NICOLAS DHERS

Computational Science and Engineering

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EDUCATION

Bachelor of Engineering (Mechanical)
McGill University: CGPA 3.86/4.00

📅 Sept 2016 - Dec 2020   ⚲ Montreal, QC

- 2020 Summer Undergraduate Research in Engineering (SURE) Scholarship: selected for summer research grant. National Science and Engineering Research Council of Canada Undergraduate Summer Research Award (NSERC): $3000.
- McGill Merit-Based Hugh Brock Scholarship (2016-2018).
- Golden Key International Society (2016-2020).
- McGill Major Entrance Merit-Based Scholarship (2016-2017).

High School
Lycée Français de New York

📅 2013-2016   ⚲ New York City, USA

- Baccalauréat (S-OIB) Highest Honours: 19/20.

EXPERIENCE

Research Assistant (SURE)
Computational Aerodynamics Group

📅 May 2020 – Aug 2020   ⚲ McGill University, QC

- Designed and tested neural networks (MLP NNs, CNNs) to predict aerodynamic coefficients of aircraft wings in various flow conditions, when coupled with the in-house aerodynamic numerical code.
- Developed and coded a Gradient Enhanced MLP NN based on the propagation of a dual signal consisting of a response signal and a gradient signal estimating the coefficients and their spatial derivatives respectively. Demonstrated faster training and effectively cut the computational time in wing performance optimization.
- Used Python, TensorFlow, HPC ComputeCanada.
- Supervisor: Professor Siva Nadarajah.

Global 7500 Project Engineering Intern
Bombardier Aerospace

📅 May 2019 - Aug 2019   ⚲ Saint-Laurent, QC

- Organized weekly technical meetings with Technical Engineering teams (incl. Acoustics, thermodynamics, Dynamics, Safety and Compliance, CLAWS, Performance, Loads, EMC) and provided support for their planning and governance on Global 7500 business aircraft.
- Presented to Managers and Director daily and weekly priorities for the engineering teams.
- Played a key part in the completion of time sensitive projects over the summer, including Steep Approach Certification and Brazilian validation of the Global 7500.

Mechanical & Computational Engineering Intern
Air-Therm Inc

📅 May 2018 - Jul 2018   ⚲ Montreal, QC

- Devised C++ and Matlab codes to compute airflow rate, given ventilator dimensions, indoor/outdoor temperature, discharge coefficient for vent opening.
- Converted design requirements to engineering constraints and performed natural ventilator CAD modelling on Inventor design software.

TECHNICAL SKILLS

- **Advanced:**
  MATLAB, C, Python, LaTeX, Numerical Methods, High Performance Computing (HPC), 3D Printing, MasterCam, CNC Machining, CAD softwares (AutoCAD, SolidWorks), Finite Element Analysis (ABAQUS), TensorFlow, Linux, Git, MS Office.
- **Intermediate/Learner:**
  FORTRAN, C++, JAVA, R.

PROJECTS

Murman and Cole Method for Transonic Small Disturbance Equation (2019):

- Solved TSD PDE over circular arc airfoil at various Mach numbers over 2D domain with changing boundary conditions.
- Discretized equation on computational grid with finite differences; used Point Jacobi, Gauss-Seidel and SOR algorithms to solve resulting linear equations.
- Generated pressure plots for coarse and fine grids demonstrating shock location.

Multidisciplinary Design Optimization (MDO) (2020):

- Solved engineering MDO problem using Multidisciplinary Feasible Design and Concurrent Subspace Optimization architectures.
- Optimized functions using Gradient Descent, Conjugate Gradient Fletcher-Reeves, Quasi-Newton BFGS and Newton approaches. Implemented backtracking algorithm to determine optimal step length. Compared and ranked methods based on convergence rate and computational cost.
- Solved constrained problems using Quadratic Penalty and Sequential Quadratic Programming methods.

Numerical Solutions to PDEs (2020):

- Evaluated Upwind, Lax, Lax-Wendroff, Leap-Frog, MacCormack numerical solutions to Linear-Advection equation.
- Solved 2D diffusion equation using approximate factorization method.

Composite Material Behavior Program (2020):

- Coded MATLAB program for optimization of composite laminate under various external loads. Through complete failure analysis and computation of on-, off- axis stresses and strains, identified appropriate material and geometry, while minimizing weight.

3D Printing of a New Vascular Graft - Capstone Project (2019-2020):

- Designed and 3D printed hydrogel composite mimicking the mechanical properties of the human aorta.
- Tested prototypes and computed their mechanical properties using McGill's biaxial tensile testing machine and relevant equations.

Rotor Design Project (2019):

- Designed robotic manipulator operating remotely thanks to Arduino code. Vehicle built capable of pebble avoidance, wall-climbing and object transport.

EXTRACURRICULAR

Mathematics Tutor

Linear Algebra and Calculus

📅 Sept 2019 - May 2020   📍 McGill University, QC

- Tutor in Linear Algebra and Geometry: topics include matrix operations, vector spaces, quadratic loci in two and three dimensions.
- Tutor in Calculus: topics include integral applications and techniques, sequences and series.

McGill Rocket Team

Aerostructure Division

📅 Sept 2018 - May 2020   📍 McGill University, QC

- Used various manufacturing methods (CNC, machining) to produce airframe composite parts. Performed VARI (Vacuum Assisted Resin Infusion) for nose cone and body tube.
- Actively involved in rocket design on SolidWorks and OpenRocket. Optimized nose cone performance using MATLAB aerodynamic code.
- Vehicle finished first in its category at 2018 Spaceport America Cup.

ONLINE TRAINING

- Tensorflow 2.0: Deep Learning and Artificial Intelligence (2020), Udemy.
- Machine Learning on Supercomputer (2020), Calcul Quebec.
- Mathematics for Machine Learning Specialization (2020), Coursera (Imperial College).
- Probability and R (2020), Coursera (Duke University).
- Machine Learning (2021), Coursera (Stanford University).
- Convolutional Neural Networks for Visual Recognition (CS231n, Spring 2017), Stanford University (lectures and course content available online).