Yu Feng, Ph. D.

CONTACT INFORMATION

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RESEARCH INTERESTS

Advanced Modeling of Microparticle and Nanoparticle Dynamics, Lung Aerosol Dynamics, Targeted Drug Aerosol Delivery, Nanofluid Heat Transfer in Microscale, Entropy Generation Minimization.

EDUCATION

North Carolina State University, Raleigh, NC, USA GPA: 3.9/4.0
Ph. D. in Mechanical Engineering, Minor in Mathematics August 2013

- **Ph.D. Dissertation:** "Computational Ellipsoidal Particle-Fluid Analysis and Discrete Element Method with Applications to Particle Transport and Deposition in Human Respiratory Models."
- **Relevant Coursework**: Modern Fluid Dynamics, Principle of Structure Vibration, Computational Fluid Mechanics, Heat Transfer Theory and Applications, Discrete Element Method
- **Advisor:** Dr. Clement Kleinstreuer

North Carolina State University, Raleigh, NC, USA GPA: 3.9/4.0
M.S. in Mechanical Engineering, Minor in Mathematics May 2010

- **Master Thesis:** "A New Thermal Conductivity Model for Nanofluids with Convection Heat Transfer Application"
- **Relevant Coursework:** Particle Differential Equations, Finite Element Partial Differential Equations, Finite Element Analysis, Advanced Solid Mechanics, Microfluidics, Continuum Mechanics, C++ and Data Structure
- **Advisor:** Dr. Clement Kleinstreuer
- McDonald-Kleinstreuer Fellowship

Zhejiang University, Hangzhou, China First class graduate
B.S. in Engineering Mechanics June 2007

- **Bachelor Thesis:** "Brownian Coagulation Efficiency of Spherical Dioctyl Phthalate Aerosol Particles during Collisions"
- **Advisor:** Dr. Jian-Zhong Lin

Hong Kong Polytechnic University, Hong Kong, China August 2005-January 2006
Exchange Student in Mechanical Engineering

POSITIONS AND EMPLOYMENTS

Postdoctoral Research Associate August 2013 - Present
Department of Mechanical and Aerospace Engineering
North Carolina State University, Raleigh, NC, USA

Lab Manager May 2012 - Present
Computational Multi-Physics Laboratory (C M-P Lab)
North Carolina State University, Raleigh, NC, USA

FUNDED RESEARCH PROJECTS

CURRENT PROJECTS:

Computational Analysis of Lung-Aerosol Dynamics with Applications on E-cigarettes 2013-2014

- **Granting Company:** Altria Client Services Inc., Richmond, VA, USA
- **Role:** Main Investigator
- **Intellectual Contributions:**
  - Develop novel numerical models for e-cigarette aerosol transport and deposition in subject-specific nasal-oral and lung airway models;
  - Track the systemic fate of toxicants and carcinogenic biomarkers from inhaled e-cigarette vapor-droplet mixtures via hybrid CFD and physiologically based pharmacokinetics modeling, using ANSYS Fluent enhanced by customized C programs (UDFs);
  - Perform parametric sensitivity potential health risks analyses for manufacturers who could use the computer simulation model to evaluate, before marketing, the impact of new nicotine-delivery devices which do not rely on tobacco combustion.

A Predictive Open-Source Computer Model for Inhaled Nanoparticle Transport and Deposition in Subject-specific Upper Airways 2012-2014

- **Granting Agency:** National Science Foundation (NSF-CBET 1232988)
- **Role:** Investigator
- **Intellectual Contributions:**
  - Collaborated with image processing specialists to generate stereo-lithography file of the human respiratory system;
  - Employed shear stress transport (SST) transition turbulence model to predict the laminar-to-turbulence airflow regime in the complex flow domain with high accuracy;
  - Established numerical model (EL-ER Method) for the transport and deposition of non-spherical fibers in human respiratory system which captured the anisotropic effects, using ANSYS Fluent coupled with customized C programs (UDFs);
  - Evaluated potential health risks of micro-scale fibers to human respiratory systems;
  - Investigated particle-particle interactions via discrete element method (DEM).

COMPLETED PROJECTS:

Computational Deposition Prediction of Multi-component Liquid Aerosols from Next Generation Products in Human Respiratory System 2010-2011

- **Granting Company:** Philip Morris Product, Neuchâtel, Switzerland
- **Role:** Investigator
- **Intellectual Contributions:**
  - Developed of representative human upper airway models using ICEM CFD;
  - Initiated mathematical modeling of cigarette smoke droplet hygroscopic growth;
  - Simulated transient transport and deposition of cigarette smoke vapors of selected species using ANSYS Fluent enhanced by customized C programs (UDFs).

Experimentally Validated Numerical Models of Nanomaterial Deposition in a Model of a Human Respiratory System 2010-2012

- **Granting Agency:** National Science Foundation (NSF-CBET 0834054)
- **Role:** Investigator
- **Intellectual Contributions:**
  - Analysis of transport and deposition of toxic tobacco-smoke vapors (e.g., acrolein, 1,3-butadiene, acetaldehyde, and CO) in a human respiratory system via ANSYS Fluent.

Computational Analysis of Nanofluid Flow in Microchannels Applied to Micro-heat Sink Optimization 2008-2010

- **Granting Agency:** McDonald-Kleinstreuer Fellowship
- **Role:** Main Investigator
- **Intellectual Contributions:**
  - Developed a unified theory for nanofluid thermal conductivity properties;
  - Derived Feng-Kleinstreuer (F-K) thermal conductivity model to evaluate Brownian motion induced micro-mixing effect on heat transfer performance enhancement of nanofluids;
  - Established numerical models using ANSYS CFX enhanced by CFX Expression Language (CEL) for entropy generation minimization to optimize micro-cooling devices/micro-heat sinks design for the best efficiencies;
  - Analyzed the thermal performance enhancement in micro-heat sinks/microchannels employing nanofluids and demonstrated the promising characteristics of nanofluids as next generation coolants.

Multiphase Dynamics Models for Particles and Fibers in Nanoscale 2007-2008

- **Granting Agency:** National Natural Science Foundation of China (Grant No. 10632070)
- **Role:** Investigator
- **Intellectual Contributions:**
  - Calculated the Brownian coagulation efficiency of submicron particles considering Van der Waals force, lubrication force, Stokes force, etc.

JOURNAL PAPERS (* CO-FIRST AUTHOR)

[J13] Kleinstreuer, C., **Feng, Y.***, Childress, E. (2013), Drug-Targeting Methodologies with Applications, World Journal of Clinical Cases (under review)

[J12] **Feng, Y**., Kleinstreuer, C. (2013), Analysis of non-spherical particle transport in complex internal shear flows, Physics of Fluids, 25:091904

[J11] Kleinstreuer, C., **Feng, Y.*** (2013), Lung Deposition Analyses of Inhaled Toxic Aerosols in Conventional and Less Harmful Cigarette Smoke: A Review, Int. J. Environ. Res. Public Health, 10(9), 4454-4485

[J10] Kleinstreuer, C., **Feng, Y.*** (2013), Computational Analysis of Non-Spherical Particle Transport and Deposition in Shear Flow with Application to Lung Aerosol Dynamics-A Review, Journal of Biomechanical Engineering, 135(2), 021007-1-021007-19

[J9] Kleinstreuer, C., **Feng, Y.*** (2012), Thermal Nanofluid Property Model with Application to Nanofluid Flow in a Parallel-Disk System Part I: A New Thermal Conductivity Model for Nanofluid Flow, Journal of Heat Transfer, Vol. 134(5), 051002

[J8] **Feng, Y.**, Kleinstreuer, C. (2012), Thermal Nanofluid Property Model with Application to Nanofluid Flow in a Parallel-disk System Part II: Nanofluid Flow in a Parallel-Disk System, Journal of Heat Transfer, Vol. 134(5), 051003

[J7] Zhang, Z., Kleinstreuer, C., **Feng, Y.** (2012), Vapor Deposition During Cigarette Smoke Inhalation in Subject-specific Human Airway Model, Journal of Aerosol Science , Vol. 53, pp. 40-60

[J6] **Feng, Y.** (2012), Comments on Paper: "Transport and Deposition on Ellipsoidal Fibers in Low Reynolds Number Flows" from L. Tian, G. Ahmadi, Z. Wang, P. K. Hopke, Journal of Aerosol Science, Vol. 45, pp. 1-18 , Vol. 52, pp. 127-128

[J5] Wang, S., Ying, J., Chen, Z. C., **Feng, Y.** (2011), A new fuzzy self-tuning method for controlling packing pressure of a high-accuracy injection molding machine. Journal of Zhejiang University. Engineering Science, 45(8), 1370-1375.

[J4] **Feng, Y.**, Kleinstreuer, C. (2010), Nanofluid Convective Heat Transfer in a Parallel-Disk System, International Journal of Heat and Mass Transfer, Vol. 53, Issue 21-22, pp. 4619-4628

[J3] Kleinstreuer, C., **Feng, Y.*** (2010), Experimental and Theoretical Studies of Nanofluid Thermal Conductivity Enhancement: A Review, Nanoscale Research Letters, Vol. 6:229

[J2] Wang, Y., Lin, J., **Feng, Y.** (2010), The Central Oblique Collision Efficiency of Spherical Nanoparticles in the Brownian Coagulation, Modern Physics Letters B., Vol. 24(14), pp. 1523-1531

[J1] **Feng, Y.**, Lin, J. (2008), The Collision Efficiency of Spherical Dioctyle Phthalate Aerosol Particles in the Brownian Coagulation, Chinese Physics B., Vol. 17(12), pp. 4547-4553

BOOK CHAPTER

[B1] Kleinstreuer, C., Li, J., **Feng, Y.** (2011), Computational Analysis of Enhanced Cooling Performance and Pressure Drop for Nanofluid Flow in Microchannels, Advanced in Numerical Heat Transfer, Vol. 4, Nanoparticle Heat Transfer and Fluid Flow

REFEREED CONFERENCE PROCEEDINGS

[C10] **Feng. Y.**, Kleinstreuer, C. (2013), DDPM-DEM Simulations of Particulate Flows in Human Tracheobronchial Airways, ASME 2013 International Mechanical Engineering Congress & Exposition, San Diego, CA, USA

[C9] **Feng. Y.**, Kleinstreuer, C. (2013), Transport and Deposition of Non-spherical Aerosols in Patient-specific Lung-airway Models, 12th U. S. National Congress on Computational Mechanics (USNCCM12), Raleigh, NC, USA

[C8] **Feng. Y.,** (2013), Exact and Approximate Solutions of Steady and Transient Electroosmotic and Pressure-drive Flows in a Microtube, Advances in Microfluidics & Nanofluidics (AMN2013), Notre Dame, IN, USA

[C7] **Feng, Y.**, Kleinstreuer, C. (2012), Transport and Deposition of Non-spherical Nanomaterial in Subject-specific Lung Airways, First Sustainable Nanotechnology Organization Conference, Arlington, VA, USA

[C6] **Feng, Y.**, Kleinstreuer, C. (2012), Transport and Deposition of Ellipsoidal Fibers in Subject-specific Lung Airways, ASME 2012 Internationl Mechanical Engineering Congress & Exposition, Houston, Texas, USA

[C5] Kleinstreuer, C., Zhang, Z., **Feng, Y.** (2012), Deposition of Inhaled Nano- and Micron-material in Subject-specific Lung Airways, Joint US EPA & NCSU Poster Sesson, Raleigh, NC, USA

[C4] Li, J., Kleinstreuer, C., **Feng, Y.** (2012), Computational Analysis of Thermal Performance and Entropy Generation of Nanofluid Flow in Microchannels, 3rd Micro/Nanoscale Heat and Mass Transfer International Conference, Atlanta. GA, USA

[C3] **Feng, Y.**, Kleinstreuer, C. (2011), Computational Analysis of Droplet Evaporation and Deposition in a Realistic Respiratory Tract subject to Puff-like Inhalation Waveforms, CMBE11, Washington D. C., USA

[C2] **Feng, Y.**, Kleinstreuer, C. (2010), Thermal Nanofluid Property Model with Application to Nanofluid Flow in a Parallel-Disk System, 16th US National Congress of Theoretical and Applied Mechanics, State College, Pennsylvania, USA

[C1] Wang, S., Ying, J., Chen, Z. C., **Feng, Y.** (2010), Packing Pressure Control for Energy-saving Servo Injection Molding Based on Fuzzy-PID Controller, 2010 2nd International Conference on Mechanical and Electronics Engineering, Kyoto, Japan.

TECHNICAL REPORTS

[T6] **Feng, Y.,** Kleinstreuer, C. (2012), Inhaler Design, Drug Formulation, and Device Performance- A Review, Technical Report.

[T5] **Feng, Y.** (2009), The Relationship between Entrance Length and Reynolds number of Flows in a Duct with Rectangular Cross Section, Technical Report.

[T4] Kleinstreuer, C., Zhang, Z., **Feng, Y.** (2011), Philip Morris Product Report IV: Transport and Deposition of Smoke Particles/Droplets in Human Respiratory Systems, Technical Report.

[T3] Kleinstreuer, C., Zhang, Z., **Feng, Y.** (2011), Philip Morris Product Report III: Model Development/Validation of NGP-Droplet Vaporization and Condensation, Technical Report.

[T2] Kleinstreuer, C., Zhang, Z., **Feng, Y.** (2010), Philip Morris Product Report II: Development of Human Respiratory Airway Geometries with Mesh Generation and Sensitivity Test, Technical Report.

[T1] Kleinstreuer, C., Zhang, Z., **Feng, Y.** (2010), Philip Morris Product Report I: Literature Review, Data Sets and Computer Simulation, Technical Report.

INVITED TALKS AND PRESENTATIONS

[5] **Feng. Y.**, Kleinstreuer, C. (2013), DDPM-DEM Simulations of Particulate Flows in Human Tracheobronchial Airways, ASME 2013 International Mechanical Engineering Congress & Exposition, San Diego, CA, USA

[4] **Feng. Y.**, Kleinstreuer, C. (2013), Transport and Deposition of Non-spherical Aerosols in Patient-specific Lung-airway Models, 12th U. S. National Congress on Computational Mechanics (USNCCM12), Raleigh, NC, USA

[3] **Feng, Y.**, Kleinstreuer, C. (2012), Transport and Deposition of Ellipsoidal Fibers in Subject-specific Lung Airways, ASME 2012 International Mechanical Engineering Congress & Exposition, Houston, Texas, USA

[2] **Feng, Y.**, Kleinstreuer, C. (2011), Computational Analysis of Droplet Evaporation and Deposition in a Realistic Respiratory Tract subject to Puff-like Inhalation Waveforms, CMBE11, Washington D. C., USA

[1] **Feng, Y.**, Kleinstreuer, C. (2010), Thermal Nanofluid Property Model with Application to Nanofluid Flow in a Parallel-Disk System, 16th US National Congress of Theoretical and Applied Mechanics, State College, Pennsylvania, USA

PROFESSIONAL AFFILIATION AND MEMBERSHIPS

- Member of American Society of Mechanical Engineers (ASME)
- Member of American Physical Society (APS)
- Member of Sustainable Nanotechnology Organization (SNO)
- Member of Biomedical Engineering Society (BMES)
- Member of NC State University Postdoctoral Association (NCSU PDA)
- Member of Chinese Association for Science & Technology, NC Chapter (CAST-NC)
- Substitute Session Organizer of 2-8-3 Transport Phenomena in Biomedical Applications III, ASME 2012 Houston

TECHNICAL REVIEW ACTIVITIES

(7 Journals and 1 Conference)

Journal of Physics D: Applied Physics; International Journal of Thermal Sciences; International Journal of Physical Science; Journal of Thermophysics and Heat Transfer; Energy; Journal of Mechanical Engineering Science; Journal of Nanoengineering and Nanosystems; IMECE 2013

HONORS AND REWARDS

- Certificate in Teaching Techniques (CITT) (2013)
- McDonald-Kleinstreuer Fellowship (2008-2010)