

# MORAN WANG

---

Oppenheimer Fellow  
Groups EES6 and T13  
Los Alamos National Laboratory  
Los Alamos, New Mexico  
USA

Mail Stop T003, Los Alamos National Lab  
Los Alamos, NM 87545  
Phone: 1-505-664-0698 (O)  
Email: [mwang@lanl.gov](mailto:mwang@lanl.gov)  
Page: <http://pegasus.me.jhu.edu/~mwang/>

## Education

Ph.D	School of Aerospace, Tsinghua University	2004
Major:	<b>Power Engineering and Engineering Thermophysics</b>	
Ph.D. Thesis:	<i>Monte Carlo Simulations on Micro- and Nanoscale Gas Flow and Heat Transfer</i>	
M.S	Department of Engineering Mechanics, Tsinghua University	2001
Major:	<b>Engineering Thermophysics</b>	
M.S. Thesis:	<i>Experimental Investigation and Mechanism Analysis of the Thermally Driven Phase Transition Micropump</i>	
B.S.,	Department of Engineering Mechanics, Tsinghua University	1999
Major:	<b>Engineering Thermophysics</b>	

## Research Experiences

2008.5 - 2011.5	Oppenheimer Fellow @ EES6&T13, Los Alamos National Lab
2006.3 - 2008.4	Research Associate @ NEAT&BAE, University of California (N. Pan)
2007.1 - 2008.5	Visiting Scientist @ ME, Johns Hopkins University (S. Chen)
2004.9 - 2006.2	Postdoctoral Research Fellow @ ME, Johns Hopkins University (S. Chen)
2001.11-2004.7	Research Assistant @ DEM, Tsinghua University (Z. Li)
1999.9-2001.11	Research Assistant @ DEM, Tsinghua University (Z. Guo & Z. Li)
1999.7-1999.9	Intern @ Institute of Engineering Thermophysics, CAS

## Recent Competitive Awards/Honors

2008	J. Robert Oppenheimer Fellowship
2006	National Distinguished Ph.D Dissertation of China, Honorable Mention
2004	Distinguished Ph.D Dissertation of Tsinghua University
2004	Distinguished Ph.D graduate of Tsinghua University (Only one in School of Aerospace)
2004	"Academic NewStar" Prize of Tsinghua University. (The highest academic honor for graduate students)
2004	"NSK" Sino-Japan Friendship Distinguished Paper Award
2003	"Framtome" Fellowship, Tsinghua University (Special Grade)
2002	"Dong Qi" Fellowship, Tsinghua University (Rank 1)
2001	"Takata" Fellowship, Tsinghua University (Rank 2)
2000	"Guanghua" Fellowship, Tsinghua University (Rank 2)

## Research Interests

- ◆ Multiscale Multiphysical and Multiphase ( $M^3$ ) transports in Complex Systems

- ◆ Microfluidics and heat transfer; Nanofluidics
- ◆ Optimization in complex systems
- ◆ Multiscale modeling; Hybrid atomistic-continuum algorithms
- ◆ Computational fluid mechanics; Mesoscopic modeling
- ◆ Transports in geophysics, materials, bio-medicine, energy and environment
- ◆ Electrokinetic flow; Chemical reactive flows; Interface fluid flows; Electrowetting

## Relevant Academic Services

Membership: ASME(2003~), AIAA(2003~), APS(2005~), Fiber Society(2006~)

Editorship: Editorial board, Colloid Science Journal (2008~)  
 Editorial board, Advances in Mechanical Engineering (2008~)  
 Editorial board, Research & Reviews in ElectroChemistry (2007~)  
 Editorial review board, Scientific Journal International (2006~)

Reviewer for Journals (>80 times):

Microfluidics & Nanofluidics (2005~), Nanotechnology (2005~), Microscale Thermophysical Engineering (2005~), International Journal of Thermal Science (2005~), IEEE Sensor Journal (2005~), Journal of Colloid and Interface Science (2006~), Journal Micromechanics Microengineering (2006~), Heat Transfer Engineering (2006~), Computer Physics Communications (2006~), Applied Mathematical Modelling (2006~), Acta Mechanica Sinica (2006~), Polymer Composites (2006~), Composite Science and Technology (2007~), Communications in Nonlinear Science and Numerical Simulations (2007~), Journal of Computational and Applied Mathematics (2007~), Physics of Fluids (2007~), Journal of Computational Physics (2007~), Physical Review E (2007~), International Journal of Computer Mathematics (2007~), International Journal of Engineering (2007~), Vadose Zone Journal (2008~), International Journal of Heat and Fluid Flow (2008~), International Journal of Heat and Mass Transfer (2008~), Colloids and Surface A: Physicochemical and Engineering Aspects (2008~); Computers & Fluids (2008~); Langmuir (2008); Molecular Physics (2008~), Nanoscale and Microscale Thermophysical Engineering (2008~)

## Publications

### Books and Chapters

6. Moran Wang. *Analysis of electroosmotic microfluidics by the lattice Poisson-Boltzmann method*. Encyclopedia of Micro- and Nanofluidics. Springer, 2008
5. Moran Wang and Zhixin Li. *Micro- and nanoscale gas fluidics*. Encyclopedia of Micro- and Nanofluidics. Springer, 2008
4. Moran Wang. *Scientific Computation with MATLAB (Second Edition)* Publishing House of Electronics Industry, Beijing, China, 2003.9 (In Chinese)
3. Moran Wang. *Modeling and Dynamic Simulating with Simulink 4*. Publishing House of Electronics Industry, 2002.1 (Recommended Book by Mathwork) (In Chinese)
2. Moran Wang. *Scientific Computation with MATLAB 6.0*. Publishing House of Electronics Industry, Beijing, China, 2001.10 (In Chinese)
1. Moran Wang. *MATLAB Version 5.X and Scientific Computing*. Tsinghua University Press, Beijing, China, (1st Ed. 2000.5; 2nd Ed. 2001.5) (In Chinese)

In Journals (citations>200)

### To Be Submitted

55. Q. Chen, **M. Wang**, N. Pan, and Z. Guo. Optimization principles for convective heat transfer enhancement. Energy.

54. **M. Wang**, T. Squires, and Q. Kang. Electrokinetic transport in microchannels with random roughness. *Analytical Chemistry*
53. J. Liu, **M. Wang**, S. Chen and M.O. Robbins. Efficient Molecular Simulations of Nanoscale Electrokinetic Flows. *J. Comput. Phys.*

#### Under Review

52. **M. Wang**, and Q. Kang. Modeling electrokinetic flows in microchannels using coupled lattice Boltzmann methods. *Journal of Computational Physics*
51. X. Liu, **M. Wang**, J. Meng, and E. Ben-Naim. Minimum entransy dissipation principle for the optimization of transport networks. *Phys. Rev. E*
50. **M. Wang** Q. Kang, and N. Pan. Elastic property of multiphase composites with random microstructures. *Journal of Computational Physics*

#### 2008

49. Q. Chen, **M. Wang**, N. Pan, and Z. Guo. Irreversibility of heat conduction in complex multiphase systems and its application to the effective thermal conductivity of porous media *Int. J. Non-linear Sci. Numer. Simu (In Press)*, 2008
48. **Moran Wang**, Ning Pan. Predictions of Effective Physical Properties of Complex Multiphase Materials. *Material Science and Engineering-R: Report*. (Impact Factor: **17.731**), 63(1): 1-30, 2008
47. **Moran Wang\***, Qinjun Kang, and Ning Pan. Thermal conductivity enhancement of carbon fiber composites. *Applied Thermal Engineering. (In Press)*, 2008
46. **Moran Wang**, Xudong Lan and Zhixin Li\*. Analysis of Gas flows in Micro- and Nanochannels. *Int. J. Heat Mass Transfer*. **51**(13-14): 3630-3641, 2008
45. Fankong Meng, **Moran Wang**, Zhixin Li\*, Lattice Boltzmann Simulations of Conjugate Heat Transfer in High-Frequency Oscillating Flows. *Int. J. Heat Fluid Flow*. **29**(4): 1203-1210, 2008
44. **Moran Wang\***, and Shiyi Chen. On applicability of Poisson-Boltzmann equation for micro- and nanoscale electroosmotic flows. *Communications in Computational Physics* **3**(5): 1087-1099, 2008
43. **Moran Wang\***, and Ning Pan. Modeling and prediction of the Effective Thermal Conductivity of Random Open-cell Porous Foams. *Int. J. Heat Mass Transfer*. **51**(5-6): 1325-1331, 2008
42. Jinku Wang, **Moran Wang\***, and Zhixin Li. Lattice Evolution Solution for the Nonlinear Poisson-Boltzmann Equation in Confined Domains. *Communications of Nonlinear Sciences and Numerical Simulation*. **13**(3): 575-583, 2008

#### 2007

41. **Moran Wang\*** Jin Liu, and Shiyi Chen. Electric potential distribution in nanoscale electroosmosis: from molecules to continuum. *Molecular Simulation*. **33**(15): 1273 - 1277, 2007
40. **Moran Wang\***, Jin Liu, Shiyi Chen. Similarity of Electro-osmotic flows in nanochannels. *Molecular Simulation*. **33**(3): 239-244, 2007
39. **Moran Wang\***, Jinku Wang, Ning Pan, and Shiyi Chen. Mesoscopic Predictions of the Effective Thermal Conductivity of Microscale Random Porous Media. *Physical Review E*. **75**: 036702, 2007
38. **Moran Wang\***, Fankong Meng, and Ning Pan. Transport properties of functionally graded materials. *Journal of Applied Physics* **102**: 033514, 2007 (also be selected for the August 27, 2007 issue of *Virtual Journal of Nanoscale Science & Technology*)
37. **Moran Wang\***, and Ning Pan. Numerical analyses of the effective dielectric constant of multiphase microporous media. *Journal of Applied Physics* **101**: 114102, 2007
36. **Moran Wang\***, Jinku Wang, Ning Pan, Shiyi Chen, and Jihuan He. Three dimensional effect on the effective thermal conductivity of porous media. *J. Phys. D: Appl. Phys.* **40**(1): 260–265, 2007
35. **Moran Wang\***, Ning Pan, Jinku Wang, and Shiyi Chen. Mesoscopic simulations of phase distribution effects on the effective thermal conductivity of micro porous media. *J. Colloid Interface Sci.* **311**(2): 562-570, 2007
34. **Moran Wang**, Jihuan He, Jianyong Yu and Ning Pan\*. Lattice Boltzmann modeling of the effective thermal conductivity for fibrous materials. *Int. J. Thermal Sci.* **46**(9): 848-855, 2007

33. **Moran Wang\***, and Shiyi Chen. Electroosmosis in homogeneously charged micro- and nanoscale random porous media. *J. Colloid Interface Sci.* **314**(1): 264-273, 2007
32. **Moran Wang\***, Ning Pan, Jinku Wang and Shiyi Chen. Lattice Poisson-Boltzmann Simulations of Electroosmotic Flows in Charged Anisotropic Porous Media. *Communications in Computational Physics* **2**(6): 1055-1070, 2007
31. **Moran Wang\***, Jinku Wang, and Shiyi Chen. Roughness and Cavitations effects on Electro-osmotic Flows in Rough Microchannels using the Lattice Poisson-Boltzmann Methods. *Journal of Computational Physics*. **226**(1): 836-851, 2007
30. Jinku Wang, **Moran Wang**, and Zhixin Li\*. A Lattice Boltzmann Algorithm for Fluid-Solid Conjugate Heat Transfer. *Int. J. Thermal Sci.* **46**(3) 228-234, 2007
29. **Moran Wang\***, Zhixin Li. An Enskog based Monte Carlo method for high Knudsen number non-ideal gas flows. *Computer & Fluids* **36**(8): 1291-1297, 2007
28. **Moran Wang\***, Macrossan M. and Zhixin Li. Relaxation Time Simulation Method with Internal Energy Exchange for Perfect Gas Flow at Near-Continuum Conditions. *Communications of Nonlinear Sciences and Numerical Simulation*. **12**(7): 1277-1282, 2007
27. Hongwei Liu, **Moran Wang\***, Jinku Wang et al. Monte Carlo simulations of gas glow and heat transfer in vacuum packaged MEMS devices. *Applied Thermal Engineering*. **27**: 323-329, 2007

#### 2006

26. **Moran Wang\***, Jinku Wang, Shiyi Chen, and Ning Pan. Electrokinetic Pumping Effects of Charged Porous Media in Microchannels using the Lattice Poisson-Boltzmann Method. *J. Colloid Interface Sci.* **304**(1): 246-253, 2006
25. Jinku Wang, **Moran Wang\***, and Zhixin Li. Lattice Poisson-Boltzmann Simulations of Electro-osmotic Flows in Microchannels. *Journal of Colloid and Interface Science* **296**(2): 729-736, 2006; Corrigendum: *JCIS*, **300**(1): 446-446, 2006
24. **Moran Wang\***, Zhixin Li. Gas mixing in microchannels using the direct simulation Monte Carlo method. *Int. J. Heat Mass Transfer* **49**: 1696-1702, 2006
23. Fankong Meng\*, **Moran Wang**, Zhixin Li. Lattice Boltzmann Simulations of Oscillating Flow and Heat Transfer under Linearization Assumption. *Journal of Jilin University*. **36**(s1): 110-115, 2006

#### 2005

22. **Moran Wang**, Zhixin Li\*. Monte Carlo simulations of dense gas flow and heat transfer in micro- and nano-channels. *Science in China Ser. E, Engineering & Materials Science*, **48**(3): 317-325, 2005
21. Jinku Wang\*, **Moran Wang**, and Zhixin Li. Lattice Boltzmann simulations of mixing enhancement by the electro-osmotic flow in microchannels. *Modern Physics Letters B*. **19**:1515-1518, 2005
20. **Moran Wang**, Zhixin Li\*. Statistical Simulation of Gas Flow and Heat Transfer in Micro Air Bearing. *Tribology* **25**(1): 55-60, 2005 (In Chinese)

#### 2004

19. **Moran Wang\***, Zhixin Li. Failure analysis of the molecular block model for the direct simulation Monte Carlo method. *Physics of Fluids*, **16**(6): 2122-2125, 2004
18. **Moran Wang\***, Zhixin Li. Micro- and nanoscale non-ideal gas poiseuille flows in a consistent Boltzmann algorithm model. *J. Micromechanics and Microengineering*. **14**(7): 1057-1063, 2004
17. **Moran Wang**, Zhixin Li\*. Simulations for gas flows in microgeometries using the direct simulation Monte Carlo method. *Int. J. Heat Fluid Flow*, **25**(6): 975-985, 2004
16. **Moran Wang**, Zhixin Li\*. Numerical Simulations on Performance of MEMS-Based Nozzles at Moderate or Low Temperatures. *Microfluidics and Nanofluidics*, **1**(1): 62-70, 2004
15. **Moran Wang\***, Zhixin Li. A Monte Carlo Method for Perfect Gas Near-Continuum Flows. *Recent Advances in Fluid Mechanics*. pp. 716-719, 2004
14. **Moran Wang\***, Zhixin. Li. Valve-less thermally-driven moving-phase-change micropump. *Tsinghua Science and Technology*. **9**(6): 688-693, 2004
13. Zhixin Li\*, **Moran Wang**, Xiao-Bo Yao, Zeng-Yuan Guo. Pumping mechanism of thermally driven

phase transition micropump. *Microscale Thermophysical Engineering*, **8**(1): 31-42, 2004

12. **Wang Moran\***, Li Zhixin. Three-dimensional effect of gas flow in micro channels. *Journal of Engineering Thermophysics*, **25**(5): 840-842, 2004 (In Chinese)
11. **Wang Moran\***, Wang Jinku, Li Zhixin. New boundary condition implements for the DSMC method. *Chinese Journal of Computational Physics*, **21**(3): 48-52, 2004 (In Chinese)

### 2003

10. **Moran Wang\***, Zhixin Li. Nonideal gas flow and heat transfer in micro- and nanochannels using the direct simulation Monte Carlo method. *Physical Review E*, **68**: 046704, 2003
9. **Moran Wang\***, Zhixin Li. Similarity of ideal gas flow at different scales. *Science in China E*, **46**(6): 661-670, 2003
8. **Wang Moran\***, Chen Zejing, Li Zhixin. Simulations and optimization for micro gas flowmeter. *Micronanoelectronic Technology*, (7/8): 61-65, 2003 (In Chinese)
7. **Wang Moran\***, Chen Zejing, Li Zhixin. Simulation and analysis of gas flow and heat transfer in micro nozzle. *Micronanoelectronic Technology*, (7/8): 66-68, 2003 (In Chinese)

### 2002

6. **Moran Wang\***, Zhixin Li, Zejing Chen. The pumping effect of traveling phase transition in microtubes. *International Journal of Nonlinear Sciences and Numerical Simulation*, **3**: 565-568, 2002
5. Zhixin Li\*, **Moran Wang**, Liyan Tan. Experimental investigation on phase transformation type micropump. *Chinese Science Bulletin* **47**: 518-522, 2002
4. **Wang Moran\***, Li Zhixin. Microscale Thermal Science and its Applications in MEMS. *Journal of Instrument Technology and Sensors*, (7): 1-4, 2002 (in Chinese)
3. **Wang Moran\***, Li Zhixin. Investigation Process of Micropump Based on MEMS. *Journal of Transducer Technology*, **21**(6): 59-61, 2002 (in Chinese)
2. **Wang Moran\***, Li Zhixin. Investigation Process in MEMS-based Micro Fluid Machinery *Fluid Machinery*, **30**(4): 23-28, 2002 (in Chinese)
1. **Wang Moran\***, Li Zhixin, Tan Liyan. Pumping Mechanism of the phase Transition Type Micropump. *Mechanical Science and Technology*, **21**(6): 966-968, 2002 (In Chinese)

## In Conferences

### Peer reviewed

1. **Moran Wang\***, Zhixin Li. Gases Mixing in Microchannels using DSMC. *The 3<sup>rd</sup> International Conference of Minichannel and Microchannel ASME*, Toronto, CA, June 13-15, ICMM2005-75133, 2005
2. Xudong Lan, Zhixin Li\*, **Moran Wang**. Similarity of microscale and rarefied gas flow. *The 3<sup>rd</sup> International Conference of Minichannel and Microchannel ASME*, Toronto, CA, June 13-15, ICMM2005-75146, 2005
3. **Moran Wang\***, Zhixin Li. A Monte Carlo Method for Perfect Gas Near-Continuum Flows *The Fourth International Conference on Fluid Mechanics*, Dalian, PRC, 2004
4. **Moran Wang**, Zhixin Li\*. Performance Predictions of MEMS-Based Nozzles at Moderate or Low Temperatures In: *Proceedings of the Second International Conference on Microchannels and Minichannels (ICMM2004)*, pp 731-738, Rochester, New York, USA, 2004
5. **Moran Wang\***, Jinku Wang, Zhixin Li. Gas Flow and Heat Transfer in Microchannels with Bends Using DSMC. In: *Proceedings of the 3<sup>rd</sup> International Symposium on Heat Transfer Enhancement and Energy Conservation*, Vols 1&2: 3-9, Guangzhou, PRC, 2004

### Non-peer reviewed

- Qinjun Kang, Peter C. Lichtner, and **Moran Wang**. Lattice Boltzmann simulation of fluid flow and solute transport in porous media at the pore scale and upscaling. AGU Meeting, San Francisco, December, 2007 (Abstract)
- **Moran Wang\***, Shiyi Chen. On break-down of continuum theories for electroosmotic flow in nanoscale channels. *APS Meeting*, Utah University, Nov. 2007 (Abstract)

- **Moran Wang\***, Ning Pan. Thermal Conductivity of Fibrous Materials. *THE FIBER SOCIETY 2007 Annual Meeting and Technical Conference*, University of California at Davis, Davis, USA, Oct. 2007
- **Moran Wang\***, Ning Pan, and Shiyi Chen. Mesoscopic modeling and predictions of effective dielectric permittivity of multiphase micro porous media. *ICNM-V*, Shanghai, CHINA, June, 2007
- Fankong Meng\*, **Moran Wang**, Zhixin Li. Lattice Boltzmann Simulations of Oscillating Flow and Heat Transfer under Linearization Assumption. *International Conference on Enhancement and Promotion of Computational Methods in Engineering Science and Mechanics.*, Changchun, CHINA, August 2006
- **Moran Wang**, Jin Liu, and Shiyi Chen\*. Molecular simulations of electro-osmotic flows in nano-channels: from molecules to continuum. *58th Annual Meeting of APS, the Division of Fluid Dynamics*. Chicago, IL USA. Nov. 20-22, 2005 (Abstract)
- Zhixin Li\*, **Moran Wang** and Xudong Lan. Gas Flow in Micro- and Nanochannels using DSMC. In: *Kyoto-Tsinghua-Seoul National University Thermal Engineering Conference*, pp.1-8. Seoul, KR, Sep. 26-30, 2005
- Jinku Wang\*, **Moran Wang**, and Zhixin Li. Lattice Boltzmann simulations of mixing enhancement by the electro-osmotic flow in microchannels. *International Symposium on Physics of Fluids*, Huangshan, PRC, June 9-12, 2005
- **Wang Moran**, Li Zhixin\* Three-dimensional effect of gas flow in micro channels. *The 12<sup>th</sup> National Academic Conference on Engineering Thermophysics of China*, Beijing, PRC, 2003 (in Chinese)
- **Wang Moran**, Li Zhixin\*. Numerical Simulation of Gas Flow and Heat Transfer in Micro Air Bearing. *The 12<sup>th</sup> National Academic Conference on Engineering Thermophysics of China*, Beijing, 2003 (in Chinese)
- Wang Jinku, **Wang Moran**, Li Zhixin\*. Numerical Simulation of External Field of Micro Synthetic Jet. *The 12<sup>th</sup> National Academic Conference on Engineering Thermophysics of China*, Beijing, 2003 (in Chinese)
- **Wang Moran\***, Chen Zejing, Li Zhixin. Simulation and Optimization of Micro Gas Flowmeter. *The 6<sup>th</sup> National Micro/Nano Technology Conference*. Taiyuan, 2003 (in Chinese)
- **Wang Moran\***, Chen Zejing, Li Zhixin. Analysis and Numerical Simulation of Micro Nozzle. *The 6<sup>th</sup> National Micro/Nano Technology Conference*. Taiyuan, 2003 (in Chinese)
- **Moran Wang\***, Li Zhixin. Valve-less Thermally-driven Phase-change Micropump. *Pacific Rim Workshop on Transducers and Micro/Nano Technologies*. Xiamen, PRC, 2002
- **Moran Wang\***, Li Zhixin, Chen Zejing. The Pumping Effect of Phase Transition in a Micro Tube. *International Conference on Micro & Nano Systems*, Kunming, PRC, 2002
- Xiaobo Yao, **Moran Wang**, Zhixin Li\*, Zengyuan Guo. Pumping Mechanism of Thermally Driven Phase Transformation Type Micropump. *International Symposium on Micro/Nano Scale Energy Conversion and Transport*. Antalya, Turkey, 2002
- **Wang Moran**, Li Zhixin\*. Pressure Model of Phase-change Micropump. *The 10<sup>th</sup> National Academic Conference on Engineering Thermophysics of China*, Qingdao, 2001 (in Chinese)
- **Wang Moran**, Chen Zejing, Li Zhixin\*. Numerical Simulation of Gas Flow in Micro Laval Nozzles. *The 5<sup>th</sup> National Micro/Nano Technology Conference*. Chongqing, 2001 (in Chinese)