

E-Mobility Simulation Laboratory

The **E-Mobility Simulation Laboratory** is a state-of-the-art facility dedicated to advancing the research, development, and education of electric vehicle (EV) technologies. Powered by **Altair**, the lab integrates cutting-edge simulation tools to optimize vehicle design, performance, and energy efficiency. Focusing on various aspects of EV systems—including aerodynamics, thermal management, powertrain dynamics, and battery optimization—the laboratory aims to accelerate the evolution of electric mobility by leveraging simulation-based innovation. By enabling engineers, researchers, and students to explore complex design scenarios and assess the performance of various EV systems, the lab is helping shape the future of sustainable transportation.

The **Altair EV Simulation Lab** is equipped with advanced simulation software and high-performance computing infrastructure to provide an ideal learning and research environment. Sponsored by **Altair**, a global leader in simulation technology, the lab offers a rich set of tools that allow users to explore and optimize the performance of electric vehicles across multiple domains. With the support of **Altair's comprehensive suite of simulation tools**, the lab empowers the next generation of engineers to push the boundaries of electric vehicle design.

Key Features of the Altair EV Simulation Lab:

1. High-Performance Workstations



Each workstation is powered by the latest processors, high-capacity RAM, and robust GPUs, enabling the seamless handling of complex simulations, large datasets, and computationally intensive tasks. The state-of-the-art workstations are designed to ensure smooth and efficient operation, even when simulating advanced vehicle systems.

2. Comprehensive Altair Tool Suite

The lab features a broad range of **Altair simulation tools**, each tailored to specific aspects of electric vehicle development. These tools are essential for simulating and optimizing vehicle systems, including powertrain dynamics, aerodynamics, battery systems, structural integrity, and more.

Altair HyperMesh: Supports advanced mesh generation and pre-processing for **Finite Element Analysis (FEA)**, enabling users to perform detailed structural and thermal analyses.

Altair Inspire: Focuses on **conceptual design and topology optimization**, allowing users to innovate and minimize material usage while maintaining strength and performance.

Altair Flux: A specialized tool for **electromagnetic simulations**, essential for analyzing the performance of motors, batteries, and electrical components in EVs.

Altair AcuSolve: Offers **Computational Fluid Dynamics (CFD)** capabilities to analyze and optimize **aerodynamics and thermal management** of EVs, reducing drag and improving energy efficiency.

Altair MotionSolve: Simulates **multi-body dynamics** to study interactions between various vehicle components and analyze motion, suspension, and handling characteristics.

Altair OptiStruct: Provides structural analysis and optimization tools, ensuring that vehicle components are both strong and lightweight to maximize performance and safety.

Altair Smart Learning: Leverages **data analytics** and **machine learning** to refine simulation results and guide design decisions based on real-world data.

Altair PSIM: A specialized simulation tool for modeling and analyzing **power electronics** and **motor drives**, crucial for optimizing EV powertrains.

Altair Twin Activate: Supports **model-based design** and simulation, enabling integration of **physical and virtual systems** to optimize performance and predict behavior under various operating conditions.

3. User-Friendly Environment

To support seamless learning and research, the lab's software tools are designed with **intuitive user interfaces**, making complex simulations more accessible to users with varying levels of expertise. Additionally, the lab offers extensive **training resources**, including tutorials, documentation, and workshops, ensuring that users can quickly become proficient in the tools and workflows.



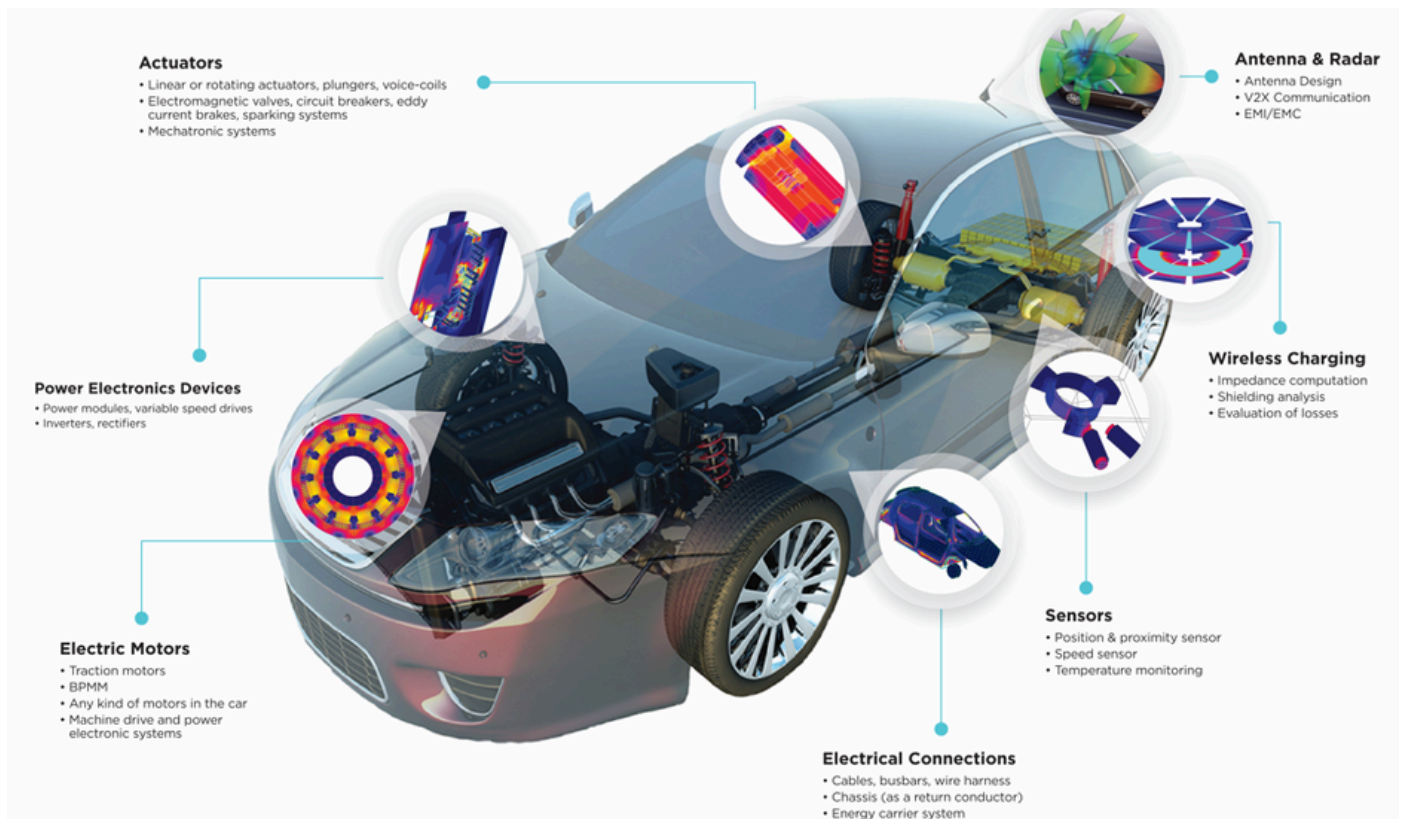
4. Collaborative Space for Teamwork



The lab is designed to foster collaboration and innovation. With multiple workstations available, teams can collaborate on projects, share insights, and conduct simultaneous simulations. This collaborative environment is ideal for group projects, research initiatives, and educational activities, allowing users to solve problems together and enhance the learning experiences.

Applications in Electric Vehicle Development

The Altair EV Simulation Lab supports a wide array of applications in electric vehicle design, performance analysis, and optimization. The lab is a hub for research and development, providing users with the tools needed to simulate and optimize vehicle systems for greater energy efficiency, improved safety, and enhanced performance.



Pic. Courtesy:Altair

Core Applications of the Lab Include:

1. Electric Vehicle Design

Students, engineers, and researchers can simulate various aspects of **EV performance**, including powertrain dynamics, energy consumption, range estimation, and overall vehicle efficiency. By optimizing design parameters, the lab aids in developing high-performance vehicles with reduced environmental impact.

2. Battery Optimization

The lab enables detailed simulations of **battery systems**, evaluating their performance, **thermal characteristics**, and **life cycle** under different operating conditions. This analysis helps improve battery efficiency, extend lifespan, and enhance the overall sustainability of EVs.

3. Powertrain Simulation

Using tools like **PSIM** and **MotionSolve**, users can simulate **electric motors** and **drive systems**, optimizing performance and responsiveness. The lab supports the design of powertrains that deliver maximum efficiency and performance while ensuring smooth integration with the vehicle's other systems.

4. Structural Integrity

Structural analysis and optimization are critical for ensuring the **safety and durability** of vehicle components. By simulating the impact of various loads and stresses on the vehicle body and chassis, the lab helps ensure that the EV is both strong and lightweight, reducing weight and improving overall efficiency.

5. Aerodynamics and Thermal Management

Through **CFD simulations** using **AcuSolve**, users can analyze airflow over the vehicle body, optimizing aerodynamics to reduce drag and improve efficiency. Additionally, the lab supports the design and simulation of advanced **thermal management systems**, ensuring that the vehicle operates within safe temperature limits, preventing overheating and maximizing battery life.

6. Model-Based Design and Performance Prediction

Using **Twin Activate**, users can integrate physical models with simulation data, enabling **iterative design improvements** and **performance predictions** under varying conditions. This model-based approach enhances the accuracy of predictions, making it possible to optimize vehicle performance even before physical prototypes are built.

Shaping the Future of eMobility with Simulation

The **Altair EV Simulation Laboratory** plays a critical role in advancing electric vehicle technology. By providing a comprehensive suite of simulation tools and fostering a collaborative learning

environment, the lab supports the development of innovative solutions for the evolving field of eMobility. Whether for educational purposes, research, or industry collaborations, the lab equips users with the skills and knowledge necessary to drive the future of electric transportation.

Through advanced simulation techniques, the lab ensures that students, engineers, and researchers can explore every facet of EV design and optimization—from aerodynamics and powertrain efficiency to battery systems and structural integrity. The result is a more sustainable, efficient, and innovative electric vehicle industry, accelerating the transition to greener transportation solutions worldwide.
