David E. Cunningham, B.E.Sc.

Ph.D. Candidate, University of Western Ontario

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Education

2020/05 - Present

University of Western Ontario, London, ON, Ph.D.

Department of Mechanical and Materials Engineering

Dissertation Title: Development of Novel Approaches in the Assessment of the Fixation and Load Transfer in Reverse Shoulder Arthroplasty

Dissertation supervisor: Dr. James A. Johnson, P.Eng. PhD

2015/09 - 2020/05

University of Western Ontario, London, ON, B.E.Sc.

Department of Mechanical and Materials Engineering

Thesis Title: Effectiveness of Analogue Bone Materials in Glenoid Baseplate Fixation Studies

Thesis supervisor: Dr. James A. Johnson, PEng PhD

Academic achievements:

- Dean's Honour List 2020
- Dean's Honour List 2018
- Dean's Honour List 2016
- Western Scholarship of Distinction 2015

Design Experience

2020/05 - 2022/01

Novel Implant Testing Apparatus, Ph.D. HULC

Roth McFarlane Hand and Upper Limb Centre

Design title: Triaxial Implant Loading Apparatus

Solidworks design and statics analysis of a machined stainless steel loading apparatus for the in-vitro evaluation of novel reversed total shoulder arthroplasty humeral prosthetics. Custom Python code design of a synchronized pneumatic loading, digital tracking, and sensor feedback control application and paired user interface compatible with the NI DAQ interface. Extended functionality of loading and sensory software to all pneumatic equipment in HULC biomechanics laboratory.

Design supervisor: Dr. James A. Johnson, P.Eng. PhD

2019/08 - 2020/05

Mechanical BESc Capstone Design Project

Department of Mechanical and Materials Engineering

Design title: Proximal Phalanx Actuated Finger Prosthetic

Solidworks design of a 3D printed actuated prosthetic for the functional replacement of the proximal phalanx of an amputee. Code design and incorporation of surface electromyography technology using an Arduino controller and micromotors to facilitate flexion/extension actuations of the prosthetic.

Design supervisor: Dr. George K. Knopf, PEng PhD

Teaching Appointments

2022/01 - Present

Teaching Assistant, Biomechanics of the MSK System - MME 4469B

University of Western Ontario

Second invitation to participate in the teaching of this course. Taking responsibility for a lecture on soft tissue muscle physiology and mechanics, taught tutorial anatomy sessions, marked assignments and exams, and implemented GradeScope marking software. Provided proctoring support during examination periods. Developed and implemented assignment marking rubrics and standardized online marking procedures.

Class Description: Application of fundamental principles of engineering to the analysis of the human musculoskeletal system. Bone and soft tissue biomechanics, joint mechanics and kinematics, joint replacement with implants, with special interest in design of these systems; biomaterials and wear. Joints studied will include the elbow, hip, shoulder and knee.

Supervisor(s): Dr. James A. Johnson, P.Eng., PhD

2022/01 - Present

Teaching Assistant, Mechanical Components Design - MME 3380B

University of Western Ontario

Marked exams and assignments while implementing GradeScope marking software. Provided proctoring support during examination periods.

Class Description: The objective of this course is to consider the stress analysis and design of various components of a machine, e.g. an automobile.

Supervisor(s): Dr. James A. Johnson, P.Eng., PhD

2021/05 - 2021/08

Teaching Assistant, Product Design and Development - MME 2259A

University of Western Ontario

Taught laboratory sessions on the basics of SolidWorks 3D modelling. Evaluated design project reports and ensured that students were able to pass the CSWA modelling certification examination.

Class Description: Introduction to engineering design and structured design methods. Topics included: mechanical design process; design specifications, concept generation and selection; detailed design, design simulation, design for manufacturing and assembly, design for product safety; principles of life-cycle engineering.

Supervisor(s): Dr. Aaron Price, PhD

2021/05 - 2021/08

Teaching Assistant, Finite Element Methods - MME 9612L

University of Western Ontario

Taught laboratory sessions, created rubrics, and implemented GradeScope marking software. Provided proctoring support during examination periods and guided students through the operation of SolidWorks analysis software.

Class Description: Mastery of the theoretical foundations of the finite element method (FEM) and solution of practical design analysis problems with commercial FEM tools while in control of the errors inherent to the use of FEM.

Supervisor(s): Dr. Pawel Kurowski, PhD

2021/01 - 2021/05

Teaching Assistant, Biomechanics of the MSK System - MME 4469B

University of Western Ontario

Taught tutorial sessions, marked exams, and implemented GradeScope marking software. Provided proctoring support during examination periods. Developed and implemented marking rubrics and standardized marking procedures.

Class Description: Application of fundamental principles of engineering to the analysis of the human musculoskeletal system. Bone and soft tissue biomechanics, joint mechanics and kinematics, joint replacement with implants, with special interest in design of these systems; biomaterials and wear. Joints studied will include the elbow, hip, shoulder and knee.

Supervisor(s): Dr. James A. Johnson, P.Eng., PhD

2021/01 - 2020/05

Teaching Assistant, Engineering Experimentation - MME 2285B

University of Western Ontario

Taught laboratories, marked exams, and created marking rubrics using GradeScope software. Created laboratory videos and software orientation videos for colleagues for new grading tools.

Class Description: Measurement of physical quantities; experiment planning and design; characteristics of measurement systems; calibration, linearity, accuracy, bias and sensitivity; data acquisition systems; sampling theorem; signal conditioning; sources of errors; uncertainty

analysis; data analysis techniques; systems for the measurement of displacement, velocity, acceleration, force, strain, pressure, temperature, flow rate, etc.

Supervisor(s): Dr. Ryan Willing, PhD

2020/09 - 2020/12

Teaching Assistant, Industrial Materials - MME 2260A

University of Western Ontario

Provided support in teaching and marking. Created laboratory videos in materials test procedures.

Class Description: Upon successful completion of this course, students were able to explain basics of the following manufacturing processes, and the relationship of these industrial processes to principles of materials science: 1. Solidification processes (casting of metal, shaping of polymers) 2. Metal forming processes (rolling, forging, extrusion, drawing) 3. Particulate processes (sintered metals and ceramics)

Supervisor(s): Dr. Robert J. Klassen, PhD

Professional Appointments

2021/09 - present

Laboratory Engineering (EIT)

Roth McFarlane Hand and Upper Limb Clinic, London, ON

Developed custom experimental loading software for actuation of pneumatic systems in the laboratory. Procured high-resolution machine vision cameras, and implemented digital tracking software for micromotion analysis of implants in-vitro. Built and initialized new computer equipment. Performed finite element analyses of bone-implant models for the evaluation of novel implants.

Supervisor(s): Dr. James A. Johnson, P.Eng. PhD, Dr. Daniel Langohr, PhD

2020/05 - present

Ricky Ratchets Auto Repair Mechanical Assistant

Ricky Ratchets Auto Repair, London, ON

Welding and fabrication of automotive and shop floor parts. Repair, replacement, and procurement of automotive parts and assemblies. Design and fabrication of custom snowplow and motor mounting arrangements. Modification to existing vehicle designs. Vehicle repair and inspection under the supervision of licenced automotive technicians.

Supervisor(s): Richard McMullin, RSE, 310S 310T 310B, Linda McMullin

2019/01 - 2019/08

Mechanical Reliability Engineering EIT (Intern)

NOVA Chemicals, Corunna, ON

Implementation and design of condition monitoring plans for NOVA manufacturing east facilities. Vibration analysis and preventative maintenance plan response using AMS Machinery Health.

Research, project planning, and implementation of Emerson Triaxial Accelerometer technology into NOVA condition monitoring program. Structural auditing, level of safety design, and modification of existing high-pressure rotating equipment. Gas testing, radiation testing, troubleshooting and repair of rotating equipment as per OSHA, API, and NOVA standards.

Supervisor(s): Dr. Saeed Varziri, PEng PhD, Nirmal Patel, PEng, Geoff Bunda

2018/05 - 2018/12

Polyethylene Engineering and Capital EIT (Intern)

NOVA Chemicals, Mooretown, ON

Design of pressure vessels, high pressure piping, and associated components as per ASME B31.3 and ASME Sec. VIII Div. 1 standards. Engineering design and documentation using MicroStation V7, V8, and pressure vessel design and piping stress analysis and design using CAEPIPE, CAESAR II, and PVElite. Research, budget, and design implementation of various high pressure devices including heat exchangers, tubesheet filters, pulsation dampeners and other safety-critical equipment. Equipment specification and stocking requirements using SAP. Performed low temperature embrittlement assessments and issued construction work packages for capital and major maintenance projects.

Supervisor(s): Joseph Burlingham, PEng, Brent Humphries, PEng

2017/05 - 2017/08

2016/05 - 2016/08

Manufacturing Engineering Systems Designer & Line/Inventory Specialist

Schneider Electric, Victoria, BC

Worked closely with department leadership to identify barriers in the pilot meter program. Developed pilot unit scheduling software for the continuous improvement of the pilot meter program. Reviewed operating procedures throughout the 6-Sigma plant, presenting potential improvements to engineering groups in accordance with Six-Sigma best practice approaches. Operated high-potential (3300V+) testing machinery (LabView) for quality control and data analysis. Adhered to 5S, KanBan, One Piece Flow, Poka-yoke and Jidoka best practices during assembly and testing of high-accuracy electrical monitoring equipment. Operated conformal coating machinery for the heat-treating of environmentally-sensitive circuitry.

Supervisor(s): Steeve Gauthier

Grants and Fellowships

2020/05 - Present

Western Graduate Research Scholarship (WGRS-MME)

Department of Mechanical and Materials Engineering

2020/05 - Present

Western Graduate Research Assistance (WGRA-GMME)

Department of Graduate Mechanical and Materials Engineering

Conference Talks and Seminars

2022/01/20-22 **Advanced Shoulder Arthroplasty International Conference Attendee**
Department of Health, University of Utah

2021/07/30 **Leveraging Kindness Seminar Speaker**
Department of Health Studies, Western University

2021/03/01 **Western Engineering Biomedical Club Seminar 2021 Speaker**
Department of Biomechanical Engineering, Western University

Technical Skills

CAD Modelling	Solidworks CAD and FEA (CSWA-S), MicroStation v7 and v8, PVElite, CAESAR II, AutoCAD
Manufacturing Software	SAP Business and Inventory Systems, Smartplant Foundation, LabVIEW, MatLAB, AMS Machinery Health, SharePoint
Manufacturing Tools	ASTM, ASME B31.3, OSHA, CSA, API, WHMIS Standards, 6-Sigma, Kaizen, Critical Path Method, DFM, DFA Analysis, Engineering Report Writing
Computer Languages	Python, C++, C, Arduino, Visual Basic (Excel), HTML

Non-Academic Activities

2015/08 - Present **CPA Bodybuilding**
Canadian Physique Alliance Bodybuilding, Men's Classic category.

2004 - Present **Classical Violin, French Horn - Royal Conservatory of Music**
Grade 10 practical Royal Conservatory of Music violinist, orchestral and solo categories.
Concert Master - SMUS Orchestra '15, Soloist/First Violin - Cowichan Consort Orchestra '14-15
French Horn - SMUS Orchestra '11-15

2020/01 - 2020/05 **UWO Flag Football**
University of Western Ontario Intramural Flag Football, Co-Ed.

2018/05 - 2019/08 **United Way Event Volunteer**
Volunteer for United Way, providing local community aid in the Middlesex-Elgin county, fundraising and providing assistance during community events.

REFERENCES AVAILABLE UPON REQUEST