Naser Mahfouz

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Education

Carnegie Mellon University *Pittsburgh, PA*
PhD, Chemical Engineering *Aug 2015 – Aug 2020*

Brown University *Providence, RI*
BSc, Bioengineering and Biomedical Engineering (Honors) *Sep 2011 – May 2015*

Coursework

PDE theory & numerics, optimization, control, instrumentation/biomedical design, fluid mechanics, statistical thermodynamics, (bio)transport, heat/mass transfer, physiology, cell biophysics, neuroengineering, meteorology

Skills

Software: MATLAB, OpenFOAM, LabVIEW, COMSOL Multiphysics, Adobe Creative Suite
Programming: Python, C++, Fortran, HPC & parallel computing (e.g. openMP, MPI, CUDA)
Instrumentation: AMS, SMPS, PTR-MS, XRD, UV-Vis spectroscopy, chromatography techniques (e.g. GC, TLC)

Research

Center for Atmospheric Particle Studies, Chemical Engineering, Carnegie Mellon University *Pittsburgh, PA*
Graduate Researcher (PhD thesis; advisor: Neil Donahue) *Aug 2015 – Aug 2020*

- Created particle model based on hyperbolic partial differential equations (PDE) theory to investigate environmental chamber experiments, both in forward (inputs to outputs) and inverse (outputs to inputs) manners
- Implemented coagulation of charged particles to calculate enhanced scavenging rates of small particle during new-particle formation events to probe validity and extent of ion-induced formation of aerosols
- Modeled dynamics of atmospheric ion charging of particles, and determined the importance of taking into account the ion charging rates in interpreting aerosol particle deposition and experimental charge steady states
- Formulated optimization techniques on top of particle model, and separately constructed passivity-based control theory of conservation/balance laws to apply it to general classes of physics-based hyperbolic PDEs
- Constructed calculation routine to reconcile aerosol instrumentation's biases, ensuring data collected based on electric mobility (e.g. SMPS) and aerodynamic forces (e.g. AMS) are aligned through physical parameters
- Developed open-source computational fluid dynamics (CFD) model to study turbulent particle deposition and eddy diffusivity/viscosity in particle-laden turbulent flows on high-performance computers
- Collaborated with an international and multidisciplinary team of researchers to design experiments and test models for new-particle formation and growth at the European Center for Nuclear Research (CERN) studying well-controlled physical and chemical systems comparable to the pre-/post-industrial atmosphere

Laboratory for Environmental and Health Nanoscience, Engineering, Brown University *Providence, RI*
Undergraduate Researcher (BSc honors thesis; advisor: Robert Hurt) *Sep 2013 – May 2015*

- Manufactured graphene oxide solution in laboratory with a PhD student, and characterized resulting graphene layers using refraction methods to calculate separating lengths between graphene sheets
- Designed and conducted first experiments to study graphene oxide apparent preferential transport of evaporating water from water-alcohol solution, and measured resulting expansion of graphene membranes
- Modeled transport phenomena of water through graphene layers and hypothesized the importance of hydrogen bonding in facilitating the preferential transport of water from water-alcohol mixture

Publications

Mahfouz, N. G. & Donahue, N. M. (2020). The enhanced coagulation scavenging of charged nucleating particles and its implication to ion-induced nucleation. *Geophysical Research Letters*. Submitted.

Mahfouz, N. G. & Donahue, N. M. (2020). Primary ion diffusion charging and particle wall loss in smog chamber experiments. *Aerosol Science and Technology*. In Press.

Spitz Steinberg, R., Cruz, M., **Mahfouz, N. G.**, Qiu, Y., & Hurt, R. H. (2017). Breathable vapor toxicant barriers based on multilayer graphene oxide. *ACS nano, 11*(6), 5670-5679.

Presentations

Mahfouz, N. G.. "Modeling particles in chambers: a closer look at deposition." 2019 37th Association for American Aerosol Research (AAAR) Conference. Portland, OR, USA. 18 October 2019. Conference Platform Presentation.
Mahfouz, N. G.. "Graphene oxide materials for environmental and selective barriers." 2014 American Institute of Chemical Engineers (AIChE) Annual Meeting. Atlanta, GA, USA. 17 November 2014. Poster Presentation.

Teaching

College of Engineering, Carnegie Mellon University *Pittsburgh, PA*
Teaching Assistant *Jan 2016 – May 2019*

- Held weekly office hours, delivered (6) guest lectures; courses (5): reaction kinetics, advanced physical chemistry, global atmospheric chemistry modeling, chemistry and physics of climate change, meteorology

School of Engineering, Brown University *Providence, RI*
Teaching Assistant *Jun 2014 – May 2015*

- Held weekly office hours, led weekly problem sessions, delivered biweekly laboratory lectures, supervised biweekly experiments; courses (3): thermodynamics, biomechanics, robotics for high-school students

Department of Mathematics, Brown University *Providence, RI*
Teaching Assistant *Jan 2013 – Dec 2013*

- Held weekly supplementary lecture and weekly office hours, evaluated students' performance; courses: multivariable calculus for engineering and physics (repeated 3 times)
- Promoted to head TA: managed other TAs and graders

Office of the Dean of College, Brown University *Providence, RI*
Academic Tutor *Nov 2012 – May 2015*

- Coached students individually and in groups; subjects: mathematics, engineering, chemistry
- Trained newly-assigned mathematics tutors

The Brown Leadership Institute, Brown University *Providence, RI*
Leader Fellow: Teaching Assistant and Residential Advisor *Jun 2013 – Aug 2013*

- Facilitated leadership and diversity workshops, ropes courses, developmental and group exercises
- Led class on the scientific revolutions and paradigm shifts, taught Kuhn's *Structure*

Experience

Media Production Group, Brown University *Providence, RI*
Production Assistant *Mar 2012 – May 2015*

- Filmed live events in teams, individually with varying complexity
- Automated archiving, production, publishing for upgrades and ease of use
- Helped professors with instructional and educational technology (modern tools and digital content)

Atlantic Outdoor Centre, UWC Atlantic College *St Donats, UK*
Summer Instructor *May 2011 – Jul 2011*

- Mentored children with varying abilities, developed leadership skills and group cohesiveness; example activities: archery, canoeing, initiative exercises

Honors

- 2019 37th AAAR Conference travel grant and teaching assistant
- 2018–2019 Robert R. Rothus Graduate Fellowship
- 2016–2017 Roy W. Weiland Graduate Fellowship
- 2015–2016 Bradford and Diane Smith Graduate Fellowship
- 2014 AIChE Outstanding Poster Award (Separation)
- 2011–2015 Brown Club of London Scholarship
- 2011–2015 Davis United World College Scholar
- 2011 Featured Admission Essay at Brown University
- 2009–2011 UWC Atlantic College Scholarship