Mehdi Vahab

mehdivahab.com, mvahab@fsu.edu, (530) 204-8724
Research Faculty, Department of Mechanical Engineering, FAMU-FSU College of Engineering

Education and Post-Degree Training

2014–2016	Post Doctoral Research Associate in Computational Science & Engineering Department of Mathematics, Florida State University, Tallahassee, FL Mentors: M. Yousuff Hussaini and Mark Sussman
2008–2014	PhD, University of California, Davis, CA Major: Applied Science, Computational Science and Engineering Supervisor: Greg Miller
2006–2008	MSc, Chalmers University of Technology, Goteborg, Sweden Major: Complex Adaptive Systems Supervisor: Bernhard Mehlig
2001–2005	BSc, K.N.Toosi University of Technology, Tehran, Iran Major: Electrical Engineering and Control Systems Supervisor: Alireza Fatehi

Work Experience

2017–	Research Faculty, Department of Mechanical Engineering, FAMU-FSU College of Engineering, Tallahassee, FL
2016–2017	Visiting Professor, Department of Mathematics, Florida A&M University, Tallahassee, FL
2014–2016	Post Doctoral Research Associate, Department of Mathematics, Florida State University, Tallahassee, FL
2008–2014	Teaching/research assistant, University of California, Davis, CA
2005–2006	System developer, Advance Control System Lab. KNTU, Tehran, Iran
2003–2005	Control system internship, Ijad Niroo, Tehran, Iran

Research Interests

Multimaterial systems	Phase change dynamics	Systems of conservation laws
Finite volume methods	Hybrid high order methods	Front tracking methods
Shock capturing methods	Embedded boundary methods	LS-VOF/MOF coupled algorithms
Time dependent domains	Fractional differential equation	Chaotic systems analysis
Dynamical systems	Artificial neural networks	Information theory
Evolutionary algorithms	Agent based modeling	

Reports and Publications

- M. Vahab, M.Y. Hussaini and M. Sussman, "A continuous moment-of-fluid method for modeling multimaterial systems", (2017). in prep.
- M. Vahab, M. Sussman, M.Y. Hussaini, "An adaptive moment-of-fluid method for simulating solidification process in multimaterial systems", (2017). in prep.
- Y. Lian, D. Liao, H. Qiu, M. Sussman, M. Vahab, Y. Hussaini, "Experimental and Numerical Investigation of Icing Process of a Liquid Droplet", *9th AIAA Atmospheric and Space Environments Conference AIAA AVIATION Forum*, AIAA 2017-4481, (2017), (Link)
- M. Vahab, C. Pei, M. Y. Hussaini, M Sussman and Y. Lian, "An adaptive coupled level set and moment-of-fluid method for simulating droplet impact and solidification on solid surfaces with application to aircraft icing", *54th AIAA Aerospace Sciences Meeting*, p. 1340, (2016) (Link)
- M. Vahab, G. Miller, "A front-tracking shock-capturing method for two gases", *Communication in Applied Mathematics and Computational Science*, 11-1, (2015): 1-35, (Link)
- M. Vahab, "A front-tracking shock-capturing method for two fluids", *PhD Dissertation*, UC Davis, (2014) (Link)
- M. Vahab, Design of a high-order front tracking method in 2D, *Master Thesis*, UC Davis, (2010) (Link)
- M. Vahab, "Relative velocities of particles suspended in stochastic Kolmogorov turbulence", *Master Thesis*, Chalmers University, (2008) (Link)

Presentations

- A Coupled Level-set and Moment-of-Fluid Method for Multiphase Systems with Solidification, *International Conference on Numerical Methods for Multi-Material Fluid Flows*, 2017
- An Adaptive Coupled Level Set and Moment-of-Fluid Method for Simulating the Solidification Process in Multimaterial Systems, *SIAM Conference on Computational Science and Engineering*, 2017
- An adaptive coupled level set and moment-of-fluid method for simulating the solidification process in multimaterial systems, *School of Mathematics, Georgia Institute of Technology*, 2016
- An adaptive coupled level set and moment-of-fluid method for simulating droplet impact and solidification on solid surfaces with application to aircraft icing, *AIAA 54th Aerospace Sciences Meeting*, 2016
- An adaptive coupled level set and moment-of-fluid method for simulating droplet impact and solidification on solid surfaces with application to aircraft icing, *Florida State University, Department of Scientific Computing*, 2015
- Numerical methods for fractional order systems, *39th SIAM Southeastern Atlantic Section Conference SIAM-SEAS*, 2015
- High-order interface tracking methods for compressible and incompressible two-phase flow, *SIAM Conference on Computational Science and Engineering*, 2013
- A front-tracking method for moving fronts and hyperbolic conservation laws, *SIAM Annual Meeting*, 2012
- A front-tracking method for systems of hyperbolic conservation laws, *Davis SIAM Student Research Conference*, 2012

Selected Projects

Continuous moment-of-fluid method for multimaterial systems

- Formulated the continuous moment-of-fluid for multimaterial systems
- Applied CMOF approach for the systems where the surface tension forces are dominant
- Revised the algorithm to resolve accurate contact angle on solid surfaces
- Compared with MOF and CLSVOF method for analytical and experimental solutions
- Implemented in FORTRAN, C++ using BoxLib

Modeling and simulation of droplet impact and solidification on solid surfaces

- Considered the impact and solidification of supercooled water droplets
- Applied a coupled moment of fluid and level set method to capture the sharp freezing front
- Employed an adaptive mesh refinement approach
- Comparison made with analytical and experimental results
- Implemented in FORTRAN, C++ using BoxLib

High order method for free boundary two phase flow systems

- Designed a hybrid method for hyperbolic systems of conservation laws
- Adapted a finite volume method on Cartesian grid for irregular moving geometries
- Devised a high order level set method for performing geometrical calculation
- Tested for front tracking and shock capturing in gas dynamics
- Successfully applied for study of Richtmyer–Meshkov instability
- Implemented in C++ using Chombo

Stochastic modeling of Kolmogorov turbulence and suspended particles

- Implemented a multiscale stochastic model of turbulence with energy spectrum characterization
- Developed spatial and temporal correlation verification methods
- Created verification methods based on analysis of topological properties of the velocity field
- Performed simulation and analysis for suspended particles coalescence
- Implemented in C

Traffic modeling

- Developed an agent based modeling for driver/road interaction
- Performed phase space verification of traffic flow based on empirical data
- Facilitated an interface to create user defined maps
- Implemented in Java

Teaching Experience

2016-7	College Algebra, Instructor, Florida A&M University
2016-7	Statistics, Instructor, Florida A&M University
2014	Computational Methods for Chemical Engineers, Teaching Assistant, UC Davis
2014	Introduction to Engineering Methods, The Design of Coffee, Teaching Assistant, UC Davis
2013	Mathematical Methods in Biochemical and Chemical Engineering, Teaching Assistant, UC Davis
2012	The Science Behind the Technology in Our Lives, Teaching Assistant, UC Davis
2009	Numerical Solution of Engineering and Scientific Problems, Teaching Assistant, UC Davis
2005	Logical/PLC Programming, Instructor, Novin Andishe Alborz, Tehran, Iran
2004	C programming, Teaching assistant, KNTU, Tehran, Iran

Professional Skills

- Programming Languages: C++, C, FORTRAN, MATLAB, Assembly, Java
- Modeling environments: Simulink, StateFlow
- Computational libraries: LAPACK, BLAS, Chombo, BoxLib
- System administration: Linux, Windows