

# Ilya Mishev

## CURRICULUM VITAE

### Address:

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### Education

- Ph.D. **Texas A & M University**, Mathematics, 1996,  
specialization in Numerical Analysis and Scientific Computing.  
Ph.D. Advisor: Raytcho Lazarov, GPA 4.0
- M.S. **Sofia University**, Bulgaria, Mathematics, 1984,  
specialization in Mathematical Modeling, GPA 3.75

### Research Interests

Numerical analysis and Scientific Computing,  
Numerical solution of PDEs (Discretizations and efficient linear solvers), Large scale parallel scientific computing, Modeling and simulation of fluid flows in porous media.

### Professional Experience

2000-2020 **ExxonMobil Corp, Upstream Research Company**, Houston,  
engineering associate in Reservoir Simulation Development section  
conducting research and working on the development of the proprietary  
state-of-the-art reservoir simulators:

- **Linear solvers:**

Developed several new parallel preconditioners,  
Coordinated linear solver research program and collaboration for  
ExxonMobil (Lawrence Livermore National Laboratory (LLNL),  
University of Houston, Institute of Comp. Math.(Novosibirsk),  
NeurOk TechSoft(Atlanta)).  
Results implemented in the simulator and published in SPE papers

- **Discretizations:**

Research on new discretizations published in several papers in  
academic journals  
Collaboration with outside groups (Swansea University, Rice U. ,  
U. of Houston, LLNL, Institute of Numerical Mathematics(Moscow))

- **Simulator development:**

Implemented new features: tracer flow, flexible timestepping, etc.

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### Professional Experience (cont.)

- 1997–1999 **Mobil Oil Corp, Mobil E & P Technical Center**, Dallas, staff engineer in Reservoir Engineering group working on the development of the proprietary state-of-the-art reservoir simulator:
- Designed, and implemented several new discretizations.
  - Communicated with vendor providers of linear solvers (GeoQuest and Landmark). Implemented the interface to the solvers.
- 1996–1997 **Duke University**, Durham, research associate working on the project “High Resolution 3D Simulation for Surfactant Enhanced Aquifer Remediation” funded by the Army Research Office.
- 1992–1996 **Texas A & M University**, graduate student at the Department of Mathematics
- 1992–1996 **Institute for Scientific Computation**, research assistant responsible for the development of the model and code concerning the saturation equation in **GCT** project funded by DOE (Grand Challenge Problems in Environmental Modeling and Remediation: Groundwater Contaminant Transport (**GCT**))
- July 1994, 1995 **Brookhaven National Laboratory**, internship on modeling of groundwater flow for **GCT** project (under supervision of J.E. Pasciak)
- 1992(March–Aug.) **University of California at Los Angeles**, visiting scholar on the project “Multilevel preconditioners on massively parallel computers” (with T.F. Chan and P.S. Vassilevski)

### Teaching Experience

- 2000–2020 **ExxonMobil**, mentored two postdoctoral associates and three summer intern students, invited lectures at student seminars: Rice University and Penn State University. Helped colleagues in academia with student projects / competitions.
- 1996–1997 **Duke University**, taught one undergraduate class and received excellent evaluation
- 1992–1996 **Texas A&M University**, teaching assistant

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| 1989–1991 | <b>Sofia University, Bulgaria</b> , taught undergraduate classes in Numerical Analysis                             |
| 1986–1988 | <b>Technical University of Sofia, Bulgaria</b> , taught all basic lower division undergraduate mathematics classes |

## Service

Reviewer of NSF proposal and articles submitted to journals,  
 Organizer of three minisymposiums at the SIAM Conferences on “Mathematical and Computational Issues in the Geosciences”, minisymposium at IMACS Conference on Iterative Methods  
 Member of the organizing committee of SPE Forum ”Reservoir Simulation - Beyond Tomorrow”  
 Invited at IMA “Hot Topics” workshop Compatible Spatial Discretizations for Partial Differential Equations, May 11–15, 2004.  
 Chaired a session at SPE Reservoir Simulation Symposium.

## Professional Organizations

Society for Industrial and Applied Mathematics (**SIAM**)  
 Society of Petroleum Engineers (**SPE**)

## Patents

1. A. Usadi, and I. Mishev. *Parallel Adaptive Data Partitioning on a Reservoir Simulation Using an Unstructured Grid*. US20100217574 A1.
2. I. Mishev, S. Nepomnyashchikh, and A. Matsokin. *Self-Adapting Iterative Solver*. US2009505292A.
3. A. Usadi, N. Federova, S. Terekhov, O. Diyankov, B. Beckner, M. Ray, and I. Mishev. *Simulation System and Method*. US20100082142 A1.
4. I. Mishev, L. Jiang, and O. Dubois. *Method and System for Finite Volume Simulation of Flow*. US9134454 B2.

## Publications

1. I. Mishev. A Finite volume method for singularly perturbed problems. In *Proc. of XVII National Summer School, Applications of mathematics in techniques*, 149–152, Varna, Bulgaria, 1992.
2. I. Mishev. Some error estimates for convection–diffusion problems. *Comptes rendus de l’Académie Bulgare des Sciences*, 45:117–20,1992.

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### Publications (cont.)

3. I. Mishev, V. Austel, T. F. Chan, and P. S. Vassilevski. Experiments with Algebraic Multilevel Preconditioners on Connection Machine. *CAM Report 93–25*, UCLA, 1993.
4. R. D. Lazarov, I. Mishev, and P. S. Vassilevski. Finite Volume Methods with Local Refinement for Convection-Diffusion Problems. *Computing*, 53:33–57.
5. I. Mishev. Preconditioning cell-centered finite difference equations on grids with local refinement. In *Domain Decomposition Methods*, D.E. Keyes and J. Xu, eds, 283–288.
6. R. D. Lazarov, I. Mishev, and P. S. Vassilevski. Finite Volume Methods for Convection-Diffusion Problems. *SIAM J. Num. Anal.*, n. 1, v. 33:31–55, 1996.
7. I. Mishev. *Finite Volume and Finite Volume Element Methods for Nonsymmetric Problems*. Dissertation, Texas A&M University, 1996.
8. R. D. Lazarov and I. Mishev. Finite Volume Methods for Reaction-Diffusion Problems. In *Finite Volumes for Complex Applications*, ed. F. Benkhaldoun and R. Vilsmeier, 1996.
9. I. Mishev. Finite Volume Methods on Voronoi meshes. *Numer. methods Partial Differential Eq.*, v. 14:193–212, 1998.
10. I. Mishev. Finite Volume Element Methods for Nonsymmetric Problems. *Numerische Mathematik*, v. 83:161–175, 1999.
11. I. Mishev. Nonconforming Finite Volume Methods. *Computational Geosciences*, 6:253–268, 2002.
12. I. Mishev. A New Mixed Finite Finite Volume Method. In *Finite Volumes for Complex Applications III*, 235–242, ed. R. Herbin and D. Kroner, 2002.
13. I. Mishev. Analysis of a new Mixed Finite Volume Method. *Computational Methods in Applied Math.*, 3 (2003), 1–14.
14. I. Mishev and Q.-Y. Chen. A mixed finite volume method for elliptic problems. *Numer. methods Partial Differential Eq.*, v. 23:1122–1138, 2007.
15. V. Diyankov, S. Koshelev, S. Kotegov, I. Krasnogorov, N. Kuznetsova, V. Pravilnikov, B. Beckner, S. Maliassov, I. Mishev, and A. Usadi. SparSol: sparse linear systems solver. *Russian Journal of Numerical Analysis and Mathematical Modeling*, 22:325–340, 2007.

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### Publications (cont.)

16. A. Usadi, I. Mishev, J. Shaw, and K. Wiegand. Parallelization on unstructured grids. In *SPE Reservoir Simulation Symposium*, 2007.
17. I. Mishev, N. Federova, S. Terekhov, B. Beckner, A. Usadi, M. Ray, and O. Diyankov. Adaptive control for solver performance optimization in reservoir simulation. In *ECMOR XI*, Bergen, 2008
18. P.Lu, J. Shaw, T. Eccles, I. Mishev, A. Usadi, and B. Beckner. Adaptive parallel reservoir simulation. In *IPTC*, 2008.
19. I. Mishev, B. Beckner, N. Fedorova, and S. Terekhov. Linear solver performance optimization in reservoir simulation studies. In *SPE Reservoir Simulation Symposium*, 2009.
20. O. Dubois, I. Mishev, and L. Zikatanov. Energy minimizing bases for efficient multiscale modeling and linear solvers in reservoir simulation. In *SPE Reservoir Simulation Symposium*, 2009.
21. P. Lu, J. Shaw, T. Eccles, I. Mishev, and B. Beckner. Experience with numerical stability, formulation, and parallel efficiency of adaptive implicit methods. In *SPE Reservoir Simulation Symposium*, 2009.
22. I. Christov, I. Mishev, and B. Popov. Finite volume methods on unstructured Voronoi meshes for hyperbolic conservation laws. In *HYP2008 - The 12th International Conference on Hyperbolic Problems*, 2009.
23. Y. Efendiev, L. Jiang, and I. Mishev. Multiscale finite element methods using partial upscaling. *Computational Geosciences*, 14 (2010), 319-341.
24. L. Jiang, I. Mishev, and Y. Li. Stochastic mixed multiscale finite element methods and their applications in random porous media. *Computer Methods in Applied Mechanics and Engineering*, 199 (2010), 2721-2740.
25. I. Mishev and L. Jiang. Mixed multiscale finite volume method for reservoir simulation in porous media with non local features. In *SPE Reservoir Simulation Symposium*, 2011.
26. B. Riviere, P. Chidyagwai, and I. Mishev. On the coupling of finite volume and discontinuous Galerkin for reservoir simulation problems. In *SPE Reservoir Simulation Symposium*, 2011.

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### Publications (cont.)

27. I. Mishev, J. Shaw, and P. Lu. Numerical Experiments with AMG Solver in Reservoir Simulation. In *SPE Reservoir Simulation Symposium*, 2011.
28. P. Chidyagwai, I. Mishev, and B. Riviere. On the coupling of finite volume and discontinuous Galerkin method for elliptic problems. *Journal of Computational and Applied Mathematics*, 231 p. 2193-2204, 2011.
29. L. Jiang and I. Mishev. A mixed multiscale finite volume method for elliptic problems in two-phase flow simulations. *Commun. Comput. Phys.*, 11 (2012), 19-47.
30. V. Pravilnikov, O. Diyankov, S. Diyankova, B. Beckner, and I. Mishev. An Efficient Multicore Linear Solver for Reservoir Simulation Applications. In *SPE Reservoir Simulation Symposium*, 2013.
31. A. T. Barker, D. Z. Kalchev, I. Mishev, P. Vassilevski, and Y. Yang. Accurate Coarse-Scale AMG-Based Finite Volume Reservoir Simulations in Highly Heterogeneous Media. In *SPE Reservoir Simulation Symposium*, 2015.
32. L. Wang, D. Osei-Kuffuor, R. Falgout, I. Mishev, and J. Li. Multigrid Reduction for Coupled Flow Problems with Application to reservoir Simulation. In *SPE Reservoir Simulation Conference*, 2017. /
33. I. Mishev and R. Rin. Grid Quality measures for PEBI grids. In *SPE Reservoir Simulation Conference*, 2021, *accepted*.

### Technical Expertise

C, C++, Python on UNIX, LINUX, WINDOWS

Work in 15+ member team using version control software

Experience with parallel computers (threads, MPI)