

Proposing digital thread as an effective data management framework for modelling and simulation of EV battery thermal management systems

Pranav Milind Khanolkar, Carlos Da Silva, Alison Olechowski, Cristina Amon

Abstract:

The design of battery thermal management systems (BTMSs) of electric vehicles (EVs) is a complex interdisciplinary endeavour, involving multiple objectives such as optimal temperature control, lightweight material, multi-component assembly, and sustainability goals [1–5]. Therefore, achieving the right BTMS design with desired objectives can require satisfying a series of integrated models, thus resulting in work that is highly iterative—requiring appropriate decision-making to be made across the design process. To successfully navigate through this complex process, digital systems are increasingly researched to assist designers in effective decision-making for achieving the optimal BTMSs in EV batteries [6–8]. Digital threads are information systems that facilitate streamlined data management services across the entire product lifecycle—enabling effective data synchronicity, transparency, and traceability for informed decision-making and effective collaboration [9,10]. However, there is a lack of studies demonstrating successful digital thread implementation strategies in BTMS design. Exploring this gap can help EV designers implement digital threads in their traditional EVs' BTMS design framework appropriately and leverage the features and benefits of digital threads in supporting the BTMS design process. As motivation for the BTMS context, this poster presents a case study on how digital thread, its features, benefits, implementation challenges, revealed the best practices for implementing digital threads in a composites design-and-manufacturing process. This poster also presents a discussion on how digital thread-enabled BTMS design process can further support model-based systems engineering to achieve a more cohesive, structured, efficient, and effective systems engineering process—leading to better-designed BTMS with a streamlined development workflow.

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