JOEL BALMER (PhD)

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SKILLS SUMMARY

- Teaching
- Scientific Presentation
- Computer Programming
- Engineering Systems Analysis
- Data Management
- Data Analytics
- Signal Acquisition & Processing
- Computational modelling

LANGUAGES

- Python (proficient)
- Matlab (proficient)
- LaTeX (proficient)
- C/C++
- JavaScript
- XML
- HTML

EXPERIENCE

2015 – 2019

Teaching Assistant (TA) / Academic Tutor

UNIVERSITY OF CANTERBURY

Tutored a variety of undergraduate level engineering courses, including mathematics, control systems theory, thermodynamics and electronics. Experience lecturing and running tutorials for large classes (>200 students), as well as tutoring at a one-on-one level.

Role responsibility and skills:

- Creating course content, including:
  - Examination/assessment material.
  - Tutorial questions/problems and solution sets.
  - Supplementary lecturing notes.
- Facilitating Tutorials.
- Lecturing.
- Pastoral/academic support.

JAN 2014 – APR 2015

Mechanical Engineer

BECA

Worked in the Christchurch Building Services team, during the exceptional circumstances of the design and rebuild following the 2011 earthquakes. The role was design based and included time on site ensuring construction was as per the design, or that any deviations were still fit for purpose.

Notable projects:

- Christchurch Hospital - the Acute Services Building
- CPIT (now known as the Ara Institute) - creation of new and refurbished learning spaces
- Burwood Hospital - energy modelling
- The Crossing Shopping Centre - mixed ventilation design for the car park building
- Lyttelton School Development

NOV 2011 - FEB 2012

Summer Intern Weapons Engineer

HARDY ENGINEERING

Designed numerous aftermarket firearms components in CAD software (Solidworks), including complete manufacturing drawings, to be manufactured using CNC. The components designed were:

- Rifle receivers
- Rifle bolts (and shroud)
- Trigger guard
- Detachable magazine
- Scope mounts

EDUCATION

2015 - 2019

Doctor of Philosophy (PhD) in Mechanical Engineering

UNIVERSITY OF CANTERBURY

- Thesis title: *"Model-Based Arterial Flow and Stroke Volume Estimation for Hemodynamic Monitoring in a Critical Care Environment"*
- Thesis outcome: Developing a clinically applicable, minimally invasive method of measuring *beat-to-beat stroke volume*, using data abstraction and computational modelling, significantly improving circulatory management.

Translational skills:

- Problem definition, abstraction and simplification, including learning across diverse disciplines to ensure accurate problem formulation leads to an end-user centric solution.
- Analysis across disciplines and domains (engineering, medicine and physiology).
- Effective communication of results and their implications across a wide variety of end-users and disciplines.
- Using mathematics to develop a computational model capable of translating data into a more useful domain for end-users.
- Data ethics and management: Acquisition of large data sets in numerous formats, with data collected from hospitals in New Zealand and Belgium, from both human and animal patients.
- Data pre-processing: Formatting the large data structure into a more manageable state.
- Developing and publishing novel algorithms for signal characteristic detection (e.g. detection of the start and end of a cardiac cycle (systole and diastole) in numerous circulatory system signals).
- Model parameter identification optimization.
- Computational and clinical validation of model and problem solution.

2010 - 2013

Bachelor of Engineering with Honours (in Mechanical Engineering)

UNIVERSITY OF CANTERBURY

- Graduated with 1st class honours, final year GPA of 7.75
- Honours Project: Worked in a group of four to design, build and implement a test rig for fatigue analysis of the forward mooring arm and bearing of the Cavotec MoorMaster automated mooring system. The test rigs design also incorporated seaside environmental conditions artificially.

COMMUNITY INVOLVEMENT

2016 - 2017

Community Justice Panel

Member at the Ilam suburb panel for community based restorative justice. The panel has low-level offences referred to it by Police and works with the both the victim(s) and defendant(s) to reach a binding contract. Upon fulfillment of the contract by the defendant, the matter is considered resolved and does not progress to the courts. This role required panel members to have an exceptionally high degree of patience, understanding and unbiased empathy to achieve an equitable outcome and reduce rates of reoffence.

RECENT AWARDS

- Young Author Award – 10th IFAC Symposium on Biological and Medical Systems, 2019
- Bringing Science to Life – 2018 winner
- Vice-Chancellors Excellence Award – two-time recipient, in 2016 and 2017
- Thesis in Three – 2015 1st place in department, 3rd place in college

PUBLICATIONS

Journal Papers

- **Balmer, J**, Pretty, C, Davidson, S, Mehta-Wilson, T, Desaive, T, Smith, R, Shaw, GM, Chase, JG, *"Clinically applicable model-based method, for physiologically accurate flow waveform and stroke volume estimation"* (2019) Computer Methods and Programs in Biomedicine.
- **Balmer J**, Smith R, Pretty C, Desaive T, Shaw GM, Chase JG, *"Accurate end systole detection in dicrotic notch-less arterial pressure waveforms."* (2019) [Under Review]
- **Balmer, J**, Pretty, C, Davidson, S, Desaive, T, Kamoi, S, Pironet, A, Morimont, P, Janssen, N, Lambermont, B,Shaw, GM, Chase, JG, *"Pre-ejection period, the reason why the electrocardiogram Q-wave is an unreliable indicator of pulse wave initialization"* (2018) Journal of Physiological Measurement.
- Davidson, S, Pretty, C, **Balmer, J**, Desaive, T, Chase, JG, *"Blood pressure waveform contour analysis for assessing peripheral resistance changes in sepsis"* (2018) Biomedical Engineering Online.
- Kamoi, S, Pretty, C, **Balmer, J**, Davidson, S, Pironet, A, Desaive, T, Shaw, GM, Chase, JG, *"Improved pressure contour analysis for estimating cardiac stroke volume using pulse wave velocity measurement"* (2017) Biomedical Engineering Online.
- Davidson, S, Pretty, C, Pironet, A, Kamoi, S, **Balmer, J**, Desaive, T, Chase, JG, *"Minimally invasive, patient specific, beat-by-beat estimation of left ventricular time varying elastance"* (2017) Biomedical Engineering Online.
- Khan, M, Pretty, C, Amies, A, **Balmer, J**, Banna, H, Shaw, GM, Chase, JG, *"Proof of concept non-invasive estimation of peripheral venous oxygen saturation"* (2017) Biomedical Engineering Online.

Conference Papers

- **Balmer, J**, Pretty, C, Davidson, S, Desaive, T, Habran, S, Chase, JG, *"Effect of arterial pressure measurement location on pulse contour stroke volume estimation, during a rapid change in hemodynamic state"* (2018) 10th IFAC Symposium on Biological and Medical Systems BMS São Paulo, Brazil, 3–5 September 2018 **(invited– Winner of Young Author Award)**
- **Balmer, J**, Pretty, C, Amies, A, Desaive, T, Chase, JG, *"Accurate dicrotic notch detection using adaptive shear transforms"* (2018) 10th IFAC Symposium on Biological and Medical Systems BMS São Paulo, Brazil, 3–5 September 2018 **(invited)**
- Davidson, SM, **Balmer, J**, Pretty, C, Desaive, T, Chase, JG, *"A Simplified Waveform Energetics Approach to Interpreting Arterial and Venous Pressure"* (2018) 10th IFAC Symposium on Biological and Medical Systems BMS São Paulo, Brazil, 3–5 September 2018 **(invited)**
- Davidson, SM, Pretty, C, **Balmer, J**, Desaive, T, Chase, JG, *"An Investigation into the Clinical Utility of Transfer Functions between the Aortic and Femoral Pressure Waveforms"* (2018) 10th IFAC Symposium on Biological and Medical Systems BMS São Paulo, Brazil, 3–5 September 2018 **(invited)**
- **Balmer, J**, Pretty, C, Kamoi, S, Davidson, S, Pironet, A, Desaive, T, Shaw, GM, Chase, JG,*"Electrocardiogram R-wave is an Unreliable Indicator of Pulse Wave Initialization"* (2018) 20th World Congress of the International Federation of Automatic Control (IFAC), 9-14 July 2017 **(invited)**
- Davidson, SM, Pretty, C, Kamoi, S, **Balmer, J**, Desaive, T, Chase, JG, *"Real-Time, Minimally Invasive, Beat-to-Beat Estimation of End-Systolic Volume Using a Modified End-Systolic Pressure-Volume Relation"* (2017) 20th World Congress of the International Federation of Automatic Control (IFAC), 9-14 July 2017 **(invited)**