Curriculum Vitae

1. PERSONAL

Sorin Mitran
Professor
Department of Mathematics, University of North Carolina
Campus Box 3250, Chapel Hill, NC, 27599-3250
Tel.: 919-843-8901 Email: mitran@unc.edu   WWW: mitran-lab.amath.unc.edu

2. EDUCATION

1995, Dr.Eng. Politehnica University Bucharest, Romania. Thesis: *The interaction of instability waves with turbulent flow with application to supersonic jet noise*, adviser: Corneliu Berbente.

1985, Aero.Eng.[1], Politehnica University Bucharest, Romania. Thesis: *Heat transfer in turbine blades using the electrical analogy and finite element methods*, adviser: Victor Pimsner.

3. PROFESSIONAL EXPERIENCE

2013 – present, *Professor*, Department of Mathematics, University of North Carolina, Chapel Hill.

2008 – 2013, *Associate Professor (tenured)*, Department of Mathematics, University of North Carolina, Chapel Hill. (Multiscale computation with applications in viscoelastic flow, lung physiology, polymer photovoltaic cells, lithotripsy)

2002 – 2008, *Assistant Professor*, Department of Mathematics, University of North Carolina, Chapel Hill. (Computational methods in astrophysics, geophysics, lung physiology)

1999 – 2002, *Research Associate*, Department of Applied Mathematics, University of Washington, Seattle, WA. (Adaptive mesh refinement for hyperbolic partial differential equations)

1998 – 1999, *Guest Scientist*, Forschungszentrum Karlsruhe, Institut für Reaktorsicherheit, Karlsruhe, Germany. (Modeling of bubbly flow)

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1   The Aero.Eng. degree comprised a five-year program of study and thesis defense equivalent to U.S. Master's degree.

1995 – 1998, *Lecturer*, Department of Aerospace Engineering, Politehnica University Bucharest, Romania. (Gas dynamics, aeroengine design, numerical methods)

1993, *Visiting Researcher*, Department of Aerospace Engineering, University of Tokyo, Japan. (Computational fluid dynamics, jet stability)

1989 – 1995, *Assistant*, Department of Aerospace Engineering, Politehnica University Bucharest, Romania. (Jet engine design)

1986 – 1989, *Propulsion research engineer.* Politehnica University Bucharest, Romania. (Modeling of combustion processes)

1986, *System engineer*, INCREST - The Institute for Scientific Research and Technological Development for Aviation, Bucharest, Romania. (CAD/CAM module development, Ansys, CD-2000)

1985 – 1986, *Engineer*, Bucharest Aircraft Factory, Bucharest, Romania. (Computer Numerical Control machine programming of aerospace parts, 5-axis, Aerospatiale Puma Helicopter blade, British Aerospace BAC 1-11 wing)
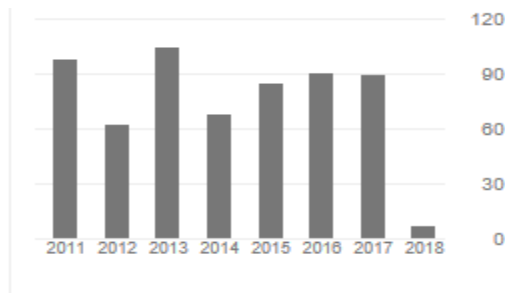
4. HONORS

2010, UNC Kenan Senior Faculty Research and Scholarly Leave

5. BIBLIOGRAPHY[2]

Citation indices

	All	Since 2013
Citations	946	442
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Books and chapters

[B9] <u>S. Mitran</u>, J. Young, "Multiscale Computation of Cytoskeletal Mechanics During Blebbing", pp. 346-371, *Cellular and Biomolecular Mechanics and Mechanobiology,* Springer Book Series: Studies in Mechanobiology Tissue Engineering and Biomaterials Volume: 4, 2011.

[B8] A. Bogoi, <u>S. Mitran</u>, C. Berbente, *Metode numerice – Elemente de teorie, aplicatii si programe de calcul in FORTRAN*, (Numerical methods – Elements of theory, aplications and computational programs in FORTRAN), Bren Publishing House, Bucharest, 2007, 191pp. (in Romanian)

[B7] J. Sewall, P. Mecklenburg, <u>S. Mitran</u>, M. Lin, "Fast Fluid Simulation Using Residual Distribution Schemes", *3rd Eurographics Workshop on Natural Phenomena*, EG Publishing, pp. 47-54, 2007.

[B6] A.Y. Poludnenko, A. Frank, <u>S. Mitran</u>, P. Varnière, A. Cunningham, "AstroBEAR: Astrophysical Fluid and Magnetofluid Dynamics with BEARCLAW", pp.331-340 *Chicago Workshop on Adaptive Mesh Refinement Methods,* Vol. 41 Lecture Notes in Computational Science and Engineering, Springer, 2005.

[B5] A.Y. Poludnenko, A. Frank, <u>S. Mitran</u>, "Clumpy Flows in Protoplanetary and Planetary Nebulae", pp. 434-437, in *Asymmetric Planetary Nebulae III*, eds. M. Meixner, J. Kastner, N. Soker and B. Balick, 2003, ASP Conference Series, CS-313.

[B4] <u>S. Mitran</u>, "A Comparison of Adaptive Mesh Refinement Approaches for Large Eddy Simulation", pp.397-408, *DNS/LES Progress and Challenges*, Third AFOSR International Conference, C. Liu, L. Sakell, T. Beutner, (eds.), Greyden Press, Columbus, Ohio, 2001.

[B3] <u>S. Mitran</u>, *Closure Models for the Computation of Dilute Bubbly Flows*, 121 pages, Forschungszentrum Karlsruhe, Wissenschaftliche Berichte, FZKA 6357, 2000.

[B2] C. Berbente, <u>S. Mitran</u>, S. Zancu, *Metode Numerice (Numerical Methods)*, Editura Tehnica, 1997. 304 pages. (in Romanian)

[B1] C. Berbente, S. Zancu, O. Pleter, C. Tataranu, <u>S. Mitran</u>, *Metode numerice cu aplicatii in ingineria aeronautica* (*Numerical Methods with application to aeronautical engineering*), Bucharest Politehnica Press, 1986, (Revised and enlarged second edition, 1992) (in Romanian)

Refereed journal papers

[P41] Nault, I, Mitran, S, "Modeling high strain-impacts using Eulerian hyper-elastoplasticity with Johnson-Cook Constitutive law", Intl. J. Plasticity (submitted, 2018, 46p)

[P40] Malahe, M, Mitran, S, "Hybrid Krylov-Random Walk Algorithms for Solving Discretized Elliptic Partial Differential Equations on CPU-GPU architectures", SIAM J. Sci. Comp., (submitted, 2017, 15p).

[P39] Fovargue, D, Mitran, S, Sankin, G, Zhang, Y, Zhong, P, "An experimentally-calibrated damage mechanics model for stone fracture in shock wave lithotripsy", Int. J. Fracture, (accepted, Feb, 2018), 33p.

[P37] Feng, Y, Mitran, S, "Data-driven reduced-order model of microtubule mechanics", Cytoskeleton, Nov. 30, 2017, 16p., DOI: 10.1002/cm.21419

[P36] Zhang, Y, Nault, I, Mitran, S, Iversen ES, Zhong, P, "Effects of stone size on the comminution process and efficiency in shock wave lithotripsy", Ultrasound in Med. & Bio., 42(11):2662-2675, 2016.

[P35] Zdanski, C, Davis, S, Hong, Y, Miao, D, Quammen, C, Mitran, S, Niethammer, M, Kimbell J, Pitkin, E, Fine, J, Fordham, L, Vaughn, B, Superfine, R, "Quantitative Assessment of the Upper Airway in Infants and Children with Subglottic Stenosis", Laryngoscope 126(5):1225-1231, 2016

[P34] Moot, T, Palin, C, Mitran, S, Cahoon, JF, Lopez, R, "Designing plasmon-enhanced thermochromic films using a vanadium dioxide nanoparticle elastomeric composite", Adv. Opt. Materials, 4(4):578-583, 2016.

[P33] Quammen C, Taylor, RM, Krajcevski, P, Mitran, S, Enquobahrie, A, Superfine, R, Davis, B, Davis, S, Zdanski, C, "The virtual pediatric airways workbench", Medicine Meets Virtual Reality 220:295-300, 2016, DOI: 10.3233/978-1-61499-625-5-295.

[P32] Bu, R., Price, H., Mitran, S., Zdanski, C, Oldenburg, AL, "Swept-source anatomic coherence elastography of porcine trachea", Photonic Therapeutics and Diagnostics XII (16p), DOI:10.1117/12.2213186

[P31] Herschlag, G., Mitran, S, Lin, G, " A consistent hierarchy of generalized kinetic equation approximations to the master equation applied to surface catalysis", J. Chem. Phys. 142(23):A234703 (14p), 2015

[P30] A. Neisus, N.B. Smith, G.N. Sankin, N.J. Kuntz, J.F. Madded, D.E. Fovargue, S. Mitran, M.E. Lipkin, W.N. Simmons, G.M. Preminger, P. Zhong,

"Improving the lens design and performance of a contemporary electromagnetic shock wave lithotripter", Proc. Natl. Acad. Sci. 111(13):E1167-E1175, 2014.

[P29] Liu, YC, Tippets, CA, Kirsch, C, Mitran, S, Samulski, ET, Lopez, R, "Balance between light trapping and charge carrier collection: Electro-photonic optimization of organic photovoltaics with ridge-patterned back electrodes", *J. Appl. Phys.* 113(24):244503, 2013.

[**P28**] S. Mitran, Lattice Fokker-Planck Method Based on Wasserstein Gradient Flows (submitted, Phys. Rev.), 2012.

[P27] Y. Liu, C. Kirsch, A. Gadisa, M. Aryal, S. Mitran, E.T. Samulski, R. Lopez, "Effects of nano-patterned versus simple flat active layers in upright organic photovoltaic devices", *J. Phys. D*. 46(2):024008, 2013.

[P26] D.E. Fovargue, S. Mitran, N.B. Smith, G.N. Sankin, W.N. Simmons, P. Zhong, "Experimentally validated multiphysics computational model of focusing and shock wave formation in an electromagnetic lithotripter", *J. Ac. Soc. Am.*,, 134(2):1598-1609, 2013.

[P25] S. Mitran, "Continuum-kinetic-microscopic model of lung core-annular fluid clearance", invited contribution to *J. Comp. Phys.* Special issue on Multi-scale Modeling and Simulation of Biological Systems, 244:193-211, 2013.

[P24] C. Kirsch, S. Mitran, "Simulated annealing electro-photonic optimization of organic solar cells", *J. Appl. Phys.*, 112:054502, 2012.

[P23] B. Kallemov, G.H. Miller, S. Mitran, D. Trebotich, "Calculation of viscoelastic bead–rod flow mediated by a homogenised kinetic scale with holonomic constraints", *Molecular Simulation*, 38(10):786-792, 2012.

[P22] B.S. Lindley, M.G. Forest, B.D. Smith, S. Mitran, D.B. Hill, "Spatial stress and strain distributions of viscoelastic layers in oscillatory shear", *Mathematics and Computers in Simulation*, 82(7):1249-1257, 2012

[P21] J.D. Young, S. Mitran, "A Continuum-Microscopic Algorithm for Modeling Fibrous, Heterogeneous Media with Dynamic Microstructures", *SIAM Multiscale Modeling and Simulation*, 9:241-256, 2011.

[P20] S. Mitran, "Time parallel kinetic-molecular interaction algorithm for CPU/GPU computers", *Proc. Comp. Sci.* 1:745-752, 2010.

[P19] J.D. Young, S. Mitran, "A Numerical Model of Cellular Blebbing. A Volume-Conserving, Fluid-Structure Interaction Model of the Entire Cell", *J. Biomechanics*, 43:210-220, 2010.

[P18] T.J. Dennis, A. Frank, E.G. Blackman, O. DeMarco, B. Balick, S. Mitran, "Magnetic Nested-Wind Scenarios for Bipolar Outflows: Preplanetary and YSO Nebular Shaping", *Astrophys. J.*, 707(2):1485-1494, 2009.

[P17] A.J. Cunningham, A. Frank, P. Varniere, S. Mitran, T.W. Jones, "Simulating Magnetohydrodynamical Flow With Constrained Transport and Adaptive Mesh Refinement: Algorithms And Tests Of The Astrobear Code", *Astrophys. J. Suppl. Series,* 182(2):519-542, 2009.

[P16] K. Yirak, A. Frank, A.J. Cunningham, S. Mitran, "Hypersonic Buckshot: Astrophysical Jets As Heterogeneous Collimated Plasmoids", *Astrophys. J.*, 695(2):999-1005, 2009.

[P15] B. Lindley, E.L. Howell, B.D. Smith, G.J. Rubinstein, M.G. Forest, S. Mitran, D.B. Hill, R. Superfine, "Stress communication and filtering of viscoelastic layers in oscillatory shear", *J. Non-Newtonian Fluid Mechanics*, 156(1-2):112-120, 2009.

[P14] A. Scotti, S. Mitran, "An approximated method for the solution of elliptic problems in thin domains: Application to nonlinear internal waves ", *Ocean Modelling*, 25(3-4):144-153, 2008.

[P13] T.J. Dennis, A. Cunningham, A. Frank, B. Balick, E. Blackman, S. Mitran, "Proto-planetary nebulae as Explosions: Bullets vs Jets and Nebular Shaping", *Astrophys. J.* 679(2):1327-1337, 2008.

[P12] S. Mitran, G. Forest, L. Yao, B. Lindley, D.B. Hill, "Extensions of the Ferry shear wave model for active linear and nonlinear microrheology", *J. Non-Newtonian Fluid Mechanics*, 154(2-3):120-135, 2008.

[P11] L.E. McNeil, S. Mitran, "Vibrational Frequencies and Tuning of the African Mbira", *J. Ac. Soc. Am.* 123(1):1169-1178, 2008.

[P10] K. Yirak, A. Frank, A. Cunningham, S. Mitran, S. Hartmann, "The Interaction Between a Pulsed Astrophysical Jet and Small-Scale Heterogeneous Media", *Astrophys. J.*, 672(2):996-1005, 2008.

[P9] S. Mitran, "Computational model of mucociliary clearance - Relevance to therapy", *Pediatric Pulmonology*, Supplement 30: 111-112, 2007.

[P8] S. Mitran, "Metachronal wave formation in a model of pulmonary cilia", *Computers & Structures* 85(11-14):763-774, 2007.

[P7] A. Cunningham, A. Frank, P. Varniere, A. Poludnenko, S. Mitran, L. Hartmann, "Evolution and fragmentation of wide-angle wind driven molecular

outflows", *Astrophysics and Space Science* 298(1-2):317-322, 2005.

[P6] A.Y. Poludnenko, A. Frank, S. Mitran, "Strings in the Eta Carinae Nebula: Hypersonic Radiative Cosmic Bullets", *Astrophys. J.*, 613(1):387-392, 2004.

[P5] A.Y. Poludnenko, K.K. Dannenberg, R.P. Drake, A. Frank, J. Knauer, D.D. Meyerhofer, M. Furnish, J. R. Asay, S. Mitran, "A laboratory investigation of supersonic clumpy flows: Experimental design and theoretical analysis", *Astrophys. J.*, 604 (1): 213-221, 2004.

[P4] D.S. Bale, R.J. LeVeque, S. Mitran, J.A. Rossmanith, "A wave propagation method for conservation laws and balance laws with spatially varying flux functions", *SIAM J. Sci. Comp.,* 24(3):955-978, 2002.

[P3] L. Palese, A. Georgescu, S. Mitran, "Neutral curves for the MHD Sorret-Dufour driven convection", *Rev. Roumaine Sci. Tech., Mecanique Appliquee,* 45(3):265-276, 2000.

[P2] S. Mitran, "A boundary layer solution of the axisymmetric jet instability problem. I. Isothermal, incompressible jets", *Rev. Roumaine Sci. Tech., Mecanique Appliquee,* 41(5-6):359-380,1995.

[P1] C. Berbente, S. Mitran, S. Zancu, "Inviscid Incompressible Flow Around Inlets", *Revue Roumaine des Sciences Techniques, Serie de Mecanique Applique*, 38(6):571-585, 1993.

Refereed conference papers

[C12] S. Mitran, A.J. Hickey, J.T. Holt, "Multilinear calibration of lattice Boltzmann pMDI spray simulation", Proceedings, 2014 Respiratory Drug Delivery Conf., 6 pp, May, 2014.

[C11] C.A. Fromen, T.W. Shen, P. Mack, A. Garcia, S. Mitran, M.E. Napier, B.W. Maynor, J.M. DeSimone, "Fabrication and characterization of engineered particles for respiratory drug delivery", J. Aerosol Med. & Pulmonary Drug Delivery, 26(4):A246, 2013.

[C10] S. Mitran, "Predictive Modeling of Upper Airway Flow in Young Children", Proceedings 34th Annual International Conference of the IEEE Engineering in Medicine & Biology Society, Aug. 2012.

[C9] D. Fovargue, S. Mitran, G. Sankin, N. Smith, P. Zhong, Experimentally Validated Multiphysics Computational Model of Refracting Shock Wave Lithotripter, 4 pages, 27th Southern Biomedical Engineering Conference, April 30, 2011, Arlington, TX.

[C8] C. Berbente, S. Mitran, S.Danaila, M. Stoia-Djeska, "The Vortex-Profile

Interaction Considering Porosity Effects", *Workshop on Vortex Dominated Flows, Achievements and Open Problems* , June 10 - 11, 2005 , Timisoara, Romania.

[C7] <u>S. Mitran</u>, "Direct Numerical Simulation of a Model of Turbulent Bubbly Flow", AIAA Paper 2001-2908, *31st AIAA Fluid Dynamics Conference and Exhibit*, June 11-14, 2001, Anaheim, CA, 6pp.

[C6] <u>S. Mitran</u>, "A Sub-Grid_Scale Turbulence Model for Dilute Bubbly Flow", *Proceedings of the Fourth International Conference on Multiphase Flow*, ICMF-2001, May 27-June 1, 2001, New Orleans, 9pp.

[C5] <u>S. Mitran</u>, P.G. Cizmas, "LES Calibration of a Turbulent Potential Model for Turbomachinery Flows", AIAA Paper 2000-3203, *36th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, July 16-19, 2000, The Von Braun Center, Huntsville, AL. pp.1-6.

[C4] C. Berbente, <u>S. Mitran</u>, "Large-Eddy Simulation of Unsteady Rotor Aerodynamics and Acoustic Emissions", *9th European Rotorcraft Forum*, October 13-15, 1999, Rome, 10pp.

[C3] <u>S. Mitran</u>, C. Safta, "A Computer Aided Education Course in Aeroengine Design", AIAA Paper 97-3280, *33rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, July 6-9, 1997, Seattle, WA. pp.1-6.

[C2] <u>S. Mitran</u>, D. Caraeni, "Large Eddy Simulation of Unsteady Rotor-Stator Interaction in a Centrifugal Compressor", AIAA Paper 97-3006, *33rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*, July 6-9, 1997, Seattle pp.1-6.

[C1] <u>S. Mitran</u>, "Renormalization Group Analysis of Jet Instability-Turbulence Interaction", Proceedings - *First Joint CEAS/AIAA Aeroacoustics Conference*, June 12-15, 1995, Munchen, pp. 1015-1022.

Refereed unpublished oral presentations and/or abstracts

<u>S. Mitran</u>, "Computational Model of Mucociliary Clearance - Relevance to Therapy", *2007 North American Cystic Fibrosis Conference,* Anaheim, CA, Oct. 2007.

<u>S. Mitran</u>, "Models of mucociliary clearance I: fluid-structure interactions", *Gordon Research Conference on Cilia, Mucus & Mucociliary Interactions*, Feb. 2007, Ventura, CA.

Other unrefereed works

R. J. LeVeque and S. Mitran, "Wave-Propagation Methods and Software for Complex Applications", *Third International Symposium on Finite Volumes for Complex Applications,* Porquerolles, France, June 2002, 12 pp.

C. Berbente, S. Mitran, D. Moroianu, "Models of fluctuation distribution for the Euler equations", *Aero 99*, July 6-9, 1999, Bucharest, 14pp.

C. Berbente, S. Mitran, "A viscid-inviscid interaction approach to axisymmetric bubble dynamics", Forschungszentrum Karlsruhe, Interner Bericht, IRS Nr. 12/97, PSF Nr. 3265, 73pages.

S. Mitran, "Contributions to the study of noise emitted by unstable jets", Acoustics Conference of the Romanian Academy, 18-19 October, 1994, Cahier 24, pp. 41-45, Bucharest.

C. Berbente, O. Pleter, I. Andrei, S. Mitran, "Computer aided education for aeronautical engineering", *Proc. of the CAE 93 Conference*, Bucharest, Romania, 1993.

C. Berbente, S. Mitran, S. Zancu, "A boundary element model of inlet flow", *Proc. of the 1993 International Conference on Boundary Elements*, Sibiu, Romania, 1993, pp.1-9.

S. Mitran, "Discrete molecular-kinetics modeling of the Navier-Stokes Equations", *Symposium on Modeling in Science and Technology*, Politehnica University, Bucharest, 1989, (in Romanian).

S. Mitran, "Discrete vortex simulations of several configurations of aeronautical engineering interest", *Symposium on Modeling in Science and Technology*, Politehnica University, Bucharest, 1989, (in Romanian).

C. Berbente, S. Mitran, "Research on optimal propellers for high speed aircraft", *Proc. of the INCREST AVIA 88 Conference*, Bucharest, Romania, 1988, (in Romanian).

S. Mitran, "Anemometry based upon the Mossbauer effect", Proc. of the Politehnica SIM 87 Conference on Internal Combustion Engines, 1987, (in Romanian).

V. Pimsner, S. Mitran, "The electrical analogy of heat transfer as applied to turbine blades", Proc. of the Politehnica SIM 87 Conference on Internal Combustion Engines, 1987, (in Romanian).

Invited presentations (past five years)

"Sensitivity of cilia-induced transport to fluid rheology, axoneme structure, and dynein forcing", Workshop on Mathematical and Computational Challenges in Cilia- and Flagella-Induced Fluid Dynamics, Mathematical Biosciences Institute, Columbus OH, Oct. 17, 2012

"Kinetic Adaptive Information Measure Closures of Continuum Equations", Numerical Analysis Seminar, University of Maryland October 2, 2012.

"Cytoskeleton multiscale model", Mathematical Biology Seminar, Duke University, Sep. 2, 2011.

"tP-CKM: Time-parallel continuum-kinetic-microscopic computation of non-equilibrated phenomena ", DOE Applied Mathematics Program Meeting, October 17, 2011, Reston, VA and AMS von Neumann Symposium, Snowbird, UT, July 5, 2011.

"Archiving Computational Research in Virtual Machines", Interface 2011 Symposium, SAS, Cary, NC, June 1, 2011.

"Combining deterministic and stochastic PDE solution algorithms for heterogeneous CPU/GPU computers", Applied Mathematics Seminar, University of Washington, Seattle, WA, May 25, 2011

"tP-CKM: Bayesian continuum closure evaluation from stochastic microdynamics", Multiscale Stochastic Dynamics Workshop, Banff, Canada, March 31, 2011.

"A time-parallel multiscale algorithm for non-equilibrated microscopic phenomena", Seminaire du Laboratoire Jacques-Louis Lions Paris 6, France, Oct. 4, 2010.

"Multiscale computation of phenomena away from microscopic equilibrium", Workshop on Current Themes in Applied Mathematics, Diaspora 2010 Meeting, Bucharest, Romania, Sep. 2010.

"A time-Parallel Continuum-Kinetic-Molecular interaction algorithm for nonequilibrium phenomena: tP-CKM", Stanford, CA, July 20, 2010.

"Kinetic-molecular interaction computation of long-chain polymer flow", SIAM Annual Meeting, Pittsburgh, PA, July 15, 2010.

"A time-parallel continuum-kinetic-molecular interaction algorithm for nonequilibrium phenomena: tP-CKM", Seminaire de Calcul Scientifique du

CERMICS Champs-sur-Marne, France, May 28, 2010.

"Computational Investigations of the Human Lung", Mathematics Colloquium, University of South Carolina, Columbia, SC, Mar. 2010.

"Self-organization in mucociliary flow", 24th Shanks Conference on *Mathematical Modeling in the Medical Sciences*, Vanderbilt University, May 19, 2009.

"Adaptive Mesh Refinement Computation of Turbulent Flows - Pitfalls and Escapes", Astronum 2008, St. John, VI, June 13, 2008.

"Metachronal wave formation in a model of pulmonary cilia", 2008 Carolina Biophysics Meeting, Chapel Hill, NC.

"Modeling of Shock Wave Propagation and Focusing Through an Acoustic Lens", 2008 Research on Calculus Kinetics Meeting, Durham, NC.

"A Double Projection Method for Incompressible Viscoelastic Flow", Applied Mathematics Seminar, University of Washington, Seattle, WA, 11/20/2007, Applied Mathematics and Partial Differential Equations Seminar, University of Wisconsin, Madison, WI, 5/2/2007.

"Magnetohydrodynamics Computations using BEARCLAW", Aeronautics and Astronautics Seminar, University of Washington, Seattle, WA, 11/20/2007.

"UNC Applied Mathematics Research Overview", Faculty of Mathematics, University of Bucharest, Sep., 2007.

Conference contributions *(past five years)*

S. Mitran ,"Predictive Modeling of Upper Airway Flow in Young Children", IEEE Engineering in Medicine and Biology Society Meeting, Aug 2012, San Diego, CA. C. Kirsch, S. Mitran, "Simulated annealing electro-photonic optimization of organic solar cells", Internat. Conf. on Simulat. of Org. Electron. and Photovolt. (SimOEP12), Oliva, Spain, 2012.

S. Mitran ,"When do cilia stop beating?", 2011 AMS Spring Western Sectional Meeting, Las Vegas, NV.

C. Kirsch, S. Mitran, "Simulated annealing electro-photonic optimization of polymer photovoltaic cells", 2nd Internat. Conf. on Comput. Engrg. (ICCE 2011), Darmstadt, Germany, 2011.

C. Kirsch, S. Mitran: Photonics Optimization of Polymer Photovoltaic Cells. 7th

Internat. Congress on Ind. and Appl. Math. (ICIAM 2011), Vancouver, Canada, 2011.

D. Fovargue, <u>S. Mitran</u>, G. Sankin, N. Smith, P. Zhong, "Experimentally validated multiphysics computational model of refracting shock wave lithotripter", ASA Meeting, Seattle, WA, May 2011.

<u>S. Mitran</u>, "Time-parallel Continuum-kinetic-molecular Computation of Polymer Rod Models", SIAM CS&E Conference, Feb., 2011.

<u>S. Mitran,</u> "Kinetic-molecular interaction computation of long-chain polymer flow", SIAM Annual Meeting, Pittsburgh, PA, July 15, 2010.

<u>S. Mitran,</u> "Time-parallel continuum-kinetic-microscopic computation of viscoelastic turbulent flow", SIAM Annual Meeting, Pittsburgh, PA, July 15, 2010.

<u>S. Mitran</u>, "Time-parallel continuum-kinetic-molecular interaction algorithm for CPU/GPU computers: tP-CKM", ICCS 2010, May 31, 2010, Amsterdam, Netherlands.

<u>S. Mitran</u>, "Adaptive mesh refinement for turbulent flow computations", AMS SE Sectional Meeting, Raleigh, NC, April, 2009.

<u>S. Mitran</u>, "Stress communication and filtering in biological layers", XVth International Congress on Rheology, Monterey, CA, Aug. 2008.

<u>S. Mitran</u>, "Two-dimensional turbulence in dilute polymer solutions - computational prediction through a microscopic-continuum interaction approach", 2007 Society of Rheology Meeting, Salt Lake City, UT, Oct. 2007.

<u>S. Mitran</u>, "Metachronal Wave Formation in a Model of Pulmonary Cilia", Fourth MIT Conference on Fluid-Structure Interaction, 6/13/2007.

<u>S. Mitran</u>, "Continuum-Discrete Computation of Viscoelastic Flows", SIAM Computational Science & Engineering Conference, Portland, ME, 2/12/2007.

Patents and inventions

"CITSIM Ion Simulation Software", UNC ROI 12-0136.

Hickey, A., Mitran, S., Smyth, H., "Methods of Acoustic Measurement and Control of Pharmaceutical Sprays", WO/2006/057660, 04.05.2006, PCT/US2005/038698, 26.10.2005, UNC ROI 04-0112.

6. TEACHING RECORD

New courses developed

At University of North Carolina Chapel Hill

Math 006, Colliding Balls and Springs – A historical overview of the development of atomic theory with computer lab experiments
Math 892(215), Continuum-microscopic computational methods – theory and practice of computational methods linking molecular and continuum scales

Courses taught

At University of North Carolina, Chapel Hill

Past three years

Spring 2012, MATH762-001, Numerical ODE and PDE II, 5 students
Fall 2011, MATH566-001, Introduction to Numerical Analysis, 17 students
Spring 2010, MATH762-001, Numerical ODE and PDE II, 5 students
Fall 2009, MATH566-001, Introduction to Numerical Analysis, 18 students

Previous years

Math 381(81), Discrete Mathematics
Math 524(124), Elementary Differential Equations
Math 529(129), Methods of Mathematical Physics II – developed case study approach
Math 547(147), Linear Algebra for Applications
Math 566(166), Introduction to Numerical Analysis
Math 661(191), Scientific Computation I
Math 662(192), Scientific Computation II
Math 761(221), Numerical ODE and PDE I – developed complete online lecture notes, numerical lab work
Math 762(222), Numerical ODE and PDE II – developed online lecture notes

At University of Washington, Seattle

AMATH 301, Beginning Scientific Computing
AMATH 581, Scientific Computing

At Politehnica University, Bucharest

Processes and Characteristics of Aeroengine Design

Gas Dynamics
Numerical Methods
Fluid Mechanics

7. PhD and Master's students supervised

At University of North Carolina at Chapel Hill

Yan Feng, (2012-)
Michael Malahe, (2012-)
Anil Shenoy, (2010-), expected PhD 2013
Gregory Herschlag, (2010-), expected PhD 2013
Dan Fovargue, (2010-), expected PhD 2013
Jennifer Young, (2007-10)
- Masters 2008, Thesis: "Mechanics of a Blebbing Cell"
- PhD 2010, Thesis: "Cytoskeleton Micromechanics: A Continuum-Microscopic Approach"
- First position after PhD: VIGRE postdoctoral fellow, Rice University

Ke Xu, (2007-2009, jointly with G. Forest)
- PhD 2009, "Mathematics of microrheology with applications to pulmonary liquids"
- First position after PhD: postdoctoral fellow, University of North Carolina

Lingxing Yao, (jointly with G. Forest, 2004-2007)
- PhD 2007, "Viscoelasticity at Microscopic and Macroscopic Scales: Characterization and Prediction"
- First position after PhD: postdoctoral fellow, University of Utah

At Politehnica University Bucharest

Radu Serban, Aero.Eng. 1996 (current position: Staff scientist Lawrence-Berkeley)
Dan Negrut, Aero.Eng. 1996 (current position: Assistant Professor, University of Wisconsin)
Cristian Nastase, Aero.Eng. 1995 (current position: Researcher, University of Wyoming)
Cosmin Safta, Aero.Eng. 1995 (current position: Staff scientist Sandia)
Virgil Adumitroaie, Aero Eng. 1993 (current position: Senior technical staff, Jet Propulsion Laboratory)

8. Post-doctoral scholars mentored

Christoph Kirsch, 2010-2012, Polymer photovoltaic cell modeling (current

position: Research staff, University of Applied Sciences, Zurich, Switzerland)
Paula Vasquez, 2010-2012, Multiscale viscoelastic flow
Jude Worthy, 2003-2004, High-order methods for ocean internal gravity waves

9. RESEARCH GRANTS RECEIVED IN PAST FIVE YEARS

NIH (R01-HL105241-01-02), 2010-2015, *Predictive modeling for treatment of upper airway obstruction in young children*, $915,508 (for 2011/12), $1,811,578 (for 2010/11), 10/10-9/14, S. Davis (PI), R. Superfine (PI), C. Zdanski (PI), J. Fine, L. Fordham, J. Kimbell, S. Mitran, M. Muhlebach, A. Oldenburg, G. Retsch-Bogart, R. Taylor. Role on project: development of quasi-interactive mathematical model of airway flow and deformation for use as surgical planning tool; supervise PhD student.

NSF (DMS-0943851), 2010-2015, *RTG Laboratory and mathematical fluid dynamics*, $276,130, R. McLaughlin (PI), D. Adalsteinsson, R. Camassa, G. Forest, T. Hendrick, J. Huang, L. Miller, M. Minion, S. Mitran, P. Mucha, R. Superfine, B. White (08/10-08/15). Role on project: Provide computational modeling guidance to students.

NIH (11-NIH-1002) - Duke Medical Center, 2010-2015, *Innovations in Shock Wave Lithotripsy technology*, $77,128 (for 2012/13), $59,949 (for 2011/12), $93,138 (for 2010/11), S. Mitran. Role on project: Development of mathematical model of shock-induced breakdown of kidney students, implementation of model; supervise PhD student.

NSF (CMMI-1068918), 2011-2014, *Ciliary Mechanics*, R. Superfine (PI), M. Falvo (coPI), S. Mitran (coPI), $465,851, 08/11-08/14. Role on project: Develop mathematical and computational model of cilium axoneme mechanical behavior; supervise PhD student.

DOE (DE-SC0001914), 2009-2012, *Modeling and Algorithmic Approaches to Constitutively-Complex Micro-structured Fluids*, $462,327, 9/09-8/12, G. Forest (PI), S. Mitran (coPI). Role on project: Develop theory for microscopic-continuum interaction for complex, viscoelastic flow.

DoD-ARO (W911NF-10-1-0447), 2010-2012, *Micro Ion Trap Mass Spectrometer Development*, $947,723, 08/10-07/12, M. Ramsey (PI), S. Mitran (PI). Role on project: Develop theory and computational model for behavior of ions in rarefied and atmospheric pressure regime.

ONR (N00014-09-0288), 2010-2012, *Barotropic to baroclinic energy conversion across topographically rough straits*, $67,361, A. Scotti (PI), S. Mitran (coPI). Role on project: Develop algorithms and theory for anisotropic computation of

ocean gravity waves.

NSF (DMR-0934433), 2008-2012, *SOLAR Integrated Electro-Photonic Development of Polymer Solar Cells*, E. Samulski (PI), R. Lopez (coPI), S. Mitran (coPI), 2009-2011, $826177 (for 2009). Role on project: Develop theory and computational model for shape optimization of organic photovoltaic cells; supervise PhD student and postdoc.

NSF (0904990), 2008-2012, *Peta-Flops Acoustic Simulation*, Maocha, D. (PI), Ming, L (coPI), Mitran S. (coPI), Fowler, R. (coPI), $848,503,
NIH, 2007-2012, *Virtual Lung Project,* R. Superfine, lead investigator, ($670,000 per year). Role on project: Develop efficient parallelization approaches for computation of acoustic propagation in large domains.

ONR, 2005-2010, *Large scale dynamics of ocean internal gravity waves,* M. Minion (coPI), S. Mitran (coPI), A. Scotti (PI)($395,000). Role on project: Develop adaptive mesh model of ocean gravity waves.

LLE (Laboratory for Laser Energetics, Rochester, 412781-G), 2005-2008, *BEARCLAW Development*, $130,198, S. Mitran. Role on project: Develop adaptive mesh algorithms for astrophysical flows (gas dynamics, magnetohydrodynamics)

10. SERVICE

To discipline
- Organizer minisymposium on Numerics for Highly Heterogeneous Media, SIAM Computational Science & Engineering Conference, Feb. 2013
- Organizer minisymposium on Computation of materials with dynamic constitutive laws, SIAM Computational Science & Engineering Conference, Feb. 2011
- Organizer minisymposium on Computational Modeling of Multiscale Systems with Dynamic Constitutive Laws, ICIAM 2011, Vancouver, BC
- Organized special sessions on multi-scale methods in fluid dynamics, 2003 SE Regional AMS
- Author of BEARCLAW package for adaptive mesh computation of PDE's – acknowledged in at least 23 research journal articles, and in active use at least 6 research establishments including:
    - DOE Laboratory for Laser Energetics – Nuclear fusion pellet ignition simulations
    - University of Rochester, Department of Physics and Astronomy – Astrophysical simulations
    - University of Minnesota, Department of Astronomy

- Blackett Laboratory, Imperial College, London, UK
- Institut National de Recherche en Informatique et Automatique (INRIA). Rocquefort, France
- University of Washington, Department of Applied Mathematics.
- Reviewer for AIAA J. of Propulsion & Power, J. Atmos. Sci., J. Comp. Phys., Adv. Water. Res., J. Fl. Mech., J. Appl. Phys., IEEE STAR
- Associate Editor for Adv. Water Res.

Within UNC-Chapel Hill
- 2011/13, Mathematics Department Graduate Committee
- 2002-2012, Committee for Scientific Computing Comprehensive Examination
- 2012/3 Applied Mathematics Assistant Professor Search Committee (chair)
- 2009/10, Mathematics Department Undergraduate Committee
- 2006 Mathematics problem solving club
- Organizer of Applied Mathematics Colloquium, 2004/2005
- 2004/5 Applied Mathematics Assistant Professor Search Committee
- 2004 UNC Advisory Committee on High Performance Computing
- Scientific Computation club organizer, 2002, 2003, weekly meetings, web presence.
- Applied mathematics computational resource coordinator, 2002-2003.
- Member of 12 PhD committees in Mathematics, Computer Science, Physics, Marine Science, Environmental Science
- Web presence applied mathematics group
- Development and maintenance of Scientific Computing virtual machine environment
- Organizer graduate computational lab (Chapman 405)