Efficient Electrified Transportation: Harnessing Reduced Order Modelling

SPEAKER

Joel Van Sickel

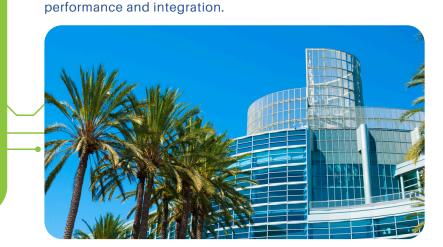*Principal Application Engineer*
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About The Speaker:

Joel Van Sickel:

Joel Van Sickel, Principal Application Engineer at MathWorks, specializes in Simscape Electrical, focusing on power electronics and real-time testing. He earned a Ph.D. in Electrical Engineering from Penn State in 2010 and previously worked as a hardware design engineer at Raytheon.

ABSTRACT

In the rapidly evolving field of electrified transportation, efficient and accurate modeling of system components is crucial for optimizing performance and integration. This tutorial explores reduced order modeling techniques for key components of electrified transportation systems, focusing on power converters, motors, and batteries. Participants will gain a comprehensive overview of how to employ system identification, artificial intelligence, and analytical/physics-based approaches to create effective and performant reduced order models.

The session begins with an overview of the various techniques available, discussing their strengths and weaknesses. Following this, three detailed examples will be presented, each highlighting a common use case. First, a classical system identification approach will be applied to a power converter to extract a time-varying state-space representation of the system. Next, an industry-standard approach to 2D motor modelling will be compared to a high-fidelity finite element motor model, capturing essential details such as saturation and spatial harmonics without the computational cost. Finally, the process of designing, training, and using a neural network for modeling a lithium-ion battery will be reviewed.

Participants will leave with a solid understanding of the existing modeling approaches available for electrified transportation systems. They will learn how to effectively apply these techniques to meet specific design and analysis needs, equipping them with the skills necessary to optimize system performance and integration.

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