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Mark Fraser, Ph.D., P.Eng.

Materials & Metallurgical Engineer

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Education

MCMASTER UNIVERSITY

2017

Ph.D. (Materials Science)

Thesis: "The Study of Architected Materials with a Corrugated Geometry"

MCMASTER UNIVERSITY

2011

Bachelor of Engineering and Management, Materials Science and Engineering

Experience

ROAR ENGINEERING

2018 – PRESENT

Materials & Metallurgical Engineer

Perform forensic engineering services in the field of materials and metallurgy. Provide failure analysis examination, including both destructive and non-destructive testing.

Investigate failure and cause of loss for a variety of scenarios, including corrosion failures, mechanical failures, and cracking failures. Failure analysis of plumbing components and systems, including household appliances, sprinkler systems, industrial processes, and heating systems.

Prepare technical reports for clients summarizing findings of investigations.

MCMASTER UNIVERSITY

2017

Postdoctoral Fellow, Materials Science and Engineering

Evaluated stress response of hierarchical corrugated materials using Finite Element Analysis (FEA) and mechanical testing.

Modeled behavior of multilayered composite materials using FEA.

Guided and supervised class of 40 students in 2nd year Materials Engineering course through a design project using CAD, FEA (Autodesk Inventor), 3D-printing of plastic prototypes and mechanical testing.

MCMASTER UNIVERSITY
PhD Student, Materials Science and Engineering

2011 – 2017

Studied the stress response of metallic corrugated structures and corrugation reinforced composites using FEA (ABAQUS), mechanical testing, metallographic analysis and analytical modeling.

Designed composites capable of improving ductility from 1% to 30% by adding a corrugated geometry.

Developed analytical model that predicted entire stress-strain curve of a corrugated sheet with <5% error.

Created property maps tool to evaluate effectiveness of corrugation for a given composite system.

Experimentally investigated fabrication methods for geometrically induced strain hardening materials, including casting, additive manufacturing, carbon diffusion masking and textile manipulation.

Experimentally tested the effect of the helical and corrugation reinforcement geometries on mechanical behavior during rolling, compression and tension using Digital Image Correlation.

MCMASTER UNIVERSITY
Teaching Assistant, Sustainable Manufacturing Processes

2012 – 2015

Designed and led tutorials for classes of between 50-90 students, covering topics discussed in lectures, going over details of assignments, and providing examples and guidance for final projects.

Supervised junior teaching assistants, delegating duties and providing guidance.

Developed expertise in conducting Life Cycle Assessments (LCA) having helped guide and evaluate over 100 comparative LCA projects over a wide range of industries.

Received student feedback in course evaluations with greater than 95% positive reviews.

MCMASTER UNIVERSITY
NSERC Research Student, Materials Science and Engineering

2010

Conducted experiments and created analytical models in collaboration with ArcelorMittal regarding impact of decarburization on phase transformations, microstructure and mechanical properties of industrial steels.



MCMASTER UNIVERSITY
NSERC Research Student, Materials Science and Engineering

2009

With a focus on thermistor applications, created thermodynamic models of metal oxide systems missing in the FactSage software library with the goal of submitting to FactSage for incorporation in future software packages.

INDEPENDENT ELECTRICITY SYSTEM OPERATOR
Development Student, Market Analysis

2008

Gathered and summarized data concerning Ontario electricity system and market using MS Access databases and Internet research for use in analyzing current status and 18-month outlook of the system.

MCMASTER UNIVERSITY
UROP Research Student, Engineering Physics

2007

Modeled nuclear reactor core behavior of CANDU and PWR reactors under extreme conditions using a safety analysis computer simulation program and conducted parametric study to find sensitivity of key parameters

Publications

Peer-reviewed Publications

Fraser, M., Zurob, H., Wu, P. and Bouaziz, O. (2020), Increasing necking strain through corrugation: Identifying composite systems that can benefit from a corrugated geometry. *Materials*. 13. No. 22: 5175-5192.

Fraser, M., Zurob, H. and Wu, P. (2018), Comparing the effect of geometry on the stress-strain response of isolated corrugation structures and corrugation reinforced composite structures. *Comp. Struct.* 187: 308-315.

Fraser, M., Zurob, H. and Wu, P. (2018), Corrugation Reinforced Composites: A Method for Filling Holes in Material-Property Space. *Adv. Eng. Mater.* 20. No. 1: 1700834.

Fraser, M., Zurob, H., Wu, P. and Bouaziz, O. (2014), Analytical Model of the Unbending Behavior of Corrugated Reinforcements. *Adv. Eng. Mater.* 16. No. 7: 872-877.

Conferences

Fraser, M., Zurob, H., Wu, P. (2015), Filling Holes in Materials Property Space using Corrugated Reinforcement Architectures. Poster presentation at 2015 Materials Research Society (MRS) Fall Meeting & Exhibit, Boston, MA.

Scholarships & Awards

Ontario Graduate Scholarship of \$15,000/yr for four years from 2012 – 2016



NSERC Alexander Graham Bell Canada Graduate Scholarship of \$17,500 for 2011 – 2012

Herbert A. Ricker Scholarship of \$2,000 for academic achievements and character in 4th year

Neil Forsyth Prize for the highest grade in Materials Engineering Mass Transfer course

Husky Injection Molding System Scholarship of \$5,000 for academic achievements in 3rd year

Crispin Calvo Scholarship of \$1,700 for achievement in 2nd year Materials Thermodynamics

University Senate Scholarship for academic achievement in 1st year

Nortel Networks Scholarship worth \$12,000 for having an admission average over 95%

President's Award scholarship of \$12,000 for obtaining an admission average above 95%

Memberships

Professional Engineers of Ontario (PEO)

License #100214049

ASM Ontario Chapter

Member

Other Relevant Activities/Qualifications

Attended NFPA 13 Hands-on Installation of Sprinkler Systems Course in August 2019.

Experience in performing the following additional experimental/testing techniques: hot rolling, cold rolling, sheet forming, hardness testing, tensile testing, compression testing, digital image correlation, chemical etching, polishing/grinding, optical microscopy, scanning electron microscopy, tempering, annealing.

Experience with the following software/languages: ABAQUS, Autodesk Inventor, Microsoft Office, Maple, Octave, Python, SQL, FactSage, ThermoCalc, ImageJ, gnuplot, GOM Correlate, CES, Mendeley.

Attended ArchiMat schools on composite materials in Autrans, France in May 2011 and June 2014.

Attended Materials Research Society Fall Meeting in 2015 in Boston, USA and gave poster presentation.

Attended Canada Makes: Additive Manufacturing Forum in Hamilton, ON in May 2016.

Experience developing machine learning algorithms for use in data analysis and predictive model development.

Performed editing services for theses, journal articles, book chapters and other technical documents.

