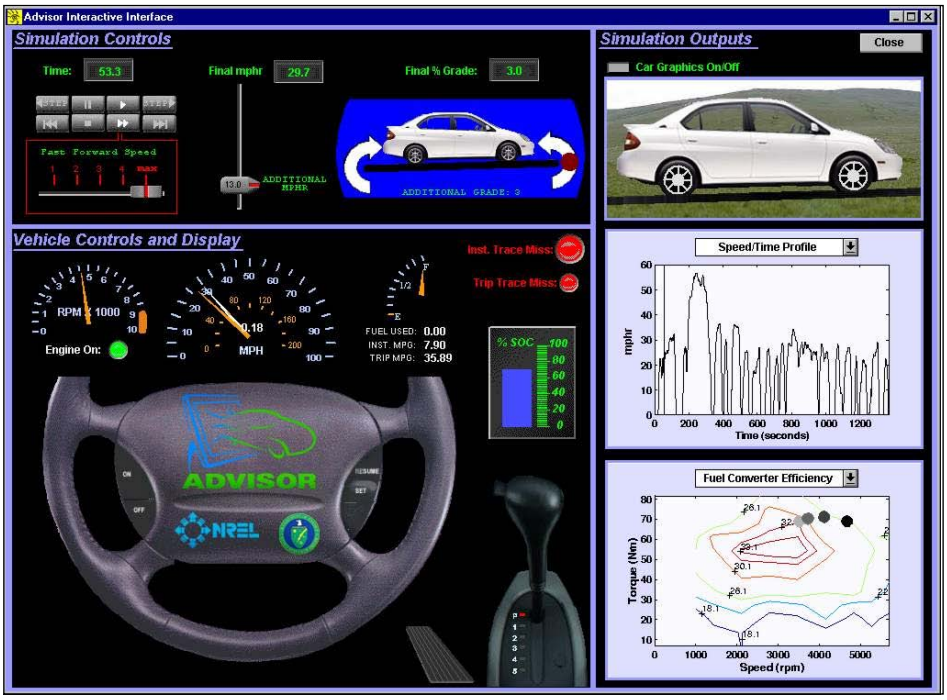
Success Story

ADVISOR Simulation Tool for Vehicle Evaluation and Testing

Background

Accurate component and vehicle simulations are critical to efficient development of advanced vehicles, particularly to making intelligent choices about energy management. Simulating vehicle and component performance helps engineers determine how to increase the life of components, improve vehicle performance, optimize vehicle system designs, and reduce development times.

The U.S. Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL) have worked with industry partners to develop a sophisticated systems analysis tool that can answer crucial questions about specific component and vehicle designs. ADVISOR (Advanced Vehicle Simulator) is a model written in the widely used MATLAB/Simulink software environment. It can be used to simulate and analyze conventional, advanced, light and heavy vehicles, including hybrid electric and fuel cell vehicles. ADVISOR tests the effect of changes in vehicle components (such as motors, batteries, catalytic converters, climate control systems, and alternative fuels) or other modifications that might affect fuel economy, performance, or emissions. The user can alter simulation results by selecting vehicle component types, sizes, and parameters.



ADVISOR can predict vehicle performance, energy consumption, emissions output, control strategy function, and average component efficiencies over multiple driving cycles and test procedures.

Technology

ADVISOR uses basic physics calculations and measured component performance to model conceptual vehicles. The user defines a vehicle using overall vehicle data and prescribes a speed-versus-time trace, along with road grade, that the vehicle must follow. ADVISOR then puts the vehicle through its paces, making sure it meets the cycle to the best of its ability. It calculates predicted torque, speed, voltage, current, and power passed from one component to another. ADVISOR allows the user to answer questions such as:

- What are the optimal drivetrain component sizes that provide the best fuel economy?
- Was the vehicle able to follow the speed trace?

- How much fuel and/or electric energy were required in the attempt?
- What was the peak power and efficiency delivered by the drivetrain components?
- What was the distribution of torque and speeds that the engine delivered?
- At what road grade can the vehicle maintain 55 mph with or without the batteries?

ADVISOR is flexible enough to operate on most computer platforms in the commercially available MATLAB/Simulink graphical/ object-oriented program. The model is continuously updated with actual component test data by users and through university validation efforts. It is flexible enough to model specific components and vehicle configurations for the needs of most users.

Commercialization

In an agreement between NREL and AVL Powertrain Engineering, Inc. (Plymouth, Michigan), AVL will obtain the license to commercialize the ADVISOR vehicle simulation software. Under the agreement, AVL obtains rights to manufacture, market, and sell commercial versions of ADVISOR 2003. NREL retains a royalty-free license to future versions of ADVISOR for use on government projects. A cooperative research and development agreement between NREL and AVL provides for future collaboration to develop integrated vehicle simulation tools for DOE and the private sector.

AVL provides a highly visible commercial outlet for NREL's vehicle simulation tools, leading to enhanced use of ADVISOR by automakers and suppliers. ADVISOR, which to date has been distributed at no cost on the Web, has been downloaded by more than 7,000 individuals, corporations, and universities worldwide. AVL will market and sell ADVISOR worldwide through its affiliates and will provide technical support for its global user base.

Benefits

- Reduces testing time to evaluate various vehicle powertrain alternatives
- Provides a shared simulation tool for government and industry
- Assists the automotive industry to develop fuel-efficient vehicles and components

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A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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