Minghan Xu

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PhD Candidate, McGill University
Vanier Scholar

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Education

Doctor of Philosophy, Dept. of Mining and Materials Engineering, McGill University, GPA: 4.00/4.00 **Sept 2019 — Present**
Bachelor of Engineering (Honours), Dept. of Bioresource Engineering, McGill University, GPA: 3.73/4.00 **Sept 2014 — Feb 2019**

Professional Experience

Graduate Research Assistant (Ph.D. Thesis) **Sept 2019 — Present**
Department of Mining and Materials Engineering, McGill University Montreal, Canada

- Experimental and mathematical frameworks for phase change materials (PCM) for cold thermal energy storage.
- Permafrost adaptation due to climate change in Northern Canada using artificial ground freezing (AGF).
- Thesis Supervisor: *Prof. Agus P. Sasmito*

Research Assistant in Renewable Heating and Cooling Systems (Part-time, Contract) **July 2022 — Present**
CanmetENERGY, Natural Resources Canada Varennes, Canada

- Experimental performance evaluation of a CO2 ground source heat pump system. | Évaluation des performances expérimentales d'un système de pompe à chaleur géothermique au CO2.
- Project Supervisor: *Prof. Parham Eslami Nejad*

MSSI Northern Landscapes Working Group Researcher **Sept 2019 — Apr 2021**
Trottier Institute for Sustainability in Engineering and Design (TISED), McGill University Montreal, Canada

- Sustainable northern landscapes and engineering systems to adapt the effect of climate change for Canada's Arctic regions.
- Project Director: *Prof. Laxmi Sushama*

Undergraduate Research Assistant (B.Eng. Honours Thesis) **June 2017 — Dec 2018**
Department of Bioresource Engineering, McGill University Ste-Anne-de-Bellevue, Canada

- Finite-element simulations of thermal waves for cellular structure in advanced and biological materials.
- Sustainable 3D printing of wood fibre reinforced polyethylene composites using fused deposition modeling (FDM) printers.
- Thesis Supervisor: *Prof. Abdolhamid Akbarzadeh*

Summer Research Assistant (Intern) **May 2018 — Aug 2018**
Agricultural Greenhouse Gases Program, McGill University in collaboration with AAFC Ste-Anne-de-Bellevue, Canada

- Numerical simulations of variably saturated flow in different soil types under surface and subsurface irrigation.
- Field-scale experimental measurements of soil, water and gas flux in Saint Emmanuel, Quebec.
- Project Director: *Prof. Chandra Madramootoo*

Teaching, Tutoring & Mentoring Experience

Graduate Teaching Assistant, Dept. of Mining & Materials Engineering, McGill University **Jan 2021 — June 2021**

- Courses: MIME 422 Mine Ventilation, MIME 333 Materials Handling
- Teach weekly tutorials, design assignments/projects, and mark assignments/projects/exams.
- Enrolment: 47 students [Winter 2021], 31 students [Summer 2021]

Peer Mentor, Mine Multiphyscis Laboratory, McGill University **May 2019 — Dec 2020**

- Erlei Su (Visiting PhD Student) from Chongqing University on CO2 sequestration.
- Jiyuan Zhao (Visiting PhD Student) from Shandong University of Science and Technology on mine water inrush.
- Victor Auger (Graduate Research Trainee) from Universite de Lorraine on two-phase Stefan problems.

Course Assistant, Dept. of Animal Science, McGill University **Sept 2018 — Dec 2018**

- Course: AEMA 101 Calculus I
- Teach semiweekly tutorials, mark midterm exams, hold office hours, and manage course website.
- Enrolment: 163 students [Fall 2018]

Course & Evening Tutorial Coordinator, Freshman Program, McGill University **Sept 2016 — Apr 2018**

- Courses: AEMA 105 Precalculus, AEPH 114/115 (Introductory) Physics II, AEMA 102 Calculus II
- Teach weekly lectures/tutorials, assign problems and quizzes, give review sessions, and manage course website.

Private Tutor, Freshman Program, McGill University **Sept 2015 — Apr 2017**

- Courses: AEPH 112/113 (Introductory) Physics I, AEPA 114/115 (Introductory) Physics II
- Privately tutor at least 2 hours per week during the academic years [Fall 2015 - Winter 2017].

Leadership & Volunteering Experience

Lab Safety Liaison Officer, Dept. of Mining & Materials Engineering **Jan 2022 — Present**

- Responsible of safety and safe work in the lab and safety communication within the department.

Vice President, Mining and Materials Graduate Engineering Student Association (MMGESA) **Sept 2019 — Aug 2022**

- Representative of graduate students in mining engineering at McGill University.
- Cultivate the executive association team to reason as a unit. Organize various social events and academic seminars. Actively involve in new-idea generation, decisions making, compromise negotiation, and task execution.

Volunteer, Montreal Metropolitan Area **Oct 2017 — Aug 2022**

- *Judge.* Summer Undergraduate Research in Engineering (SURE) Program Poster Presentation/Competition at McGill (Downtown).
- *Staff Volunteer.* Canadian Institute of Mining, Metallurgy and Petroleum (CIM) 2019; North American Mine Ventilation Symposium (NAMVS) 2019; Max Amini Stand-up Comedy Show (Montreal 2020).
- *Student Representative Speaker.* Internship Poster Symposium 2017 at McGill (Macdonald).

Councilor Member, Post-Graduate Students' Society (PGSS) **Sept 2019 — Aug 2020**

- Representative of graduate students in the Department of Mining and Materials Engineering at a university level.
- Promote sustainable and multicultural development projects around campus (e.g., COVID-19 transparency, climate change protests, and cultural corners in library). Speak up for students with visible minority at the university.

Honors & Distinctions

Ranked 22nd out of 172 nominees in a National Competition of Doctoral Students (Vanier CGS)	2022
Ranked 1st out of 31 candidates in a Provincial Competition of Graduate Students at Doctoral Level (FRQ-NT B2X)	2021
Ranked 2nd out of 15 candidates in a Provincial Competition of Graduate Students at Master's Level (FRQ-NT B1X)	2021
First Class Honours in Bioresource Engineering at McGill University	2019
Achievement with Honours (Academic Excellence and Leadership) in Maple Leaf International High School	2014

Awards, Scholarships & Fellowships

Vanier Canada Graduate Scholarship ($50,000×3=$150,000)	05/2022 - 05/2025
FRQ-NT B2X for Doctoral Students ($21,000×3+$9,000=$70,000)	09/2021 - 08/2025
Graduate Excellence Fellowships in Engineering ($3,500+$5,000+$5,000=$13,500)	01/2020 - 08/2023
McGill Engineering Doctoral Award ($32,000×3+$27,000=$123,000)	09/2019 - 04/2023
Graduate Research Enhancement and Travel (GREAT) Award ($427+$400+$900=$1,727)	05/2021 - 08/2022
2021 Research Excellence Award in Mining & Materials Engg.- James Douglas Felw. ($3,000)	05/2021
Rio Tinto-Richard Evans Fellowship in Engineering ($14,000)	09/2021 - 04/2022
Post-Graduate Students' Society (PGSS) Travel Awards ($468.44+$593.19=$1,061.63)	09/2020 - 12/2021
FRQ-NT B1X for Master's Students ($5,834)	05/2021 - 08/2021
Graduate Excellence Award in Mining & Materials Engineering ($3,000)	01/2021 - 08/2021
Best Paper Award in Energy Storage in the Conference "ATE-HEFAT 2021"	07/2021
Best Student Paper Award in the Conference "18th NAMVS"	06/2021
2020 Research Excellence Award in Mining & Materials Engg.- James Douglas Felw. ($2,500)	05/2021
MSSI Landscapes Research Graduate Award ($5,000+$2,000+$4,000=$11,000)	09/2019 - 04/2021
J. M. Bishop and Family Fellowships for Sustainability in Engineering ($5,406.80)	09/2019 - 04/2020
Tomlinson Undergraduate Awards ($300×11=$3,300)	09/2015 - 12/2018
Agriculture and Agri-Food Canada - Agricultural Greenhouse Gases Program Phase 2 ($2,700)	05/2018 - 08/2018
Sustainability Projects Fund ($5,173)	09/2017 - 04/2018
Bieler Family Internship Award ($1,000)	05/2017 - 08/2017

Technical Skills

Editing and Graphing Tools	LaTeX, Office 365 (Words, Excel, PowerPoint, Visio), Inkscape
Programming Languages	MATLAB, Python, Mathematica, R, SAS
3D Modeling & Segmentation	Solidworks, AutoCad, 3D Slicer, Fie (Biomedical)
Experimental Tools	3D Printing, Filament Extruding, Silicone Rubber Molding
Finite-Element/Volume Simulations	ANSYS FLUENT, COMSOL, FiPy, FEBio Software Suite
Molecular Dynamics Simulations	LAMMPS
Mine Ventilation Simulations	VentSim DESIGN
Operating Systems	Linux, Windows, macOS
Languages	English (Fluent), Mandarin (Fluent), French (Basic)

Extracurricular Activities

Musical	Leading Actor in the School Musical "Mamma Mia!" Collaborated with International Casts
Scuba Diving	Certified PADI (Professional Association of Diving Instructors) Open Water Diver
Tai Chi	Taught by the 19th Generation of Chen-Style Taijiquan Master

Peer-Reviewed Journal Publications

(* denotes equal authorship)

18. Gao, Y., Ren, Y., **Xu, M.**, Liu, J., Mujumdar, A. S., Sasmito, A. P., 2023. Influence of thermal cycling on stability and thermal conductivity of nanofluid ice slurry. *International Journal of Thermal Sciences, 185,* p.108113. https://doi.org/10.1016/j.ijthermalsci.2022.108113

17. Gao, Y., Ning, Y., Wu, C., **Xu, M.**, Akhtar, S., Mujumdar, A. S., Sasmito, A. P., 2023. Experimental investigation of producing ice slurry with water using opposed-nozzle impinging jet method. *Applied Thermal Engineering, 219,* p.119568. https://doi.org/10.1016/j.applthermaleng.2022.119568

16. Hefni, M.A.*, **Xu, M.***, Zueter, A.F., Hassani, F., Eltaher, M.A., Ahmed, H.A., Saleem, H.A., Ahmed, H.A.M., Hassan, G.S.A., Ahmed, K.I., Moustafa, E.B., Ghandourah, E., Sasmito, A.P., 2022. A 3D space-marching analytical model for geothermal borehole systems with multiple heat exchangers. *Applied Thermal Engineering, 216,* p.119027. https://doi.org/10.1016/j.applthermaleng.2022.119027

15. Gao, Y., Ning, Y., **Xu, M.**, Wu, C., Mujumdar, A. S., Sasmito, A. P., 2022. Numerical investigation of aqueous graphene nanofluid ice slurry passing through a horizontal circular pipe: Heat transfer and fluid flow characteristics. *International Communications in Heat and mass Transfer, 134,* p.106022. https://doi.org/10.1016/j.icheatmasstransfer.2022.106022

14. Zhao, J., Liu, W., Shen, J., **Xu, M.**, Sasmito, A. P., 2022. A real-time monitoring temperature-dependent risk index for predicting mine water inrush from collapse columns through a coupled thermal–hydraulic-mechanical model. *Journal of Hydrology, 607,* p.127565. https://doi.org/10.1016/j.jhydrol.2022.127565

13. **Xu, M.**, Gao, Y., Fang, F., Akhtar, S., Chaedir, B. C., Sasmito, A. P., 2022. Experimental and unified mathematical frameworks of water-ice phase change for cold thermal energy storage. *International Journal of Heat and Mass Transfer, 187,* p.122536. https://doi.org/10.1016/j.ijheatmasstransfer.2022.122536

12. Agson-Gani, P. H., Zueter, A. F., **Xu, M.**, Ghoreishi-Madiseh, S. A., Kurnia, J. C., Sasmito, A. P., 2022. Thermal and hydraulic analysis of a novel double-pipe geothermal heat exchanger with a controlled fractured zone at the well bottom. *Applied Energy, 310,* p.118407. https://doi.org/10.1016/j.apenergy.2021.118407

11. Hefni, M.A.*, **Xu, M.***, Hassani, F., Ghoreishi-Madiseh, S.A., Ahmed, H.A., Saleem, H.A., Ahmed, H.A.M., Hassan, G.S.A., Ahmed, K.I., Sasmito, A.P., 2021. An analytical model for transient heat transfer with a time-dependent boundary in solar- and waste-heat-assisted geothermal borehole systems: From single to multiple boreholes. *Applied Sciences, 11*(21), p.10338. https://doi.org/10.3390/app112110338

10. **Xu, M.**, Akhtar, S., Zueter, A. F., Alzoubi, M. A., Sushama, L., Sasmito, A. P., 2021. Asymptotic analysis of a two-phase Stefan problem in annulus: Application to outward solidification in phase change materials. *Applied Mathematics and Computation, 408,* p.126343. https://doi.org/10.1016/j.amc.2021.126343

9. Zhao, J., Liu, W., Shen, J., **Xu, M.**, Sasmito, A. P., 2021. Fractal treelike fracture network model for hydraulically and mechanically induced dynamic changes in the non-Darcy coefficient during the process of mine water inrush from collapsed columns. *Fractals, 29*(7), p.2150218. https://doi.org/10.1142/S0218348X21502182

8. Akhtar, S., **Xu, M.**, Sasmito, A. P., 2021. A novel crystal growth model with non-linear interface kinetics and curvature effects: Sensitivity analysis and optimization. *Crystal Growth & Design, 21*(6), p.3251-3265. https://doi.org/10.1021/acs.cgd.0c01652

7. Zueter, A. F., **Xu, M.**, Alzoubi, M. A., Sasmito, A. P., 2021. Development of computationally efficient conjugate reduced-order models for artificial ground freezing: Thermal and computational analysis. *Applied Thermal Engineering, 190,* p.116782. https://doi.org/10.1016/j.applthermaleng.2021.116782

6. Akhtar, S., **Xu, M.**, Sasmito, A. P., 2021. Development and validation of an asymptotic solution for a two-phase Stefan problem in a droplet subjected to convective boundary condition. *International Journal of Thermal Sciences, 164,* p.106923. https://doi.org/10.1016/j.ijthermalsci.2021.106923

5. Akhtar, S., **Xu, M.**, Sasmito, A. P., 2021. Development and validation of a semi-analytical framework for droplet freezing with heterogeneous nucleation and non-linear interface kinetics. *International Journal of Heat and Mass Transfer, 166,* p.120734. https://doi.org/10.1016/j.ijheatmasstransfer.2020.120734

4. Su, E., Liang, Y., Zou, Q., **Xu, M.**, Sasmito, A. P., 2021. Numerical analysis of permeability rebound and recovery during coalbed methane extraction: Implications for CO2 injection methods. *Process Safety and Environmental Protection, 149,* p.93-104. https://doi.org/10.1016/j.psep.2020.10.037

3. **Xu, M.**, Akhtar, S., Zueter, A. F., Auger, V., Alzoubi, M. A., Sasmito, A. P., 2020. Development of analytical solution for a two-phase Stefan problem in artificial ground freezing using singular perturbation theory. *Journal of Heat Transfer, 142*(12), p.122401. https://doi.org/10.1115/1.4048137

2. Alzoubi, M. A., **Xu, M.**, Hassani, F. P., Poncet, S., Sasmito, A. P., 2020. Artificial ground freezing: A review of thermal and hydraulic aspects. *Tunnelling and Underground Space Technology, 104,* p.103534. https://doi.org/10.1016/j.tust.2020.103534

1. Su, E., Liang, Y., Chang, X., Zou, Q., **Xu, M.**, Sasmito, A. P., 2020. Effects of cyclic saturation of supercritical CO2 on the pore structures and mechanical properties of bituminous coal: An experimental study. *Journal of CO2 Utilization, 40,* p.101208. https://doi.org/10.1016/j.jcou.2020.101208

Peer-Reviewed Conference Proceedings

(* denotes equal authorship; _ denotes presenting author)

12. Zolfagharroshan, M., Zueter A.F., **Xu, M.**, Sasmito, A. P., 2022. A novel reduced-order model for transient heat transfer in thermosyphon for geothermal systems. *Proceedings of the 16th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics (HEFAT).* August 8-10, 2022, Virtual Conference, Online.

11. **Xu, M.***, Akhtar, S.*, Sasmito, A. P., 2022. A multiscale modeling framework for droplet solidification using phase field method. *Proceedings of the 16th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics (HEFAT).* August 8-10, 2022, Virtual Conference, Online.

10. Gao, Y.*, **Xu, M.***, Wu, C., Fang, F., Akhtar, S., Mujumdar, A. S., Sasmito, A. P., 2022. Experimental and analytical investigations of ice slurry production using spray freezing. *Proceedings of the 14th International Conference on Applied Energy (ICAE).* August 8-11, 2022, Bochum, Germany. https://applied-energy.org/icae2022

9. Agson-Gani, P. H., Zueter, A., **Xu, M.**, Sasmito, A. P., 2021. Development of a 1+1D reduced-order model in double-pipe geothermal heat exchanger systems: From single to multiple boreholes. *Proceedings of the 13th International Conference on Applied Energy (ICAE).* November 29 - December 2, 2021, Bangkok, Thailand. https://applied-energy.org/icae2021cfp

8. **Xu, M.**, Akhtar, S., Sasmito, A. P., 2021. A heterogenous nucleation model for supercooled water and sucrose solution droplets under ultra-cold environments. *Proceedings of the American Society of Mechanical Engineers IMECE 2021.* November 1-4, 2021, Virtual Conference, Online. https://doi.org/10.1115/IMECE2021-68974

7. **Xu, M.**, Ghoreishi-Madiseh, S. A., Sasmito, A. P., 2021. Analytical solution for computationally efficient closed-loop geothermal system using multiple boreholes equipped with coaxial heat exchangers. *Proceedings of the 15th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics (HEFAT).* July 25-28, 2021, Virtual Conference, Online. https://hefat2021.org **(Best Paper Award)**

6. Akhtar, S., **Xu, M.**, Sasmito, A. P., 2021. Spray freezing for mine heating: A statistical perspective. *Proceedings of the 18th North American Mine Ventilation Symposium (NAMVS).* June 12–17, 2021, Virtual Conference, Online. https://doi.org/10.1201/9781003188476 **(Best Student Paper Award)**

5. **Xu, M.**, Akhtar, S., Zueter, A. F., Alzoubi, M. A., Sasmito, A. P., 2020. Analytical modeling of outward solidification with convective boundary in cylindrical coordinates. *Proceedings of the American Society of Mechanical Engineers IMECE 2020.* November 16-19, 2020, Virtual Conference, Online. https://doi.org/10.1115/IMECE2020-23397

4. Zueter, A. F., **Xu, M.**, Alzoubi, M. A., Sasmito, A. P., 2020. Effect of freeze pipe eccentricity in artificial ground freezing applications. *Proceedings of the American Society of Mechanical Engineers IMECE 2020.* November 16-19, 2020, Virtual Conference, Online. https://doi.org/10.1115/IMECE2020-23417

3. **Xu, M.**, Akhtar, S., Alzoubi, M. A., Sasmito, A. P., 2019. Singular perturbation solution for a two-phase Stefan problem in outward solidification. *Proceedings of the American Society of Mechanical Engineers IMECE 2019.* November 11-14, 2019, Salt Lake City, UT, USA. https://doi.org/10.1115/IMECE2019-11033

2. Akhtar, S., **Xu, M.**, Sasmito, A. P., 2019. Verification and validation of droplet freezing for convective boundary condition using matched asymptotic perturbation method and computational fluid dynamics. *Proceedings of the American Society of Mechanical Engineers IMECE 2019.* November 11-14, 2019, Salt Lake City, UT, USA. https://doi.org/10.1115/IMECE2019-12081

1. **Xu, M.**, Akhtar, S., Alzoubi, M. A., Sasmito, A. P., 2019. Development and verification of two-phase Stefan problem using perturbation method for artificial ground freezing. *Proceedings of the 27th Canadian Congress of Applied Mechanics (CANCAM).* May 27-30, 2019, Sherbrooke, QC, CA. http://cancam2019.evenement.usherbrooke.ca/FINAL_PROGRAM.pdf

Oral & Poster Communications

(_ denotes presenting author)

3. **Xu, M.**, Zueter, A. F., Sasmito, A. P., 2022. Development and validation of a space-marching analytical model for selective artificial ground freezing in underground mines. *Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Convention & EXPO 2022.* May 1-4, 2022, Vancouver, BC, CA. https://convention.cim.org/2022/en

2. Teufel, B., Oh, S., Poitras, C., Ruman, C., Pasco, A., **Xu, M.**, Sushama, L., Kumral, M., Sasmito, A., 2019. Sustainable Northern Landscapes and Engineering Systems. *Annual McGill Sustainability Systems Initiative (MSSI) Research Symposium. McGill University.* October 16, 2019, Montreal, QC, CA. https://www.mcgill.ca/mssi/events

1. **Xu, M.**, Akbarzadeh, A., Mirabolghasemi, A., Boldini, A., 2017. Thermal Analysis of Cellular Materials Based on Non-Fourier Heat Conduction: A Finite Element Approach. *McGill Internship Poster Event by the Office of Student Academic Services. McGill University.* October 5, 2017, Montreal, QC, CA. https://mcgill.ca/osas/files/osas/viewbook_2017.pdf