

Yu Feng, Ph. D.

CONTACT INFORMATION

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MAJOR AREAS OF RESEARCH INTEREST

Advanced Modeling of Computational Fluid-Particle Dynamics, Lung Aerosol Dynamics of Multi-component Electronic Cigarette Aerosols and Fibers, Direct Drug-Targeting Delivery, Nanofluid Convective Heat Transfer, Entropy Generation Minimization.

ACADEMIC BACKGROUND

North Carolina State University, Raleigh, NC, USA

August 2013

Ph. D. in Mechanical Engineering, Minor in Mathematics

- **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

May 2010

M.S. in Mechanical Engineering, Minor in Mathematics

- **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

Assistant Professor August 2016-Present
School of Chemical Engineering
Oklahoma State University, Stillwater, OK, USA

Center Investigator August 2016-Present
Oklahoma Center for Respiratory and Infectious Disease (OCRID)
Stillwater, OK, USA

Research Scientist II - Structural/Fluid Mechanics December 2015- June 2016
DoD Biotechnology HPC Software Applications Institute
Frederick, MD, USA

Research Assistant Professor and Lab Manager May 2015-December 2015
Department of Mechanical and Aerospace Engineering
North Carolina State University, Raleigh, NC, USA

Research Associate and Lab Manager August 201-May 2015
Department of Mechanical and Aerospace Engineering
North Carolina State University, Raleigh, NC, USA

FUNDED RESEARCH PROJECTS

CURRENT PROJECTS

Development of A Non-Invasive Tool for Diagnosis of Pulmonary Diseases 2015-Present

- **Granting Agency:** Military Operational Medicine Research Program (MOMRP)
- **Role:** Senior Personnel

COMPLETED PROJECTS:

Computational Analysis of Lung-Aerosol Dynamics with Applications on E-cigarettes 2013-2015

- **Granting Company:** Altria Client Services Inc., Richmond, VA, USA
- **Role:** Senior Personnel
- **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 2012-2015

- **Granting Agency:** National Science Foundation (NSF-CBET 1232988)
- **Role:** Senior Personnel
- **Intellectual Contributions:**
 - Collaborated with image processing specialists to generate stereo-lithography file of the human respiratory system using Mimics[®] and 3-matic Research[®];
 - 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).

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:** Graduate Student
- **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:** Graduate Student
- **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.

CONSULTING PROJECT

Capillary Driven Flow with Liquid Vaporization in a Wick-Heater System with Air Cross-Flow

2014 Summer

- **Granting Company:** Altria Client Services Inc., Richmond, VA, USA
- **Role:** Co-Investigator
- **Intellectual Contributions:**
 - Established a novel numerical model based on the VOF method for the wicking process, including heat and mass transfer, phase change, capillary-driven flow (surface tension at interface), and porous medium effect.
 - Developed user-defined functions (UDFs) for liquid-vapor evaporation or condensation as well as the semi-permeable boundary conditions.

JOURNAL PAPERS (* CO-FIRST AUTHOR)

[J17] **Feng, Y.**, Kleinstreuer, C., Nicolas, C., Rostami, A. (2016). Computational transport, phase change and deposition analysis of inhaled multicomponent droplet-vapor mixtures in an idealized human upper lung model, *Journal of Aerosol Science*, 96, 96-123

[J16] Chen, X., Zhong, W., Tom, J., Kleinstreuer, C., **Feng, Y.**, He, X. (2016). Experimental-computational study of fibrous particle transport and deposition in a bifurcating lung model, *Particuology* (In Press)

[J15] **Feng, Y.**, Kleinstreuer, C. (2015). Evaporation and condensation of multicomponent electronic cigarette droplets and conventional cigarette smoke particles in a G3-G6 triple bifurcating unit, *Journal of Aerosol Science*, 80, 58-74

[J14] Kleinstreuer, C., **Feng, Y.***, Childress, E. M. (2014). Drug-targeting methodologies with applications: a review, *World Journal of Clinical Cases*, 2(12), 745-756

[J13] **Feng, Y.**, Kleinstreuer, C. (2014). Micron-particle transport, interactions and deposition in triple lung-airway bifurcations using a novel modeling approach, *Journal of Aerosol Science*, 75,

1-15.

[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*, 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*, 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*, 53, 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, *Journal of Aerosol Science*, 52, 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*, 53(21-22), 4619-4628.

[J3] Kleinstreuer, C., **Feng, Y.*** (2010). Experimental and theoretical studies of nanofluid thermal conductivity enhancement: a review, *Nanoscale Research Letters*, 6(229), 1-13.

[J2] Wang, Y., Lin, J., **Feng, Y.** (2010). The central oblique collision efficiency of spherical nanoparticles in the brownian coagulation, *Modern Physics Letters B*, 24(14), 1523-1531.

[J1] **Feng, Y.**, Lin, J. (2008). The collision efficiency of spherical dioctyle phthalate aerosol particles in the brownian coagulation, *Chinese Physics B*, 17(12), 4547-4553.

BOOK CHAPTER

[B1] Kleinstreuer, C., Li, J., & Feng, Y. (2012). Computational analysis of enhanced cooling performance and pressure drop for nanofluid flow in microchannels. *Nanoparticle Heat Transfer and Fluid Flow. Series: Computational & Physical Processes in Mechanics & Thermal Science*, ISBN: 978-1-4398-6192-9. CRC Press, Edited by W Minkowycz, E Sparrow and J Abraham, 1, 249-276.

REFEREED CONFERENCE PROCEEDINGS

[C14] **Feng, Y.**, Kleinstreuer, C. (2015). A novel computational fluid-particle dynamics (CF-PD) model for nicotine delivery device (electronic cigarette) performance optimization, 2015 Eastern Analytical Symposium & Exposition, Somerset, NJ, USA

[C13] **Feng, Y.**, Kleinstreuer, C. (2015). A novel computational fluid-particle dynamics model for the simulation of multicomponent droplet-vapor transport/deposition in an idealized human upper airway configuration, BMES 2015 Annual Meeting, Tampa, FL, USA

[C12] **Feng, Y.** (2015). A high-resolution multi component CFD model for E-cigarette aerosols, Inhalation Asia Pulmonary and Intranasal Drug Delivery Conference (IA15), Shenyang, China

[C11] Kleinstreuer, C., **Feng, Y.** (2015). Validated computational fluid-particle dynamics simulations for toxicological considerations and health-effect evaluations of inhaled multicomponent droplet-vapor mixtures from electronic cigarettes, Electronic Cigarettes and the Public Health: Second Public Workshop, Hyattsville, MD, USA

[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 International 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 Session, 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, 2nd International Conference on Computational & Mathematical Biomedical Engineering (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, 2nd International Conference on Mechanical and Electronics Engineering, Kyoto, Japan.

INVITED TALKS AND PRESENTATIONS

[8] **Feng, Y.**, Kleinstreuer, C. (2015). A novel computational fluid-particle dynamics (CF-PD) model for nicotine delivery device (electronic cigarette) performance optimization, 2015 Eastern Analytical Symposium & Exposition, Somerset, NJ, USA

[7] **Feng, Y.** (2015). A high-resolution multi component CFD model for E-cigarette aerosols, Inhalation Asia Pulmonary and Intranasal Drug Delivery Conference (IA15), Shenyang, China

[6] Kleinstreuer, C., **Feng, Y.** (2015). Validated computational fluid-particle dynamics simulations for toxicological considerations and health-effect evaluations of inhaled multicomponent droplet-vapor mixtures from electronic cigarettes, Electronic Cigarettes and the Public Health: Second Public Workshop, Hyattsville, MD, USA

[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 ORGANIZATION MEMBERSHIPS

- Editor of Research Journal of Environmental Sciences (RJES)
- Member of American Society of Mechanical Engineers (ASME)
- Member of American Physical Society (APS)
- Member of Biomedical Engineering Society (BMES)
- Member of the Sigma-Xi Scientific Research Society
- Member of International Society for Aerosols in Medicine (ISAM)
- Member of International Association for Computational Mechanics (IACM)
- Member of Asian Council of Science Editors (ACSE)
- Member of Chinese Association for Science & Technology, NC Chapter (CAST-NC)
- Member of North Carolina Roadrunners Club, Raleigh, NC (NCRC)

TECHNICAL REVIEW ACTIVITIES

(25 Journals and 1 Conference)

- *Physics of Fluids*
- *Journal of Aerosol Science*
- *Journal of Applied Physics*
- *Journal of Biomechanics*
- *Powder Technology*
- *Aerosol Science and Technology*
- *ASME Journal of Biomechanical Engineering*
- *ASME Journal of Fluids Engineering*
- *Energy Conversion and Management*
- *Energy*
- *Fluids*
- *Particuology*
- *Journal of Mechanics Engineering and Automation*
- *Entropy*
- *European Journal of Mechanics*
- *Journal of Physics D: Applied Physics*
- *International Journal of Thermal Sciences*
- *International Journal of Physical Science*
- *Journal of Thermophysics and Heat Transfer*
- *Journal of Mechanical Engineering Science*
- *Journal of Nanoengineering and Nanosystems*
- *Abstract and Applied Analysis*
- *Applied Mathematical Modelling*
- *Nanoscale and Microscale Thermophysical Engineering*
- *Journal of Mechanical Engineering Research*
- *ASME IMECE 2013*

HONORS AND REWARDS

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