

# Ibrahim Chamseddine | Ph.D.

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## Education

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### McGill University

Montreal, Canada

Doctor of Philosophy, Mechanical Engineering

September 2014–December 2018

- **Thesis** Utilizing Computational Design Optimization in Cancer Nanotherapy and Biology System Principles in Air Transportation: a Successful Demonstration of Interdisciplinary Research

Supervised by Prof. Michael Kokkolaras

- My thesis received the [2018 Best PhD Thesis Award](#) from GERAD – Group a for Research in Decision Analysis, a multi-university research cluster focusing on optimization and decision making.
- GPA 4.00

### American University of Beirut

Beirut, Lebanon

Master of Engineering, Mechanical Engineering

September 2011–October 2013

- **Thesis** Modeling of Neonatal Oxygenation Covering the Dynamics of the Alveoli

Supervised by Prof. Issam Lakkis

- GPA 4.00

### American University of Beirut

Beirut, Lebanon

Bachelor of Engineering, Mechanical Engineering

February 2007–June 2011

- Graduated with *High Distinction*, GPA 4.00, and was on the *Dean's Honor List*

## Skills

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**Computational Expertise:** Clinical prediction models, machine learning, design optimization, multi-criteria optimization, survival analysis, casual inference, Bayesian networks, mechanistic modeling, mathematical oncology, and tumor control probability and normal tissue complication probability models

**Software:** Python, MATLAB, R, COMSOL Multiphysics, C++, Ansys, LabVIEW, PSpice, Fortran, SolidWorks, AutoCAD, L<sup>A</sup>T<sub>E</sub>X, Most MS Office products

**Familiarity with Experimental Methods:** Cell culture, enzyme-linked immunosorbent assay, molecular cloning, bacteria transformation, polymerase chain reaction, and Galvanic corrosion test

## Research Experience

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### Harvard Medical School & Massachusetts General Hospital

Boston, MA, USA

Postdoctoral Research Fellow

April 2020 – Present

Radiation Oncology Department, Radiation-Drug Treatment Design Lab

- Developing machine learning models to predict liver toxicity post radiotherapy in hepatocellular carcinoma
- Developing machine-learning models to predict recurrence in medulloblastoma and identify patients in need for treatment redesign
- Writing a book chapter on Artificial Intelligence in Radiation Oncology

## **H. Lee Moffitt Cancer Center & Research Institute**

**Tampa, FL, USA**

*Postdoctoral Research Fellow*

*January 2019 – March 2020*

Integrated Mathematical Oncology, Rejniak Lab

- Developed a machine-learning model to predict the expansion of tumor infiltrating lymphocytes in bladder cancer
- Modeled vaccine-induced immunotherapy in melanoma and optimized drug schedule in combination with anti-PD1
- Optimized biophysical properties of pancreatic tumor-specific ligand to overcome barriers to transport
- Modeled cell-ECM interaction and deconvoluted drug and microenvironmental effects on tumor growth
- Optimized treatment schedules for a combination of Hypoxia-Activated Prodrugs, sensitizer, and vasodilator, maximizing their synergy in causing cell death in pancreatic cancer
- Participated in writing an R01 grant proposal on optimizing adoptive immunotherapy in bladder cancer
- Wrote and received an internal grant to develop a machine learning model to predict vaccine-induced lymphocyte expansion in bladder cancer

## **McGill University**

**Montreal, QC, Canada**

*Graduate Student Research Assistant*

*September 2014 – December 2018*

Department of Mechanical Engineering, Systems Optimization Lab

- Modeled the delivery of anticancer drug-carrying nanoparticles to a 2D in-silico tumor
- Optimized the design of nanoparticles to maximize tumor reduction and tumoral nanoparticle accumulation
- Developed a dual nanoparticle delivery strategy that enhanced drug distribution in tumors
- Developed a bio-inspired route network configuration approach for air transportation system-of-systems optimization problems, allowing up to 33% larger airline networks to be studied

## **American University of Beirut**

**Beirut, Lebanon**

*Graduate Student Research Assistant*

*September 2011 – October 2013*

Department of Mechanical Engineering, Microflows and Microscale Heat Transfer Laboratory

- Modeled the oxygenation process in neonatal lungs
- Studied the effect of wide-band pressure oscillations on enhancing the oxygenation process
- Optimized the Bubble Nasal Continuous Positive Airway Pressure treatment typically delivered to premature infants
- Applied slip and no-through boundary conditions using vortex methods in microflows of low Knudsen number

## **American University of Beirut**

**Beirut, Lebanon**

*Undergraduate Student*

*September 2010 – June 2011*

Department of Mechanical Engineering

- Designed a new liquid-solid contact RF MEMS switch as alternative to conventional solid-solid contact switches, increasing their life-time with a conservative estimate of 20%.

## **Fellowships & Grants**

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### **Tumor Board Evolution Competition**

**November 2019**

*Moffitt Cancer Center & Research Institute, Tampa, FL*

*\$50,000*

Runner-up award to our multidisciplinary team for our proposed framework on "improving survival in pediatric osteosarcoma from standard of care to relapse"

### **Junior Scientist Research Partnership Award**

**November 2019-October 2020**

*Moffitt Cancer Center & Research Institute, Tampa, FL*

*\$10,000*

Grant prepared in collaboration with a clinician, proposing the development of a machine learning model to predict the success of tumor infiltrating lymphocyte in bladder cancer

**McGill Engineering Doctoral Award** **September 2014 – August 2017**  
*Faculty of Engineering, McGill University, Montreal, Canada* *\$96,000*  
This award is given to admitted Ph.D. students based on their academic and research record, and their potential to make a major impact on the field of engineering. I received this award at the beginning of my Ph.D. and was partially supported by it in the first 3 year of my studies.

## Awards & Honours

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### Scientific Awards and Competitions.....

**People's Choice Award** **September 2019**  
*Physical Sciences Oncology Network Investigators Meeting, Minneapolis, MN.*  
Competed with 68 other posters. This award recognizes the ability to present the science to patient advocates and non-scientists in an engaging and accessible manner.

**2018 Best PhD Thesis Award** **April 2019**  
*Group for Research in Decision Analysis (GERAD), Montreal, Canada*  
GERAD is a Canadian multi-university research center on decision-making. It currently has 93 professors, 37 postdoctoral trainees, 219 Ph.D students, and 157 Master's student. This award is given once a year to the best Ph.D. thesis submitted by a GERAD student.

**Dean's Honor List** **Spring 2007 – Spring 2011**  
*Faculty of Engineering, American University of Beirut, Beirut, Lebanon*  
To be placed on the Dean's Honor List, an undergraduate student need to have an overall average of 85% or be in the top 10% of the class. I was on the Dean's Honor's List for the most of my semesters.

**First Prize Winner of the Mathematics Competition** **April 2005**  
*Mathematics and Technology Fair, American University of Beirut, Beirut Lebanon*  
National-wide high school students in Lebanon participated in this competition.

### Travel Awards.....

**National Cancer Institute Travel Award** **September 2019**  
*Physical Sciences Oncology Network Investigators Meeting, Minneapolis, MN.*

**Graduate Research Enhancement and Travel Award** **September 2017**  
*Department of Mechanical Engineering, McGill University, Montreal, Canada*

**Competition for Doctoral Fellowships "Conference Fees"** **July 2017**  
*Group for Research in Decision Analysis, Montreal, Canada*

**Highly Qualified Personnel Travel Award** **September 2016**  
*McGill Institute for Aerospace Engineering, Montreal, Canada*

**Graduate Research Enhancement and Travel Award** **September 2016**  
*Department of Mechanical Engineering, McGill University, Montreal, Canada*

## Teaching Experience

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**McGill University** **Montreal, QC**  
*Teaching Assistant, Department of Mechanical Engineering* *September 2015–April 2018*

- MECH 463: Mechanical Engineering Capstone Design Project (a two-term course, 2 times)
- MECH 210: Mechanics 1 (6 times)

## American University of Beirut

Teaching Assistant, Department of Mechanical Engineering

Beirut, Lebanon

October 2011–June 2013

- *Mechanical Engineering Program:*
  - MECH 220: Engineering Graphics
  - MECH 310: Thermodynamics I
  - MECH 314: Introduction to Fluids Engineering
  - MECH 435L: Control Systems Laboratory II
- *Chemical Engineering Program:*
  - CHEN 200: Introduction to Chemical Engineering
  - CHEN 311: Introduction to Fluids Engineering
  - CHEN 314: Chemical Engineering Thermodynamics
  - CHEN 411: Mass and Heat Transfer Operations
- *Graduate Courses:*
  - MECH 603: Solar Energy
  - MECH 660: Advanced Fluid Mechanics

## Mentoring Experience

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### Moffitt Cancer Center & Research Institute

*Integrated Mathematical Oncology High School Internship Program*

Co-mentor for two students working on modeling of vaccine-induced immunotherapy

Tampa, FL, USA

June 2019–August 2019

### McGill University

*Mechanical Engineering Capstone Design Project*

Co-advisor for two capstone teams working on:

- Lung model to be installed in patient simulators developed by a global healthcare company
- In-home device to relieve symptoms associated with acute Laryngotracheitis

Montreal, Canada

September 2017–April 2018

## Peer-Review Activity

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Journals I reviewed for:

- JCO Clinical Cancer Informatics
- Journal of Theoretical Biology
- Structural and Multidisciplinary Optimization
- IEEE Transactions on Cybernetics
- Journal of Aircraft
- International Conference of Machine Learning

## Internships

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### A.T. Kearney

*Business Analyst*

Worked on supply chain management, procurement studies, and cost-cutting strategies.

Dubai, UAE

June 2010 – August 2010

## Publications

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### Refereed Journal Articles.....

1. **I. M. Chamseddine** and M. Kokkolaras. "A Dual Nanoparticle Delivery Strategy for Enhancing Drug Distribution in Cancerous Tissue". *Journal of Biomechanical Engineering*, accepted. doi: [10.1115/1.4047657](https://doi.org/10.1115/1.4047657).
2. **I. M. Chamseddine**, H. Frieboes, and M. Kokkolaras. "Multi-objective Optimization of Tumor Response to Drug Release from Vasculature-Bound Nanoparticles". *Nature Scientific Reports*, , vol. 10, no. 1, pp. 1–11, 2020. doi: [10.1038/s41598-020-65162-2](https://doi.org/10.1038/s41598-020-65162-2).
3. **I. M. Chamseddine** and K. A. Rejniak. "Hybrid Modeling Frameworks of Tumor Development and Treatment," *WIREs Systems Biology and Medicine*, 2019. pp. 1–16. doi: [10.1002/wsbm.1461](https://doi.org/10.1002/wsbm.1461).
  - o This paper is featured in *Advanced Science News*.
4. **I. M. Chamseddine**, H. B. Frieboes, and M. Kokkolaras, "Design Optimization of Tumor Vasculature-Bound Nanoparticles," *Nature Scientific Reports*, vol. 8, no. 17768, pp. 1–15, 2018. doi: [10.1038/s41598-018-35675-y](https://doi.org/10.1038/s41598-018-35675-y).
5. **I. M. Chamseddine** and M. Kokkolaras, "Nanoparticle Optimization for Enhanced Targeted Anticancer Drug Delivery," *Journal of Biomechanical Engineering*, vol. 140, no. 4, pp. 041002–1–10, 2018. doi: [10.1115/1.4038202](https://doi.org/10.1115/1.4038202).
  - o This paper is selected by *GERAD* research center to be featured in their *semiannual bulletin* from a pool of 80 candidate papers
6. **I. M. Chamseddine** and M. Kokkolaras, "Bio-Inspired Heuristic Network Configuration in Air Transportation System-of-Systems Design Optimization," *ASME Journal of Mechanical Design*, vol. 139, no. 8, pp. 081401–1–8, 2017. doi: [10.1115/1.4036778](https://doi.org/10.1115/1.4036778).

### Preprints.....

1. P. Bhatt, M. Kambara, S. Pilon-Thomas, K. A. Rejniak, **I. M. Chamseddine**. "Modeling vaccine-induced immunotherapy: treatment scheduling and robustness with virtual mice cohorts", *BioRxiv*, 2019. doi: [10.1101/740878](https://doi.org/10.1101/740878)
2. N. Vitos, S. Chen, S. Mathur, **I. M. Chamseddine**, K. A. Rejniak. "Hypoxia in cancer chemo- and immunotherapy: foe or friend?", *BioRxiv*, 2019. doi: [10.1101/629907](https://doi.org/10.1101/629907)

### Refereed Conference Participation.....

1. **I. M. Chamseddine**, L. Abu-Hammour, A. Karolak, K. A. Rejniak, "Optimizing the Uptake of Targeted Therapies in an In Silico Model of Pancreatic Tumor", *Biomedical Engineering Society Annual Meeting*, October 16-19, 2019, Philadelphia, PA, USA.
2. **I. M. Chamseddine**, H. B. Frieboes, and M. Kokkolaras. "Multi-objective Optimization of Nanotherapy Targeting Tumor Vasculature", *Biomedical Engineering Society Annual Meeting*, October 16-19, 2019, Philadelphia, PA, USA.
3. **I. M. Chamseddine**, Lawrence Abu-Hammour, Aleksandra Karolak, and Katarzyna A. Rejniak "Optimizing the Uptake of Targeted Therapies in an In Silico Model of Pancreatic Tumor", *3<sup>rd</sup> Annual Cancer Biology and Evolution Symposium*, October 14, 2019, Tampa, FL, USA.
  - o Selected for a *highlight talk*
4. **I. M. Chamseddine**, A. Karolak, S. Poonja, D. A. Markov, L. J. McCawley, K. A. Rejniak. "Deconvolution of Microenvironmental and Drug Effects on Tumor Growth using In Silico Organoids". *Physical Sciences in Oncology Network (PSON) Annual Investigators Meeting*, September 18-20, 2019, Minneapolis, MN, USA.
  - o Selected for a *lightning talk* and won a *travel award* from the National Institute of Cancer

- Won the *People's Choice Award* among 70 posters
- 5. **I. M. Chamseddine**, A. Karolak, S. Poonja, D. A. Markov, L. J. McCawley, K. A. Rejniak. "Deconvolution of Microenvironmental and Drug Effects on Tumor Growth using In Silico Organoids". *Physical Sciences in Oncology Network (PSON) Junior Investigators Meeting*, August 22-23, 2019, Washington D.C, USA.
  - Selected for a *lightning talk*
- 6. **I. M. Chamseddine**, A. Karolak, L. Abu-Hammour, K. A. Rejniak. "Optimizing Ligand Properties in Pancreatic Cancer Targeted Therapy". *Society for Mathematical Biology Annual Meeting*, July 21-26, 2019, Montreal, Canada.
  - I also organized the "*Advances in Cancer Treatment Scheduling and Optimization*" minisymposium
- 7. **I. M. Chamseddine**, H. B. Frieboes, and M. Kokkolaras. "Numerical Optimization in Cancer Nanotherapy". *Society for Mathematical Biology Annual Meeting*, July 21-26, 2019, Montreal, Quebec, Canada.
- 8. **I. M. Chamseddine**, S. Mathur, S. Chen, L. Abu-Hammour, A. Karolak, K. A. Rejniak. "Novel Method for Optimizing Anti-Cancer Treatments: An Application to Pancreatic Tumors". *CSBC-PSON Mathematical Oncology Meeting*, May 13-14, 2019, Portland, Oregon, USA.
- 9. **I. M. Chamseddine**, S. Mathur, S. Chen, L. Abu-Hammour, A. Karolak, K. A. Rejniak. "Novel Method for Optimizing Anti-Cancer Treatments: An Application to Pancreatic Tumors". *Moffitt Scientific Symposium*, May 1-2, 2019, Tampa, Florida, USA.
- 10. **M. Matheou**, I. M. Chamseddine, M. Kokkolaras, and M. C. Phocas. "Reconfiguration Sequence Optimization of a Bar-Linkage Structure", *Proceedings of the International Association for Shell and Spatial Structures Annual Symposium*, October 7-10, 2019, Barcelona, Spain.
- 11. **I. M. Chamseddine**, H. B. Frieboes, and M. Kokkolaras. "Design Optimization of Anticancer Nanoparticles Considering Vascularized Tumor Growth Dynamics". *Biomedical Engineering Society Annual Meeting*, October 17-20, 2018, Atlanta, GA, USA.
- 12. **I. M. Chamseddine**, H. B. Frieboes, and M. Kokkolaras. "Surrogate-Assisted Optimization of Model-Designed Cancer Nanotherapy ". *Group for Research in Decision Analysis (GERAD) Optimization Days*, May 7-9, Montreal, Canada.
  - Accepted for a *talk*
- 13. **I. M. Chamseddine** and M. Kokkolaras. "Design Optimization of Dual Nanoparticle Delivery for Enhanced Cancer Treatment". *Biomedical Engineering Society Annual Meeting*. October 11-14, 2017, Phoenix, AZ, USA.
- 14. **I. M. Chamseddine** and M.Kokkolaras. "Multi-Objective Design Optimization of Drug Nanocarriers Targeting Tumors". *Society for Mathematical Biology Annual Meeting*. July 17-21, Salt Lake City, UT, USA.
  - Accepted for a *talk*
- 15. **I. M. Chamseddine** and M. Kokkolaras. "Bio-Inspired Heuristic for DecouplingNetwork Configuration in Air Transportation System-of-Systems Design Optimization", *Proceedings of the 42nd American Society of Mechanical Engineers (ASME) Design Automation Conference*, August 21-24, 2016, Charlotte, NC, USA.
  - Accepted for a *talk*
- 16. **I. M. Chamseddine**, H. Kasab, M. Antoun, T. Dahdah, M. Merhi, I. Lakkis. "Analysis and Design of Robust RF MEMS Switch", *Proceedings of the 11th American Society of Mechanical Engineers (ASME) Biennial Conference on Engineering Systems Design and Analysis*, July 2-4, 2012, Nante, France.
  - Accepted for a *talk*

## Invited Talks

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- **September 20, 2018:**  
Biomedical Engineering Program, American University of Beirut, Beirut, Lebanon.  
*Design Optimization of Nanoparticles for Enhanced Anticancer Drug Delivery*
- **September 26, 2018:**  
Biomedical Engineering Program, American University of Beirut, Beirut, Lebanon.  
*Design Optimization of Nanoparticles for Enhanced Anticancer Drug Delivery*
- **August 24, 2018:**  
Theory Division Lab, Cleveland Clinic – Lerner Research Institute, Cleveland, OH, USA.  
*Design Optimization of Nanoparticles for Enhanced Anticancer Drug Delivery*
- **August 27, 2018:**  
Department of Integrated Mathematical Oncology, Moffitt Cancer Center & Research Institute, Tampa, FL, USA.  
*Design Optimization of Nanoparticles for Enhanced Anticancer Drug Delivery*
- **November 21, 2017:**  
"Un Chercheur du GERAD Vous Parle" Seminar, Group for Research in Decision Analysis, Montreal, Canada.  
*Multi-objective Optimization of Drug Carrying Nanoparticles for Enhanced Cancer Therapies*
- **May 2013:**  
Department of Mechanical Engineering, American University of Beirut, Beirut, Lebanon.  
*A Model of Neonatal Oxygenation Covering the Dynamics of Alveolus*

## Volunteering

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### Academic.....

**June 2020:** Program committee member of Computational Biology Symposium at the International Conference of Machine Learning.

**March 2020:** Judge of student's presentations at the annual research day of Group for Research in Decision Analysis. Montreal, Canada.

**July 2019:** Organized a mini-symposium about advances in cancer treatments scheduling and optimization in the 2019 Society for Mathematical Biology Annual Meeting. Montreal, Canada.

**April-May 2019:** Reviewed the nomination applications for the Moffitt Research Mentor of the Year Award and presented the award to Dr. Vani Nath Simmons. Tampa, FL, USA.

**April 2019:** Represented Moffitt Cancer Center at the National Postdoctoral Annual Conference. Orlando, FL, USA

**Fall 2016:** Selected by the Department of Mechanical Engineering at McGill University be a Teaching Assistant representative to the Canadian Engineering Accreditation Board. Montreal, Canada.

**Summer 2016:** Judged at the McGill Summer Undergraduate Research in Engineering for the Bioengineering and Biotechnology section. Montreal, Canada.

**Spring 2012:** Judged at Al Rawda Science Fair, the largest high school's science fair in Lebanon. Beirut, Lebanon.

**2011:** Participated with a multinational team in the Hult Prize challenge to provide a business model with innovative engineering solutions for the global Clean Water Crisis. Dubai, UAE.

**Fall 2009:** Selected by the Department of Mechanical Engineering at the American University of Beirut to present the Thermal/Fluids Lab to the Accreditation Board for Engineering and Technology assessment team. Beirut, Lebanon.

### Patient Advocacy and Outreach.....

**June 2019:** Participated in Moffitt Patient-Researcher Form for breast cancer. Tampa, FL, USA.

**April 2019:** Participated in Moffitt Patient-Researcher Form for prostate cancer. Tampa, FL, USA.

**March 2019:** Participated in Moffitt Patient-Researcher Form for pancreatic cancer. Tampa, FL, USA.

### Community and Social.....

**May 2018:** Appointed by the Lebanese Ministry of Internal Affairs as an Election Officer in the electoral station for Lebanese Diaspora in Montreal, Canada.

**April 2016–December 2018:** Treasurer of the Worldwide Alumni Association of the American University of Beirut (AUB) – Montreal Chapter.

- Organized the 2018 North America Summit of the Worldwide Alumni Association of AUB, which will be integrated with the Lebanese Diaspora Energy Forum organized by the Lebanese Ministry of Foreign Affairs and Emigrants.
- Lead organizer, financial manager, and master of ceremony for the launch event of the AUB online mentorship platform. The event was attended by AUB officials and deans, as well as prominent figures from different industrial and governmental sectors in Montreal.
- Organized the AUB 150th Anniversary Gala Dinner attended by AUB President, Consul General of Lebanon, and representatives from the Canadian Parliament and Montreal Municipality.

**Fall 2015–2018:** Vice President of the Graduate Association of Mechanical Engineering Students at McGill University.

- Organized the Graduate Engineering Research Showcase, a departmental annual student conference.

**2015 and 2016 Academic Years:** Mentor at the International Student Services Office at McGill University.

- Helped new coming international students to get established in Montreal by providing assistance with their general personal (banking, housing, etc) and academic (orientation, campus tours) needs.

**2015–2016 Academic Year:** Vice President of the Lebanese Student Association at McGill University.

- Organized a professional networking event for students from different universities in Montreal. The event was attended by 320 students and 40 mentors.

**2015–2016 Academic Year:** Executive Secretary of the Worldwide Alumni Association of AUB – Montreal Chapter.

**2013:** Worked on "End Fear" campaign, whose mandate was to rehabilitate the district of Abra. Abra, Lebanon.

- Collected statistics on the extent of destruction for the municipality, and used engineering knowledge to estimate repairs needed
- Cleaned the street
- Helped civilians repair their damaged houses
- Entertained young children using art as a tool to distract them from the surrounding destruction



## Professional Memberships

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- American Society for Cancer Research
- American Society of Clinical Oncology
- American Association of Physicists in Medicine
- American Society for Radiation Oncology
- Society for Mathematical Biology
- Biomedical Engineering Society