Md Mahmudur "Rony" Rahman

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PhD candidate, working on low Reynolds number hydrodynamics and interfacial phenomena. My research has focused on colloidal hydrodynamics, drop coalescence, and cellular mechanics. Seeking research opportunities in any of the fields of microscale transport, microfluidics, interfacial phenomena, multiphase system, energy and biophysical studies.

EDUCATION	
PhD (August 2015– Present)	University of Louisville Mechanical Engineering
	Advisor: Stuart J Williams, Ph.D.
	Relevant courses : Advanced engineering mathematics I (ME 565), Nanostructure self-assembly (ECE 675)
PhD (August 2014–May 2015)	University of Nebraska-Lincoln
	(Incomplete, degree not awarded)
	Mechanical Engineering and Applied Mechanics
	Relevant courses: Viscous flow I (MECH 810), Mechanical engineering control systems design (MECH 850), Continuum mechanics (MECH 910), Micro-Nano systems (CHME 876), Engineering Acoustics (MECH 816), Analysis with Finite Elements (MECH 883)
MS (August 2012–May 2014)	University of Nebraska-Lincoln
	Mechanical Engineering and Applied Mechanics
	 Relevant courses: Analytical methods engineering (ENGM 801), Life at low Reynolds number (MECH 898), Functional tissue engineering (MECH 996), Biophotonics (ELEC 996), Aerodynamics (MECH 813), Numerical methods engineering (MECH 880), Computational heat transfer (MECH 831), Mechanics of bio materials (898), Mechanics of elastic bodies (ENGM 325), Engineering dynamics (ENGM 373)
	Dissertation : Application of limited mixing in the Hele-Shaw geometry in fabrication of Janus hydrogels
BS (April 2002- July 2007)	Bangladesh University of Engineering & Technology
	Mechanical Engineering
	Dissertation : Investigation on Lubricating oil Dilution Problem in Automobiles in Bangladesh

ACADEMIC EMPLOYMENT

August 2019–Present

Graduate Teaching Assistant, University of Louisville

Responsibilities: Graded homework assignments, quizzes, exams and term final reports.

Courses: Fluid Mechanics I & II (undergraduate course), Intermediate Dynamics (graduate course).

August 2015–July 2019

Graduate Research Assistant, University of Louisville.

<u>Responsibilities</u>: Worked on NASA EPSCoR funded project entitled *Influence of Gravity on Electrokinetic* and Electrochemical Colloidal Self-Assembly for Future Materials.

- Experimental and theoretical study of drop coalescence
 - o Graduate students advised: Willis Lee, Fall 2017 and Arvind Iyer, Spring 2017
- Experimental, theoretical and numerical (simulation) study of colloids mobility in a confinement.
- Developed rotating microfluidic device for simulating microgravity for colloid experiments.
- Investigated self-assembled colloid structures, suspended near a rigid surface, under the application of A/C electric field and rotational gravity.
- Have been involved with two experiments on the International Space Station (with a third planned for late 2020).

May 2016-July 2016

Graduate Teaching Assistant, University of Louisville.

<u>Responsibilities</u>: Taught students before conducting experiments and graded lab reports.

Courses: Fluid Mechanics lab.

August 2012-May 2015

Graduate Teaching Assistant, University of Nebraska-Lincoln.

<u>Responsibilities</u>: Graded homework assignments, quizzes, exams and term final reports; tutored students, maintained office hours and procotored exams as well.

<u>Graded</u>: Heat Transfer, Thermodynamics, Elements of Materials Science, Introduction to Dynamics and Control of Engineering Systems, Kinematics & Dynamic.

Tutored: Statics, Engineering Dynamics, Mechanics of Elastic Bodies.

August 2012-May 2014

Graduate Research Assistant, University of Nebraska-Lincoln.

<u>Responsibilities:</u> Worked on a research project entitled as *Application of limited mixing in the Hele-Shaw* geometry in fabrication of Janus hydrogels.

- Fabricated hydrogel with stiffness gradient for cell mechanics research.
- Developed confocal microscopy indentation method for hydrogel elasticity measurement.
- Characterized stiffness of hydrogel using atomic force microscopy.
- Worked as a part of collaboration with a research group at University of Nebraska Medical School.

August 2007–July 2012

Lecturer, Department of Textile Engineering, Southeast University, Bangladesh.

<u>Responsibilities</u>: Taught and coordinated mechanical engineering courses, played key role in teaching stuff recruitment processes, worked as a teacher-in-charge for textile club- a student run extracurricular forum, organized industry visit for students, supervised exams in distance learning programs, invited expert/guest lecturer in class, engaged in numerous students activities, maintained office hours, mentored students in their projects and evaluated their class performances.

<u>Courses</u>: Strength of Materials, Elements of Theory of Machines and Machine Design, Elements of Mechanical Engineering, Microprocessor, Robotics and Control Engineering, Engineering Drawing lab.

RESEARCH SKILLS & EXPERIENCES		
Microscopy	Optical (confocal), atomic force (AFM), scanning electron (SEM)	
Fabrication	Photolithography, Sputtering, basic cleanroom protocols, PDMS based microfluidic devices, polyacrylamide hydrogel fabrication [using both chemical, and photo-initiated (UV light) crosslinking method], cutter plotter, laser cutting	
Microcontroller Electronics	Integration of simple control/automation using Arduino Uno and Raspberry pi with python, preliminary knowledge on LABVIEW	
Imaging & Image Analysis	Fluorescence imaging, High speed videography, Particle image velocimetry (PIV), Structure factor analysis, Confocal microscopy indentation,	
Simulation	Stokesian dynamics simulation using MATLAB, FEA using LS-Dyna	
Data Analysis	Python with library Pandas, Microsoft Excel	
Software	Image Analysis: ImageJ, Eng. Design: SolidWorks, Graphics Editor: Inkscape	
Others	Application of AC electric fields on colloid samples, buffer preparation, fume/bio hood experience, experienced with sterile method, use of surfactants in colloidal solution, microfluidic syringe pump, Zeta potential measurement for surface charge analysis etc, experienced in interfacing with machine shop and 3D printing.	

PUBLICATIONS

Rahman, Md Mahmudur, Stuart J. Williams. "Cyclic force driven colloidal self-assembly near a solid surface. -submitted. (<u>15 mins summary talk</u> -https://youtu.be/VbS19-blBtU?t=111)

Peer-reviewed journal articles:

- 1. Rahman, Md Mahmudur, Willis Lee, Arvind Iyer, and Stuart J. Williams. "Viscous resistance in drop coalescence." *Physics of Fluids* 31, no. 1 (2019): 012104. (<u>10 mins summary talk</u> <u>https://www.youtube.com/watch?v=bb9JS13dFCA</u>)
- Lee, D., K. Golden, Md M. Rahman, A. Moran, B. Gonzalez, and Sangjin Ryu. "Fabrication of hydrogels with a stiffness gradient using limited mixing in the Hele-Shaw geometry." *Experimental Mechanics* (2018): 1-11.
- Lee, Donghee, Md Mahmudur Rahman, You Zhou, and Sangjin Ryu. "Three-dimensional confocal microscopy indentation method for hydrogel elasticity measurement." *Langmuir* 31, no. 35 (2015): 9684-9693.
- 4. Ehsan, Md, **Md Mahmudur Rahman**, and Hasan Saadi. "Effect of fuel adulteration on engine crankcase dilution." *Journal of Mechanical Engineering* 41, no. 2 (2010): 114-120.

AWARD AND GRANT

2019 ASGSR International Space Station U.S. National Lab Poster Award in Physical Sciences. MM Rahman, John E. Payne, and SJ Williams, "Towards confinement-stabilized colloidal suspensions using a horizontally rotated microfluidic system", delivered, on behalf of ISS U.S. National laboratory, at the 35th Annual Meeting, ASGSR 2019. \$500

2017 **NSF Innovation Corps grant** SJ Williams (Academic Lead), MZ Rashed, and **MM Rahman** (Entrepreneurial Leads), "Isomotive dielectrophoresis (isoDEP) for dielectric spectroscopy of individual cells", University of Louisville NSF I-Corps, 01/17/2017-01/16/2018, \$2,500.

CONTRIBUTED PRESENTATIONS

TALKS

- Rahman, Md Mahmudur, John Payne, and Stuart Williams. "Minimizing particle induced fluid motion in a vertically rotating system." 71st Annual Meeting of the APS Division of Fluid Dynamics (APS DFD), Atlanta, Georgia, November 19, 2018
- Md Mahmudur Rahman, B King, NN Sreeramulu, J Ferguson, H Rathnayake, GA Willing, and SJ Williams, "An extended nanoparticle haloing study in microgravity", 2016 AIChE Annual Meeting, San Francisco, CA, Nov. 13-18, 2016
- 3. SJ Williams, B King, Md M Rahman, M Moradi, JJ Lee, D Bergman, A Penn, D Ryan, GA Willing, and H Rathnayake "Investigating long-term colloid stability in microgravity," *Space Grant Directors Southeast Regional Meeting*, Lexington, KY, September 28-30, **2016**.
- 4. SJ Williams, Md M Rahman, GA Willing, and H Rathnayake "Influence of gravity on nanoparticle haloing colloidal self-assembly," ASGSR Annual Meeting 2015, Alexandria, VA.
- 5. Donghee Lee, Md Mahmudur Rahman, You Zhou, and Sangjin Ryu. "Confocal Microscopy Indentation for Hydrogel." APS March Meeting 2015, San Antonio, Texas
- 6. Rahman, Md Mahmudur, "Coalescence of liquid drops is governed by surface tension driven capillary pressure in the inertial regime", 67th Annual Meeting of the APS Division of Fluid Dynamics (APS DFD, San Francisco, California, November 24, 2014
- John Davidson, Donghee Lee, Md Mahmudur Rahman, and Sangjin Ryu, "Coalescence of drops in the Hele-Shaw geometry", 67th Annual Meeting of the APS Division of Fluid Dynamics, San Francisco, California, November 24, 2014
- 8. Md Mahmudur Rahman, Donghee Lee, Divya Bhagirath, Ziangshan Zhao, Vimla Band Sangjin Ryu, "Controlled-surface-wettability-based fabrication of hydrogel substrates with matrix tethering density variations", APS March Meeting, Denver, Colorado, March 6th, 2014
- 9. Md. Ehsan, Md. Mahmudur Rahman and Md. Hassan Saadi, "An investigation on increase of volume of lubricating oil used in vehicles around Dhaka city", International Conference on Mechanical Engineering (ICME 2007), BUET, Dhaka, Bangladesh, January 1st, 2008

POSTERS

- 1. Md Mahmudur Rahman, John Payne, and Stuart Williams. "Towards confinement-stabilized colloidal suspensions using a horizontally rotated microfluidic system" ASGSR Annual Meeting 2019, Denver, Co.
- 2. Md Mahmudur Rahman & Stuart J Williams. "Coalescence manipulation of landed drops in inkjet printing" 2019 KY Nanotechnology and Additive Manufacturing Symposium, Louisville, KY.
- 3. Md Mahmudur Rahman, John E Payne & Stuart J Williams. "Colloid structure formation through hydrodynamic interactions near a wall in a vertically rotated confined cell." 93rd ACS Colloid & Surface Science Symposium, Atlanta, Georgia, Jun 16-19, 2019
- Md Mahmudur Rahman, Willis Lee, Arvind Iyer, and Stuart Williams. "Hydrodynamics of Drop Coalescence." 71st Annual Meeting of the APS Division of Fluid Dynamics (APS DFD), Atlanta, Georgia, November 19, 2018
- 5. Md Mahmudur Rahman, John Payne, and Stuart Williams. "Long term colloid suspension in a vertically rotating system" ASGSR Annual Meeting 2018, Washington, DC
- 6. Md Mahmudur Rahman, and Stuart Williams. "*Microfluidic motion of suspended colloids within a vertically rotated reference frame*" ASGSR Annual Meeting **2016**, Cleveland, OH
- 7. JJ Lee, M Moradi, Md M Rahman, B King, SJ Williams, and GA Willing, "The influence of gravity on stable crystalline colloidal self-assembly using the nanoparticle haloing method", ASGSR 2016, Cleveland, OH, October 26-29, 2016
- B King, Md M Rahman, G Willing, H Rathnayake, JJ Lee, and SJ Williams, "Image analysis and data visualization for long term studies aboard the ISS with the Light Microscopy Module", ASGSR 2016, Cleveland, OH, October 26-29, 2016