Fuel Cell Modeling for an Efficient Stack Design

The optimal design of fuel cell systems requires a thorough understanding of their complex dynamics, which can vary across dimensions and timeframes. In this presentation, we delve into the critical importance of accounting for these aspects using a combination of 3D models for detailed insights and simplified models for efficient, reliable results.

The presentation will start with an overview of our collaborative project with ENEA focused on designing a high-temperature (HT) fuel cell full stack. Starting from single-cell experimentation, we explore the intricacies of modeling and integrate the results to pave the way for a preliminary design of a 1kW stack. Through our project, we emphasize the significance of considering different spatial dimensions and temporal aspects to create a holistic understanding of fuel cell behavior. We showcase the transition from single-cell experiments to a full-stack design, emphasizing the need for comprehensive modeling.

In addition to our ongoing project, we present real-world applications of our modeling approach. Starting from the results obtained for a single cell low-temperature (LT) PEMFC to move on real case use of zero dimensional models for transport applications where we demonstrate the power of simplified models in achieving reliable results within a reasonable timeframe. These simplified models are validated with experimental data, underscoring their practicality in real-world applications.