

Final Year Project Interim Report



**University of
Sheffield**

Implamenting adaptive multistage constant-current charging in lithium based batterys to reduce degredation

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1 Introduction

This project investigates to use of machine learning techniques to model battery degradation over its lifetime; ultimately through model parameterisation and raw data regression. [1] Due to dealings with large datasets, saved data has been stored locally on a home server, with code being run remotely via SSH.

2 Project progress

3 Literature Review

4 Plans for Remaining Work

5 Self Review

References

- [1] M.-K. Tran, M. Mathew, S. Janhunen, S. Panchal, K. Raahemifar, R. Fraser, and M. Fowler, “A comprehensive equivalent circuit model for lithium-ion batteries, incorporating the effects of state of health, state of charge, and temperature on model parameters,” *Journal of Energy Storage*, vol. 43, p. 103252, Nov. 2021. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S2352152X2100949X>
- [2] M. Lucu, E. Martinez-Laserna, I. Gandiaga, K. Liu, H. Camblong, W. Widanage, and J. Marco, “Data-driven nonparametric Li-ion battery ageing model aiming at learning from real operation data – Part A: Storage operation,” *Journal of Energy Storage*, vol. 30, p. 101409, Aug. 2020.
- [3] Y. Li, W. Guo, D.-I. Stroe, H. Zhao, P. Kjær Kristensen, L. Rosgaard Jensen, K. Pedersen, and L. Gurevich, “Evolution of aging mechanisms and performance degradation of lithium-ion battery from moderate to severe capacity loss scenarios,” *Chemical Engineering Journal*, vol. 498, p. 155588, Oct. 2024. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S1385894724070797>
- [4] L. Chen, C. Chang, X. Liu, J. Jiang, Y. Jiang, and A. Tian, “Physics-informed neural networks for small sample state of health estimation of lithium-ion batteries,” *Journal of Energy Storage*, vol. 122, p. 116559, Jun. 2025. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S2352152X25012721>
- [5] J. Tebbe, A. Hartwig, A. Jamali, H. Senobar, A. Wahab, M. Kabak, H. Kemper, and H. Khayyam, “Innovations and prognostics in battery degradation and longevity for energy storage systems,” *Journal of Energy Storage*, vol. 114, p. 115724, Apr. 2025. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S2352152X25004372>
- [6] T. Kalogiannis, M. S. Hosen, M. A. Sokkeh, S. Goutam, J. Jaguemont, L. Jin, G. Qiao, M. Bercibar, and J. Van Mierlo, “Comparative Study on Parameter Identification Methods for Dual-Polarization Lithium-Ion Equivalent Circuit Model,” *Energies*, vol. 12, no. 21, p. 4031, Jan. 2019, publisher: Multidisciplinary Digital Publishing Institute. [Online]. Available: <https://www.mdpi.com/1996-1073/12/21/4031>
- [7] M.-K. Tran, M. Mathew, S. Janhunen, S. Panchal, K. Raahemifar, R. Fraser, and M. Fowler, “A comprehensive equivalent circuit model for lithium-ion batteries, incorporating the effects of state of health, state of charge, and temperature on model parameters,” *Journal of Energy Storage*, vol. 43, p. 103252, Nov. 2021. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S2352152X2100949X>