impacts of Environmental Change Using Repeat Photography: Introduction to PhenoCam Data Products and Software Tools (AGU Fall Meeting) 2018
- Studying Biological Impacts of Environmental Change Using Repeat Photography: Introduction to PhenoCam Data Products and Software Tools (Northern Arizona University) 2018
- Source Control and Reprdocible Science (workshop for postdocs and graduate students, Northern Arizona University) 2018

Certificate in College Teaching (CCT), Duke University 2017

- Training on "Fundamentals of College Teaching"
- Training on "College Teaching and Visual Communications"
- Teaching Experience
- Peer Observation of Teaching

Instructor, Duke University

- Ecohydrology using Mathematica and MATLAB (5 PhD students, teaching, holding office hours) 2016

Guest Lecturer, Duke University

- Environmental Science and Policy (main course taught by Dr. Joel Meyer) 2017
- Ecohydrology (main course taught by Dr. Amilcare Porporato) 2016
- Watershed Hydrology (main course taught by Dr. Gaby Katul) 2014
- Hydrology Modeling (main course taught by Dr. Mukesh Kumar) 2012,2013

Teaching Assistant, Duke University

- Introduction to Environmental Science and Policy (85 undergraduates, leading discussion groups, grading, holding office hours) 2016
- Ecohydrology (15 undergraduates/graduates, holding office hours) 2015
- California Water Crises (12 graduates, organizing course materials, holding office hours) 2015
- Watershed Hydrology (15 graduates, holding office hours, leading problem solving sessions, grading) 2014
- Hydrology Modeling (4+ graduates, co-teaching, grading, holding office hours) 2012, 2013
- GIS for Water Quantity and Quality Assessment (20+ graduates, leading problem solving sessions, lab assistant, grading, holding office hours) 2012, 2013, 2014

Instructor, Research Institute of Petroleum Industry

- Visual Basic for Applications Programming in Engineering (20 senior engineers, designing the course, teaching, troubleshooting sessions) 2010

Teaching Assistant / Tutor, University of Semnan

- Heat Transfer (20+ undergraduates, leading problem solving sessions) 2003
- Fluid Mechanics (20+ undergraduates, leading problem solving sessions) 2003
- Dynamics and Statics (2 undergraduates, private tutoring) 2002, 2003
- Thermodynamics (3 undergraduates, private tutoring) 2002, 2003

GRANTS, FUNDING AND FELLOWSHIPS

NEON Data Institute Fellowship , National Ecological Observatory Network	2018
Outstanding Accomplishments Fellowship , The Duke University Graduate School Ecosystem response to a changing climate: vulnerability, impact and monitoring, \$22,470	2016 - 2017
The Summer Research Fellowship , The Duke University Graduate School Remotely sensed canopy thermal stress to monitor droughts in near real-time, \$5,500	2016
Bass Online Apprentice Fellowship , Duke University, \$11,235	2016
Bass Instructional Teaching Assistant Fellowship , Duke University, \$11,235	2015
Summer Research Award , Nicholas School of the Environment, Duke University Long term monitoring of leaf out phenology using satellite observation at large scales, \$5,500	2015
Pathfinder Fellowship , The Consortium for the Advancement of Hydrologic Science Inc. (CUAHSI) Role of vegetation density and pattern on net snow cover radiation at the forest floor, \$4,996	2014
NASA Snow School Travel Award , NASA Snow School for Practitioners and Modelers, Fraser, CO	2014
CUAHSI Travel Award , CUAHSI Conference on Hydroinformatics and Modeling, Logan, UT	2013
NSF Travel Award , EarthCube Modeling Workshop for the Geosciences, Boulder, CO	2013

HONORS AND RECOGNITIONS

National Elite , The National Association of Elites (Iran)	2008
1st Departmental Rank , Mechanical Engineering Department, University of Semnan, Iran	2003
34th National Rank , Nationwide (Iran) Entrance Exam for Graduate Study in Mechanical Engineering	2003
56th National Rank , Nationwide (Iran) Entrance Exam for Graduate Study in Aerospace Engineering	2003

SERVICES AND OUTREACH

Editorial Services:

Reviewer: Frontiers in Ecology and the Environment, Remote Sensing of Environment, Remote Sensing, Methods in Ecology and Evolution, Agricultural and Forest Meteorology, Ecosphere, Atmosphere, Climate Research, Soil Earth, Journal of Geophysical Research: Atmospheres, ISPRS International Journal of Geo-Information, Science of the Total Environment, International Journal of Digital Earth, Data, Forests, Asia-Pacific Journal of Chemical Engineering

Editor: Duke Science Review 2016

Chairperson: International Conference on Advances in Mechanical Engineering 2010 (ICAME2010)

Editorial Board: Mechanical Engineering Magazine, Iranian Society of Mechanical Engineers (2004-2007)

Professional Services:

Judge , Virtual Poster Showcase, American Geophysical Union (AGU)	2018
Judge , Outstanding Student Presentation Award, American Geophysical Union, New Orleans, LA	2017
VIP Consultant in Modeling , American Statistical Association, DataFest Competition, Durham, NC	2016
Statistician , United Nations Human Settlements Programme, UN-Habitat	2016 - 2017
Competition Judge , Student Academy of Science, State Science and Engineering Fair, Raleigh, NC	2016
Competition Judge , Student Academy of Science, Reg. Science and Engineering Fair, Durham, NC	2015
Collaborator , Working group on "Ecology: Multivariate Models, Climate and Biodiversity", Statistical and Applied Mathematical Sciences Institute (SAMSI)	2014 - 2015
Member of the Diversity & Inclusion Committee , Nicholas School, Duke University	2013 - 2015
Member of the Software Council , Research Institute of Petroleum Industry, Iran	2010 - 2011
Member of the Undergraduate Scientific Committee , University of Semnan, Iran	2000 - 2001

SKILLS

Programming and Scripting:

C/C++/C#, R, R-Shiny, Python, Markdown, MATLAB, Mathematica, Java, VBA, Fortran, Pascal, Batch Script, Object Oriented Programming (OOP), High Performance Computing (HPC), Multithreaded Programming, OpenMP and MPI, Socket programming, HTML/CSS, \LaTeX , make, programming in Unix and Windows based platforms.

Quantitative, Geospatial and Visualizations:

GIS, Geospatial Analysis, Remote Sensing, Data Elevation Model (DEM) Processing, Machine Learning, Image Processing, Optimization, Numerical Methods, Hierarchical Modeling, Bayesian Statistics, Markov Chain Monte Carlo (MCMC), Finite Difference Methods, Finite Element Methods, Finite Volume Methods.