VALENTIN SULZER

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Carnegie Mellon University
5000 Forbes Ave, Pittsburgh, PA 15213

RESEARCH INTERESTS

Energy storage, mathematical modeling, scientific machine learning, asymptotic analysis

EMPLOYMENT

Postdoctoral Research Associate May 2021 - present
Carnegie Mellon University *Pittsburgh, PA*

- Viswanathan group
- Battery modeling with PyBaMM and Julia
- Hybrid physics-based/data-driven models with Scientific Machine Learning.
- Accelerated Computational Electrochemical systems Discovery (ACED)

Postdoctoral Research Fellow Oct 2019 - May 2021
University of Michigan *Ann Arbor, MI*

- Battery Control Group (Prof. Anna Stefanopoulou and Dr Jason Siegel)
- Physics-based machine learning for modeling of PEM fuel cells (in collaboration with Toyota Motor North America)
- Lithium-ion battery degradation modeling, state-of-health estimation and prognostics
- Multi-particle models for lithium-ion batteries

EDUCATION

PhD in Applied Mathematics Oct 2015 - Sep 2019
University of Oxford *Oxford, UK*

- Industrially Focussed Mathematical Modelling (InFoMM) CDT
- Thesis Topic: *Mathematical Modelling of Lead-Acid Batteries*
- Supervisors: Prof. S. Jon Chapman, Prof. Colin Please, Prof. Charles Monroe and Prof. David Howey

Master of Mathematics Oct 2014 - Jun 2015
University of Oxford *Oxford, UK*

- First-class honours (88%; top two in the year)
- Dissertation Topic: *Mathematical Modelling of the Bladder Uroepithelium*
- Supervisors: Prof. Derek Moulton, Prof. Sarah Waters and Prof. Helen Byrne

BA in Mathematics Oct 2011 - Jun 2014
University of Oxford *Oxford, UK*

- First-class honours

PUBLICATIONS

Links to papers, preprints, and code available at
https://sites.google.com/view/valentinsulzer/publications

Preprints and Submitted Manuscripts

[J15] **Sulzer, V.**, Mohtat, P., Pannala, S., Siegel, J. B., Stefanopoulou, A. G. (2021). "Accelerated battery lifetime simulations using adaptive inter-cycle extrapolation algorithm". *ECSarXiv, submitted to Journal of the Electrochemical Society.*

[J14] Mohtat, P., Pannala, S., **Sulzer, V.**, Siegel, J. B., Stefanopoulou, A. G. (2021). "An Algorithmic Safety VEST For Li-ion Batteries During Fast Charging". *arXiv preprint arXiv:2108.07833, submitted to Modeling, Estimation and Control Conference 2021.*

[J13] Zubov, K., McCarthy, Z., Ma, Y., Calisto, F., Pagliarino, V., Azeglio, S., Bottero, L., Luján, E., **Sulzer, V.**, Bharambe, A. and Vinchhi, N., Balakrishnan, K., Upadhyay, D., Rackauckas, C. (2021). "NeuralPDE: Automating Physics-Informed Neural Networks (PINNs) with Error Approximations". *arXiv preprint arXiv:2107.09443.*

Journal Articles

[J12] **Sulzer, V.**, Mohtat, P., Aitio, A., Lee, S., Yeh, Y.T., Steinbacher, F., Khan, M.U., Lee, J.W., Siegel, J.B., Stefanopoulou, A.G. and Howey, D.A. (2021). "The challenge and opportunity of battery lifetime prediction from field data". *Joule,* 5 (8), 1934-1955.

[J11] **Sulzer, V.**, Marquis, S.G., Timms, R., Robinson, M., Chapman, S.J. (2021). "Python Battery Mathematical Modelling (PyBaMM)" *Journal of Open Research Software,* 9 (1), 14.

[J10] Timms, R., Marquis, S.G., **Sulzer, V.**, Please, C.P., Chapman, S.J. (2021). "Asymptotic Reduction of a Lithium-ion Pouch Cell Model". *SIAM Journal on Applied Mathematics*, 81 (3), 765-788.

[J9] Marquis, S.G., Timms, R., **Sulzer, V.**, Please, C.P., Chapman, S.J. (2020). "A Suite of Reduced-Order Models of a Single-Layer Lithium-ion Pouch Cell". *Journal of the Electrochemical Society*, 167 (14), 140513.

[J8] Tranter, T.G., Timms, R., Heenan, T., Marquis, S., **Sulzer, V.**, Jnawali, A., Kok, M.D., Please, C.P., Chapman, S.J., Shearing, P.R. and Brett, D. (2020). "Probing heterogeneity in Li-ion batteries with coupled multiscale models of electrochemistry and thermal transport using tomographic domains". *Journal of the Electrochemical Society*, 167 (11), 110538.

[J7] Mohtat, P., Lee, S., **Sulzer, V.**, Siegel, J.B., Stefanopoulou, A.G. (2020). "Differential Expansion and Voltage Model for Li-ion Batteries at Practical Charging Rates" *Journal of The Electrochemical Society*, 167 (11), 110561.

[J6] Marquis, S.G., **Sulzer, V.**, Timms, R., Please, C.P., Chapman, S.J. (2019). "An asymptotic derivation of a single particle model with electrolyte". *Journal of The Electrochemical Society*, 166 (15), A3693-A3706.

[J5] **Sulzer, V.**, Chapman, S.J., Please, C.P., Howey, D.A., Monroe, C. W. (2019). "Faster Lead-Acid Battery Simulations from Porous Electrode Theory: I. Physical Model". *Journal of The Electrochemical Society*, 166 (12), A2363-A2371.

[J4] **Sulzer, V.**, Chapman, S.J., Please, C.P., Howey, D.A., Monroe, C. W. (2019). "Faster Lead-Acid Battery Simulations from Porous Electrode Theory: II. Asymptotic Analysis". *Journal of The Electrochemical Society*, 166 (12), A2372-A2382.

[J3] Moulton, D.E., **Sulzer, V.**, Apodaca, G., Byrne, H.M., Waters, S.L. (2016). "Mathematical modelling of stretch-induced membrane traffic in bladder umbrella cells". *Journal of Theoretical Biology*, 409, 115-132.

Conference Proceedings

[J2] **Sulzer, V.**, Mohtat, P., Lee, S., Siegel, J.B., Stefanopoulou, A.G. (2021). "Promise and Challenges of a Data-Driven Approach for Battery Lifetime Prognostics". *2021 American Control Conference, IEEE.*

Other Articles

[J1] Howey, D.A., Roberts, S. A., Viswanathan, V., Mistry, A., Beuse, M., Khoo, E., DeCaluwe, S. C., **Sulzer, V.** (2020)., "Free Radicals: Making a Case for Battery Modeling." *Electrochemical Society Interface 29*, 30.

SELECTED OPEN-SOURCE SOFTWARE

[S1] Python Battery Mathematical Modelling (PyBaMM): Fast and flexible physics-based electrochemical models in Python [pybamm.org]. Co-creator and core developer.

TECHNICAL REPORTS

[R3] Carter, J., Greenbank, S., Holderbaum, W., Marquis, S., Merino-Aceituno, S., Merla, Y., Millar, R., Please, C., Scalas, E., Shi, H. **Sulzer, V.** (2018). "Electric Vehicle Battery Degradation Study".

[R2] Croci, M., Morawiecki, P., **Sulzer, V.** Theil, F. (2017). "Classification of Two-Dimensional Gas Chromatography Data".

[R1] Bejan, A., Budd, C., Hall, C., Kavallaris, N., McPhail, M., Please, C.P., Roper, I., **Sulzer, V.** Wood, D. (2016). "How can we better understand drivers of predicted environmental concentrations of chemicals across the EU?".

PRESENTATIONS

[C16] 240$^{\text{th}}$ ECS Meeting, virtual — Oct 2021
Fast simulations of lithium-ion battery degradation

[C15] Canadian Applied and Industrial Mathematics Society, virtual — Jun 2021
Fast simulations of lithium-ion battery degradation

[C14] Battery Intelligence Lab Group Meeting, virtual — Jun 2021
Promise and Challenges of a Data-Driven Approach for Battery Lifetime Prognostics

[C13] American Control Conference, virtual — May 2021
Promise and Challenges of a Data-Driven Approach for Battery Lifetime Prognostics

[C12] ECS PRiME 2020, virtual — Oct 2020
Electrochemical Modeling of PEM Fuel Cells

[C11] Battery Modeling Webinar Series, virtual — Sep 2020
Open-source battery modeling with PyBaMM

[C10] SIAM/CAIMS Annual Meeting, Toronto, Canada [cancelled] — Jul 2020

[C9] International Congress on Industrial and Applied Mathematics, Valencia, Spain — Jul 2019
Modelling Overcharge of a Lead-Acid Battery

[C8] Oxford Mathematics Three-Minute Thesis Competition, Oxford, UK — Nov 2018
Smarter Batteries for a Clean Energy Future

[C7] SIAM Annual Meeting, Portland, OR — Jul 2018
Reduced-order Models for Lead-Acid Batteries Using Asymptotic Methods

[C6] European Consortium for Mathematics in Industry, Budapest, Hungary — Jun 2018
Battery Modelling: Why 2D Matters

[C5] InFoMM CDT Annual Meeting, Oxford, UK Mar 2018
Electrochemical Modelling of Lead-Acid Batteries for Off-Grid Energy Storage Systems

[C4] University of Warwick Applied Mathematics Seminar, Warwick, UK Dec 2017
Electrochemical Modelling of Lead-Acid Batteries for Off-Grid Energy Storage Systems

[C3] Oxford University ECS Student Chapter Conference, Oxford, UK Jun 2017
Approximate Analytical Solutions of the Newman Porous Electrode Model for Lead-Acid Batteries

[C2] Oxford University SIAM Student Chapter Conference, Oxford, UK Jun 2017
Electrochemical Modelling of Lead-Acid Batteries for Off-Grid Energy Storage Systems

[C1] Junior Applied Mathematics Seminar, Oxford, UK Jun 2017
Electrochemical Modelling of Lead-Acid Batteries for Off-Grid Energy Storage Systems

POSTERS

[P5] Oxford Battery Modelling Symposium, virtual Mar 2021
PyBaMM - Python Battery Mathematical Modeling

[P4] Oxford Battery Modelling Symposium, virtual Mar 2020
PyBaMM - Python Battery Mathematical Modeling

[P3] Oxford Battery Modelling Symposium, Oxford, UK Mar 2019
An Asymptotic Framework for Battery Modelling

[P2] British Applied Mathematics Colloquium, Guildford, UK Apr 2017
Electrochemical Modelling of Lead-Acid Batteries for Off-Grid Energy Storage Systems

[P1] InFoMM CDT Annual Meeting, Oxford, UK Mar 2017
Electrochemical Modelling of Lead-Acid Batteries for Off-Grid Energy Storage Systems

GRANTS, PRIZES & AWARDS

- St Anne's Graduate Student Travel Grant (£500) May 2018
- SIAM Student Chapter Travel Award ($500) Feb 2018
- Sponsorship for the Oxford SIAM Student Chapter (G-Research, £2,500) Sep 2017 – Aug 2018
- EPSRC Doctoral Grant (EP/L015803/1) Oct 2015 – Sep 2019
- Gibbs Prize for performance in 4th year exams – top two in Mathematics (£200) Jul 2015
- IMA Prize for performance in 4th year exams – best in Applied Mathematics Jul 2015
- Mary Kearsley prize for excellence in Applied Mathematics (£200) May 2015
- St Anne's Vacation Laboratory Studentship (£950) Jun-Sep 2014

STUDENT SUPERVISION

- **Saransh Chopra**, Cluster Innovation Centre, University of Delhi (via Google Summer of Code), Summer 2021
- **Priyanshu Agarwal**, Symbiosis Institute of Technology, Pune (via Google Summer of Code), Summer 2021
- **Mohit Yadav**, IIT Kanpur (visiting University of Michigan), Summer 2020
  Mohit joined an AI startup as an intern.
- **Daniel Albamonte**, University of Michigan, Summer 2020
  Daniel joined EDF Renewables North America as an Energy Storage Engineer.

TEACHING EXPERIENCE

- Fluids and Waves
- Applied Partial Differential Equations
- Elasticity and Plasticity

ACADEMIC SOCIETIES & SERVICE

Society Membership

- Institute of Electrical and Electronics Engineers (IEEE)
- Society for Industrial and Applied Mathematics (SIAM)
- Electrochemical Society (ECS)
- Institute of Mathematics and its Applications (IMA)

Leadership

- President, Oxford University SIAM-IMA Student Chapter (2017-18)
- Organiser and Chair, Oxford University SIAM-IMA Student Chapter Conference (2018)
- Secretary, Oxford University SIAM-IMA Student Chapter (2016-17)

Reviewer

- SIAM Journal on Applied Mathematics
- Applied Energy
- IEEE Conference on Decision and Control
- Applied Sciences
- Electrochemica Acta
- eTransportation
- Journal of Energy Storage

SKILLS

Programming	Python, MATLAB, Julia, Git, LaTeX, Linux
Languages	French (native), Spanish (conversational), Italian (basic)