Contribution ID: **71** Type: **not specified**

# A scheme for the predictive replacement of litium-ion batteries, using reinforcement learning

Based on previous results we obtained, it is possible to establish a replacement decision policy for every pair of charge/discharge cycle index and (discretized) state of health of a lithium-ion battery, using Monte Carlo reinforcement learning to optimize a state-action value function. This function balances the value of using the battery for as long as possible against the loss due to outages caused by its unserviceability. The capacity degradation process of the battery has been described via a Gaussian Process model, which is also learned as new capacity observations are collected. This model is fundamental for the correct computation of the expected value function, because the probability distribution of the future state of health is required for this task.
We expand on this work by applying degradation models with better predictive performance. We also examine uncertainty around the optimal policy and compare our method with more conventional replacement policies.
Acknowledgment: This work was produced with funding from the Italian Ministry of University and Research, under the PRIN 2022 call, assigned with Decree No. 20428 adopted on 06/11/2024. Project: 2022WBN75S - E3DM - Experimental Design and Maintenance, a Decision-Making approach driven by Degradation Models.

## Special/ Invited session

## Classification

Both methodology and application

## Keywords

Degradation forecasting, reinforcement learning, lithium-ion batteries

**Primary author:** PIEVATOLO, Antonio (CNR-IMATI)

**Co-authors:** VARINI, Elisa (CNR IMATI); Dr MECCARIELLO, Giovanni (CNR STEMS)

**Presenter:** PIEVATOLO, Antonio (CNR-IMATI)

**Track Classification:** Reliability