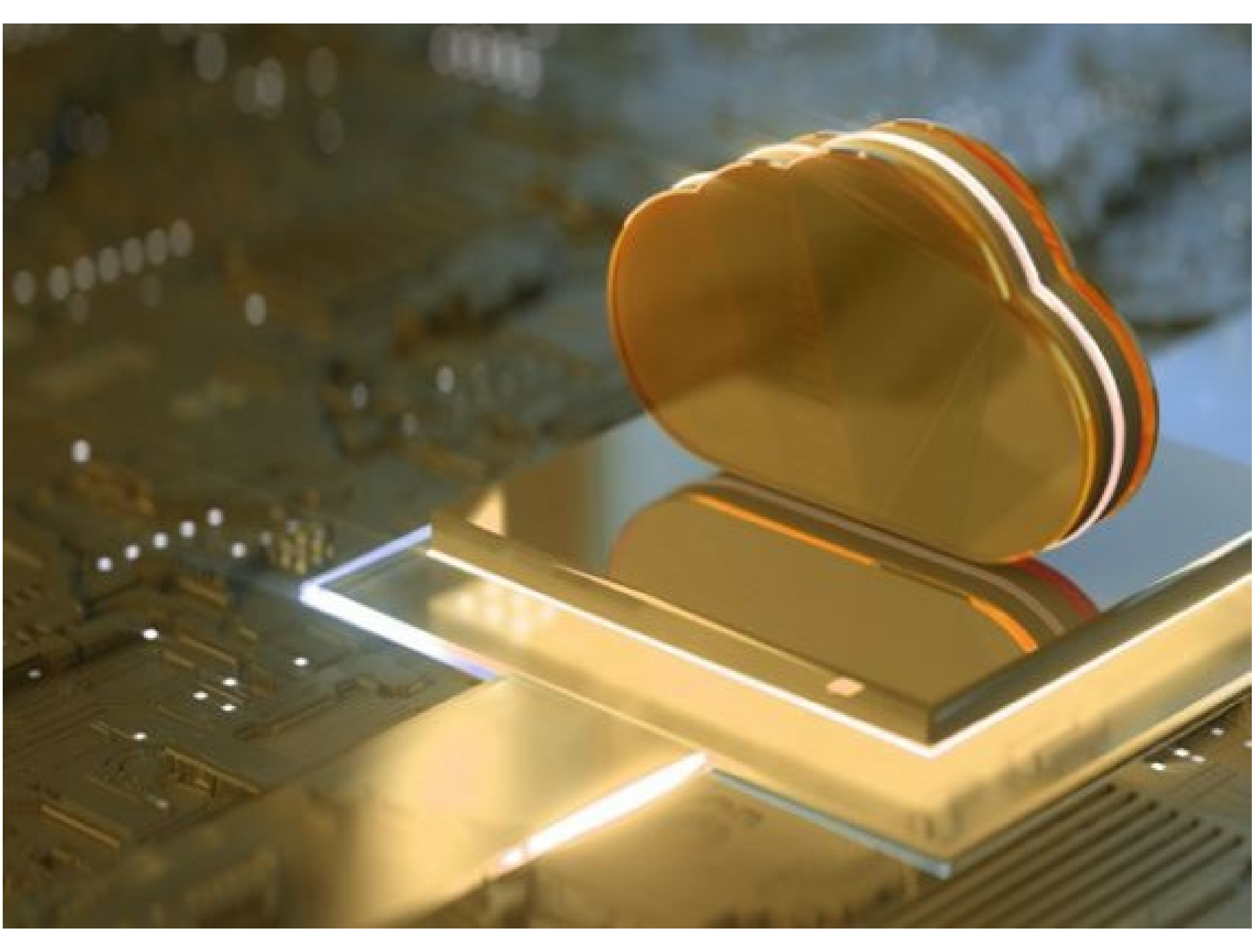
Bekijk de webversie

NEXTBMS

Advanced physics and data-based BMS or optimal battery utilization

Newsletter #2 | September 2024



Dear reader,

In this edition, you will be introduced to the BMS Alliance. Furthermore, you will get to know our partners better through the coffee break interviews, explore recent results, and review the first published article.

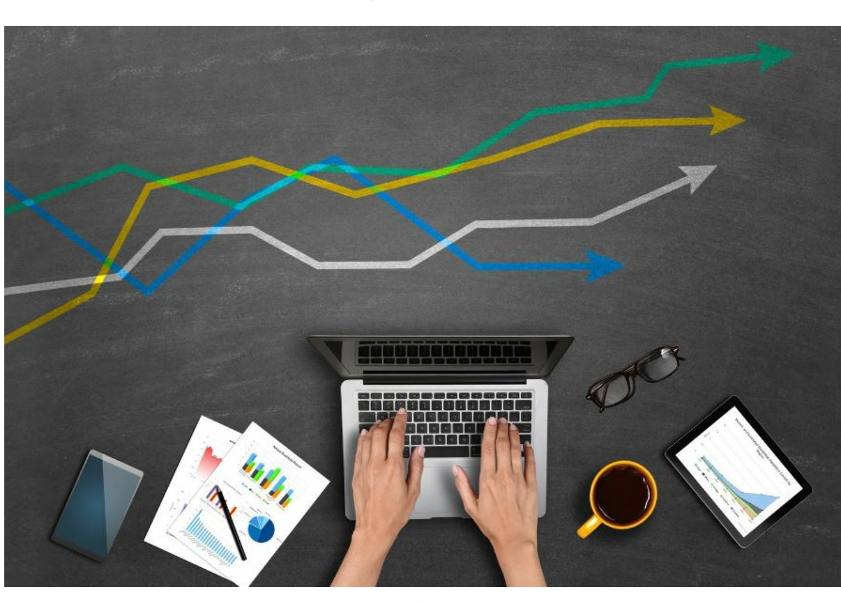
Dive into these insights and stay up-to-date with our progress.

We hope you enjoy reading!

The NEXTBMS team

Latest results & publications

Click on the images below to view the deliverable reports and publication.



Deliverable report 1.2

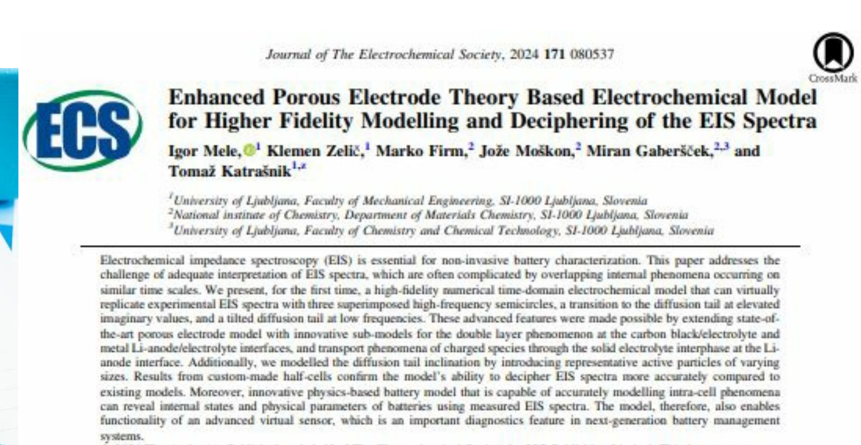
May 2024 | Requirements report for advanced BMS | The public summary is now available

Deliverable report 1.3

May 2024 | BMS specification report | The public summary is now available.

Deliverable report 2.2

May 2024 | Advanced state estimation, prediction & control functions | The public summary is now available



Journal of The Electrochemical Society, 2024 171 080537

Enhanced Porous Electrode Theory Based Electrochemical Model for Higher Fidelity Modelling and Deciphering of the EIS Spectra

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Electrochemical impedance spectroscopy (EIS) is essential for non-invasive battery characterization. This paper addresses the challenge of adequate interpretation of EIS spectra, which are often complicated by overlapping internal phenomena occurring on similar time scales. We present, for the first time, a high-fidelity numerical time-domain electrochemical model that can virtually replicate experimental EIS spectra with three superimposed high-frequency semicircles, a transition to the diffusion tail at elevated imaginary values, and a tilted diffusion tail at low frequencies. These advanced features were made possible by extending state-of-the-art porous electrode model with innovative sub-models for the double layer phenomenon at the carbon black/electrolyte and metal Li-anode/electrolyte interfaces, and transport phenomena of charged species through the solid electrolyte interphase at the Li-anode interface. Additionally, we modelled the diffusion tail inclination by introducing representative active particles of varying sizes. Results from custom-made half-cells confirm the model's ability to decipher EIS spectra more accurately compared to existing models. Moreover, innovative physics-based battery model that is capable of accurately modelling intra-cell phenomena can reveal internal states and physical parameters of batteries using measured EIS spectra. The model, therefore, also enables functionality of an advanced virtual sensor, which is an important diagnostics feature in next-generation battery management systems.

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Manuscript submitted May 30, 2024; revised manuscript received August 4, 2024. Published August 27, 2024.

Supplementary material for this article is available online

NEXTBMS first article published!

Agust 2024 | Enhanced Porous Electrode Model for High-Fidelity EIS Spectra Analysis

Introducing: The BMS Alliance

Modern battery systems are essential across various fields, yet current Battery Management Systems, or BMS, face challenges in performance optimization, safety, and adaptation to new technologies.

These hurdles limit the efficiency, reliability, and lifespan of batteries, which are vital for sustainable energy solutions and achieving climate goals.

The BMS Alliance aims to develop and implement next generation BMS Technologies that enhance battery performance, safety, and adaptability across a wide range of applications.

The main results are:

- System design with the development of advanced models and sensors in parallel, giving insight into the degradation processes inside the battery
- Automatic model update based on improved sensor data
- Efficient parametrization framework for physics-based models through cell lifetime
- Advanced Battery Materials

"Paving the way for a more reliable and sustainable energy landscape—one smart battery at a time!"

Interested and want to learn more? Join the webinar on *October 8th*! Details about this event can be found further down in this newsletter, along with information about the four collaborating projects.

Coffee break interviews

Get to know Laurent Torcheux from EDF

"I am the EDF Group's expert and Fellow on battery technologies. I have 30 years' experience in the battery field. After starting out in industrial R&D for lead-acid batteries, I have been leader for developing Li ion battery activities and laboratories for EDF since 2001. I was involved in numerous projects outside EDF, with strong international partnerships for the development of stationary batteries throughout the whole value chain.
I am actively involved in the NEXTBMS project, in which the EDF Group is an end-user reference partner for stationary batteries using innovative battery management systems."

What was your original motivation to become a researcher/project manager?
"My first motivation was to go into research and to do a PhD to get to grips with the fundamentals of a field that has a profound impact on the energy transition. I wanted to pursue this field throughout my career to make my contribution to it."

What is your (main) research area today?
"Studies of battery ageing, safety, recyclability, and the detection, as early as possible, of new technologies that could have a significant impact on the development of electrochemical storage."

To read the full interview, click here.

Get to know Sajib Chakroborty from VUB

"Currently, I am working as a senior researcher and the Digital Twin and Reliability (DTR) team lead at the EPOWERS research group in the MOBI research center, Dept. of Electrical Engineering and Energy Technology (ETEC) at Vrije Universiteit Brussel (VUB) in Belgium. One of my research area is Battery Management Systems (BMS), specifically on balancing circuits and control, with an emphasis on designing for reliability. This work aligns closely with the scope of NEXTBMS."

What was your original motivation to become a researcher/project manager?
"From the beginning of my university studies, I have been fascinated by solving complex mathematical problems, particularly in algebra and boundary value problems. During my Bachelor's program, I was introduced to power electronics and was inspired by how complex control theory can be applied to increase the efficiency and stability of power electronics converters. This experience revealed the significant connection between theoretical problems and applied engineering. It was then that my passion for research grew, leading me to become a researcher in the power electronics domain."

What is your (main) research area today?
"I am the lead technical manager of several EU and nationally funded projects from EPOWERS, specializing in multi-fidelity and AI-based models, software-defined lifetime routines for EVs, adaptive digital twins of powertrain components up to systems, condition monitoring and reliability analysis of power electronics, and Battery Management Systems (BMS): balancing circuits, sensors and control."

To read the full interview, click here.

Get to know Hansjörg Kapeller from AIT

Hansjörg Kapeller received his Dipl.-Ing. degree in Electrical Engineering from the Vienna University of Technology. He is a research engineer in the field of electric drives at AIT Austrian Institute of Technology, Vienna, Austria.

NEXTBMS offers him the opportunity to create new knowledge and contribute to solutions for next-generation Battery Management Systems to enable and achieve optimal use of the battery system by extending the operating and lifetime window and reducing costs through more efficient and appropriate use of materials. Achieving optimal utilisation of battery systems benefits not only the environment but also the increasing number of end-users.

What was your original motivation to become a researcher/project manager?
"I have always been interested in science and technology and I like finding solutions to problems. As a researcher and project manager, I can contribute to the increasing environmental awareness of today's society and the systemic changes currently taking place in the search for environmentally friendly mobility solutions."

What is your (main) research area today?
"My field of work includes modelling, simulation and control of electric drives and electric vehicles (including energy storages and electric machines, HVAC systems and other sub-components) as well as the coordination of international and national research projects. Currently I am also managing AIT's commercial simulation libraries developed at the Competence Unit Electric Vehicle Technologies."

To read the full interview, click here.

Upcoming events

The BMS Alliance webinar

This is a special event showcasing **The BMS Alliance**, a collaboration of four pioneering EU-funded projects dedicated to propelling the advancements in next-generation Battery Management System (BMS) technologies.

Through this webinar, you'll get an idea of how **The BMS Alliance** drives innovation in BMS technologies in order to enhance battery performance, safety, and adaptability across various applications.
The key results of the project members will be shared as well.

Project members: NEXTBMS, BATMAX, ENERGETIC and NEMO.

Register here.

ESGC 2024

The seventh edition of the Energy Storage Global Conference (ESGC) will take place on 15 – 17 October 2024 in Brussels.

What can you expect from the **#ESGC2024**?

- Latest insights on energy storage policies, markets and technologies and applications.
- Networking opportunities during the conference, as well as during our dinner events.
- Engaging with more than 400 delegates from around the world.

Partner EDF will represent the NEXTBMS project and manage a stand.

Find more information and register here!

Partners NEXTBMS

AIT Austrian Institute of Technology
TNO innovation for life
Univerza v Ljubljani
VUB EPOWERS Efficient Power Electronics, Powertrain & Energy Solutions Research Group
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